



Australian Government

Department of Education, Employment and Workplace Relations

PMLDATA500B Analyse data and report results

Release: 1

PMLDATA500B Analyse data and report results

Modification History

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.

This unit of competency has the following prerequisite:

PMLDATA400A Process and interpret data

This unit of competency is applicable to technical officers and laboratory technicians working in all industries.

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.

Application of the Unit

Licensing/Regulatory Information

Pre-Requisites

Employability Skills Information

Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance Criteria describe the level of performance required to demonstrate achievement of the element.

Elements and Performance Criteria

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, logarithmic, exponential, and power 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 Determine 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 is 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 security guidelines.

Required Skills and Knowledge

Evidence Guide

The Evidence Guide describes the underpinning knowledge and skills that must be demonstrated to prove competence.

Critical aspects of competency

Competency must be demonstrated in the ability to perform consistently at the required standard. In particular, assessors should look to see that the candidate 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.

Underpinning knowledge

Competency includes the ability to apply and explain:

- procedures for data traceability
- procedures for verifying data and rectifying mistakes
- procedures for maintaining and filing records, security of data
- the characteristics of a valid measurement
- sources of uncertainty in measurements
- relevant scientific and technical terminology, such as: variables, dispersion, central tendency, process control, process stability, normal distribution, confidence level and replication.
- relevance/importance of the National Measurement Act to laboratory measurement, if applicable.

Competency also includes the ability to perform laboratory computations, such as:

- calculations involving fractions, decimals, ratios, proportions and percent
- evaluation of formulae containing powers, exponents, logarithms functions
- use of scientific notation, correct units, 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, correlation coefficients
- preparation and interpretation of more complex control charts and frequency distribution plots.

Assessment context and methods

This unit of competency is to be assessed in the workplace or simulated workplace environment.

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 candidate

questions to assess understanding of relevant procedures, trends in data, 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. Questioning techniques should suit the language and literacy levels of the candidate.

Interdependent assessment of unit

This unit of competency may be assessed with:
technical units, such as the **PMLTEST '400'** and **'500'** series units

PMLDATA501B Use laboratory application software.

Resource implications

Resources may include:
data sets and records
computer and relevant software or laboratory information system
relevant workplace procedures.

This competency in practice

Manufacturing

Before pharmaceutical products can be approved for use in Australia, they must be tested for shelf-life in their Australian sales pack(s). 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 substance(s) 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 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 QC 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 spectrometric (UV-VIS) 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 data for later validation. They may also provide preliminary graphical representations of data for their supervisor.

Key Competencies

The seven key competencies represent generic skills considered for effective work participation. The bracketed numbering against each of the key competencies indicates the performance level required in this unit. These are stand-alone levels and do not correspond to levels in the Australian Qualifications Framework (AQF).

Level (1) represents the competence to undertake tasks effectively

Level (2) represents the competence to manage tasks

Level (3) represents the competence to use concepts for evaluating and reshaping tasks.

Collecting, analysing and organising information	Communicating ideas and information	Planning and organising activities	Working with others and in teams	Using mathematical ideas and techniques	Solving problems	Using technology
Level 2	Level 2	Level 2	Level 2	Level 2	Level 2	Level 2

Range Statement

The range of variables relates to the unit of competency as a whole. It allows for different work environments and situations that will affect performance.

Where reference is made to industry Codes of Practice, and/or Australian/international standards, it is expected the latest version will be used.

Data may be recorded on worksheets or entered into spreadsheets or databases linked to information management systems. Data includes the results of: tests, measurements, analyses and surveys.

Calculations may be performed with or without a calculator or computer software, such as spreadsheets, databases, statistical packages. Examples of calculations of scientific quantities could 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, K_a, pK_a, K_b, pK_b, K_w

solubility constants K_s, pK_s

radioactivity: half life, dose, activity, exposure

optical properties: absorbance/transmittance, path length, extinction coefficient, concentration (Beers law), detection limits

electrical properties: conductivity, resistivity, dielectric constants

mechanical properties: stress, strain, elastic moduli, yield strength, hardness

thermal properties: heat capacity, thermal expansion, thermal conductivity, 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 could include:

determination of linear, logarithmic, exponential and power relationships

regression lines and interpretation of correlation coefficients.

Statistical analysis could include the use of:

histograms, frequency plots, stem and leaf plots, boxplots, scatter plots

probability, normal probability plots

Pareto diagrams, Stewhart control charts, CuSum control charts

regression methods for calibration, linearity checks, comparing analytical methods

analysis of variance (ANOVA)

data acceptability tests, such as Q, T and Youden.

Records could include information associated with:

purchase of equipment and materials, service records

safety procedures

history of calibration and test results.

Reference materials could include:

material data safety sheets

equipment manuals and warranty, supplier catalogues, handbooks

sampling and test procedures, standard operating procedures (SOPs)

enterprise quality manual, customer quality plan

OHS regulations, guidelines and procedures

Australian Standards, NATA technical notes and National Measurement Act.

Health, safety and environment

All operations to which this unit applies are subject to stringent health, safety and environmental (HSE) requirements, which may be imposed through State or Federal legislation, and these must not be compromised at any time. Where there is an apparent conflict between performance criteria and HSE requirements, the HSE requirements take precedence.

All operations assume the potentially hazardous nature of samples and require standard precautions to be applied. Users should access and apply current industry understanding of infection control issued by the National Health and Medical Research Council and State and Territory Departments of Health. All operations are performed in accordance with standard operating procedures.

Unit Sector(s)