Australian Government

Department of Education, Employment and Workplace Relations

MSL925001A Analyse data and report results

Revision Number: 1

MSL925001A Analyse data and report results

Modification History

Not applicable.

Unit Descriptor

Unit descriptor	This unit of competency covers the ability to perform scientific calculations, analyse trends and uncertainty in data and report results within the required timeframe.

Application of the Unit

Application of the unit	This unit of competency is applicable to technical officers and laboratory technicians working in all industry sectors. Industry representatives have provided case studies to illustrate the practical application of this unit of competency and to show its relevance in a workplace setting. These can be found at the end of this unit of competency under the section 'This competency in practice'.

Licensing/Regulatory Information

Not applicable.

Pre-Requisites

Prerequisite units		
	MSL924001A	*Process and interpret data*

Employability Skills Information

Employability skills	This unit contains employability skills.

Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Perform scientific calculations	1.1. Ensure raw data are consistent with expectations and reasonable ranges 1.2. Calculate scientific quantities involving algebraic, power, exponential and/or logarithmic functions 1.3. Ensure calculated quantities are consistent with estimations 1.4. Present results using the appropriate units, uncertainties and number of significant figures
2. Analyse trends and relationships in data	2.1. Determine linear and non-linear relationships between sets of data 2.2. Prepare and analyse control charts to determine if a process is in control 2.3. Identify possible causes for out-of-control condition 2.4. Follow enterprise procedures to return process to in-control operation
3. Determine variation and/or uncertainty in data distributions	3.1. Organise raw data into appropriate frequency distributions 3.2. Calculate means, medians, modes, ranges and standard deviations for ungrouped and grouped data 3.3. Interpret frequency distributions to determine the characteristics of the sample or population 3.4. Calculate standard deviations and confidence limits for means and replicates 3.5. Estimate the uncertainty in measurements using statistical analysis 3.6. Determine data acceptability using statistical tests and enterprise procedures
4. Check for aberrant results	4.1. Identify results that cannot be reconciled with sample, sample documentation, testing procedures and/or expected outcomes 4.2. Determine appropriate actions in consultation with supervisor as required
5. Report results	5.1. Use charts, tables and graphs to present results in the required format 5.2. Verify that entry of data and results are correct 5.3. Prepare reports in a format and style consistent with their intended use and enterprise guidelines 5.4. Communicate results within the specified time and in accordance with enterprise confidentiality and

ELEMENT	PERFORMANCE CRITERIA
	security guidelines

Required Skills and Knowledge

REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

Required skills

Required skills include:

- performing laboratory computations
- calculating scientific quantities
- statistical analysis
- graphical analysis
- reporting results in the required formats and expected timeframe
- storing, retrieving and manipulating data following document traceability procedures
- maintaining the security and confidentiality of data in accordance with workplace and regulatory requirements

Required knowledge

Required knowledge includes:

- relevant scientific and technical terminology such as: variables, dispersion, central tendency, process control, process stability, normal distribution, confidence level and replication
- calculations involving evaluation of formulae containing algebraic, power, exponential and/or logarithmic functions
- preparation and interpretation on linear and non-linear graphs, complex control charts and frequency distribution plots
- determination of regression line equations, correlation coefficients
- statistical analysis and significance tests, such as t-test, f-test, analysis of variance (ANOVA)
- data acceptability tests, such as Q, T and Youden
- the characteristics of a valid measurement
- relevance/importance of the national measurement legislation and guidelines to laboratory measurement
- sources and estimates of uncertainty in measurements
- procedures for data traceability
- procedures for verifying data and rectifying mistakes
- procedures for maintaining and filing records, and maintaining security of data

Evidence Guide

EVIDENCE GUIDE	
The Evidence Guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.	
Overview of assessment	
Critical aspects for assessment and evidence required to demonstrate competency in this unit	Assessors should ensure that candidates can: • store, retrieve and manipulate data following document traceability procedures • calculate scientific quantities relevant to their work and present accurate results in the required format • analyse data to determine relationships between variables • prepare frequency distributions for given data, calculate and interpret measures of central tendency and dispersion • prepare and interpret control charts and take appropriate actions • maintain the security and confidentiality of data in accordance with workplace and regulatory requirements • report results in the required formats and expected timeframe.

Context of and specific resources for assessment	This unit of competency is to be assessed in the workplace or simulated workplace environment.
	This unit of competency may be assessed with:
	• *MSL924002A Use laboratory application software*
	• technical units, such as:
	  • *relevant MSL974000 series units of competency*
	  • *relevant MSL975000 series units of competency*.
	Resources may include:
	• data sets and records
	• computer and relevant software or laboratory information system
	• relevant workplace procedures.

Method of assessment	The following assessment methods are suggested: • review of data worksheets, calculations, computer files (such as spreadsheets, databases), statistical analysis, graphs and/or tables prepared by the

EVIDENCE GUIDE	
	candidate • questions to assess understanding of relevant procedures, trends in data and sources of uncertainty • review of reports prepared by the candidate • feedback from supervisors and peers regarding the candidate's ability to analyse and report data in accordance with enterprise procedures. In all cases, practical assessment should be supported by questions to assess underpinning knowledge and those aspects of competency which are difficult to assess directly. Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability. Access must be provided to appropriate learning and/or assessment support when required. The language, literacy and numeracy demands of assessment should not be greater than those required to undertake the unit of competency in a work like environment.
This competency in practice	Industry representatives have provided the case studies below to illustrate the practical application of this unit of competency and to show its relevance in a workplace setting. **Manufacturing** Before pharmaceutical products can be approved for use in Australia, they must be tested for shelflife in their Australian sales packs. The shelf life of a preparation is the time of storage which results in a preparation becoming unfit for use, either through chemical decomposition of the active substances or physical deterioration of the preparation. Stability profiles are determined by storing the preparation under a range of temperature conditions and evaluating it at predetermined time intervals. For example, a technical assistant may be required to evaluate the physical parameters of the new tablet to detect any changes in its appearance, hardness, friability, disintegration and dissolution profile. The assistant regularly assays the tablets using a stability indicating assay. The results are plotted and the information gained is used to predict the

EVIDENCE GUIDE	
	period of time for which the tablets will meet the appropriate standards for physical characteristics, purity and potency when stored under defined conditions. **Biomedical** Supplementation of vitamins and minerals in the diet as a means to avert a clinical problem is a popular area of research, linking epidemiological and clinical investigation with food analyses. In the example of folate, such combined studies have led to the fortification of a number of foods and the requirement for folate supplementation for women of child bearing age. A typical project team would involve medical staff, a dietician and a scientific or technical officer to perform the assays. One possible line of study is to control the level of supplementation for the person and introduce the micronutrient in a dose form over and above that given in a controlled baseline diet. Blood samples would be collected and the serum micronutrient levels assayed. The technical officer would be responsible for keeping the statistical quality control data and analysing the assays. The technical officer would work with the research team to correlate the serum levels with the dose input. To contribute effectively, the technical officer must understand the significance of the relationships between collected test data and the controlled experimental variables. **Food processing** A state government analytical laboratory recently performed comparative assays of (-carotene using ultraviolet-visible (UV-VIS) spectrometric and high performance liquid chromatography (HPLC) techniques. In any procedure where the assay is to be replaced, side by side analyses must be performed on multiple samples and the correlations between the data compared statistically. The two procedures are then developed or modified for local laboratories and a routine procedure developed. At this point, technical officers would assay the samples by the two methods. They would ensure that all procedures were followed with close attention to quality control. Precision would be assessed through frequent assays of the same samples. Sensitivity of the assay would be assessed by performing the assay over a range of sample concentrations. The technical officers would carefully document the procedures and record all

EVIDENCE GUIDE	
	data for later validation. They may also provide preliminary graphical representations of data for their supervisor.

Range Statement

RANGE STATEMENT	
The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.	
Codes of practice	Where reference is made to industry codes of practice, and/or Australian/international standards, it is expected the latest version will be used

Standards, **codes**, **procedures and/or enterprise requirements**	Standards, codes, procedures and/or enterprise requirements may include:
	• Australian and international standards such as:
	  • AS ISO 1000-1998 The international system of units (SI) and its application
	  • Eurachem/CITAC Guide CG4 Quantifying uncertainty in analytical measurement
	  • ISO 5725 Accuracy (trueness and precision) of measurement methods and results
	  • ISO/IEC Guide 98-3:2008 Uncertainty of measurement - Part 3 Guide to the expression of uncertainty in measurement (GUM)
	• national measurement regulations and guidelines
	• National Association of Testing Authorities (NATA) Technical notes
	• material safety data sheets (MSDS)
	• equipment manuals and warranty, supplier catalogues and handbooks
	• sampling and test procedures and standard operating procedures (SOPs)
	• enterprise quality manual and customer quality plan
	• validation of the equipment and associated software, where applicable
	• validation of spreadsheets developed in-house for assay and process calculations

Data records	Data records may include: • worksheets • spreadsheets or databases linked to information

RANGE STATEMENT	
	management systems • the results of tests, measurements, analyses and surveys
Scientific and technical terminology	Scientific and technical terminology may include: • variables • dispersion • central tendency • process control • process stability • normal distribution • confidence level • replication
Laboratory computations	Laboratory computations may include: • algebraic, logarithmic, exponential and power functions • calculations involving fractions, decimals, ratios, proportions and percentages • evaluation of formulae containing powers, exponents and logarithms functions • use of scientific notation, correct units and correct number of significant figures • calculation of uncertainties • preparation and interpretation of linear, semi-log and log-log graphs • calculation and interpretation of statistical quantities, such as mean, median, mode, range, variance and standard deviation • determination of regression line equations and correlation coefficients • preparation and interpretation of more complex control charts and frequency distribution plots
Calculations of scientific quantities	Calculations of scientific quantities may include: • percentage and absolute uncertainties in measurements and test results • dose (mg), dilution(1:10), concentration (molarity, g/mL, mg/L, ppm, ppb) • pH, [H+], [OH-], buffer calculations, Ka, pKa, Kb, pKb, Kw • solubility constants Ks, pKs • radioactivity:

RANGE STATEMENT	

	• half life, dose, activity and exposure
	• optical properties:
	  • absorbance/transmittance, path length, extinction coefficient, concentration (Beers law) and detection limits
	• electrical properties:
	  • conductivity, resistivity and dielectric constants
	• mechanical properties:
	  • stress, strain, elastic moduli, yield strength and hardness
	• thermal properties:
	  • heat capacity, thermal expansion, thermal conductivity and thermal resistance
	• food content (%) of water, ash, dietary and crude fibre, carbohydrate, protein, fat and specific vitamin
	• quantities associated with quality control monitoring, assessment and reporting

Graphical analysis	Graphical analysis may include: • determination of linear, logarithmic, exponential and power relationships • regression lines and interpretation of correlation coefficients • preparing frequency distributions for given data • calculating and interpreting measures of central tendency and dispersion

Calculations	Calculations may be performed:
	• with a calculator
	• without a calculator
	• with computer software such as:
	  • spreadsheets
	  • databases
	  • statistical packages

Statistical analysis	Statistical analysis may include the use of: • histograms, frequency plots, stem and leaf plots, boxplots and scatter plots • probability and normal probability plots • Pareto diagrams, Stewhart control charts and

RANGE STATEMENT	
	CuSum control charts • regression methods for calibration, linearity checks and comparing analytical methods • analysis of variance (ANOVA) • data acceptability tests, such as Q, T and Youden
Records	Records may include information associated with: • purchase of equipment and materials • service records • safety procedures • history of calibration and test results
Occupational health and safety (OHS) and environmental management requirements	OHS and environmental management requirements: • all operations must comply with enterprise OHS and environmental management requirements, which may be imposed through state/territory or federal legislation - these requirements must not be compromised at any time • all operations assume the potentially hazardous nature of samples and require standard precautions to be applied • where relevant, users should access and apply current industry understanding of infection control issued by the National Health and Medical Research Council (NHMRC) and State and Territory Departments of Health

Unit Sector(s)

Unit sector	Data

Competency field

Competency field	

Co-requisite units

Co-requisite units		