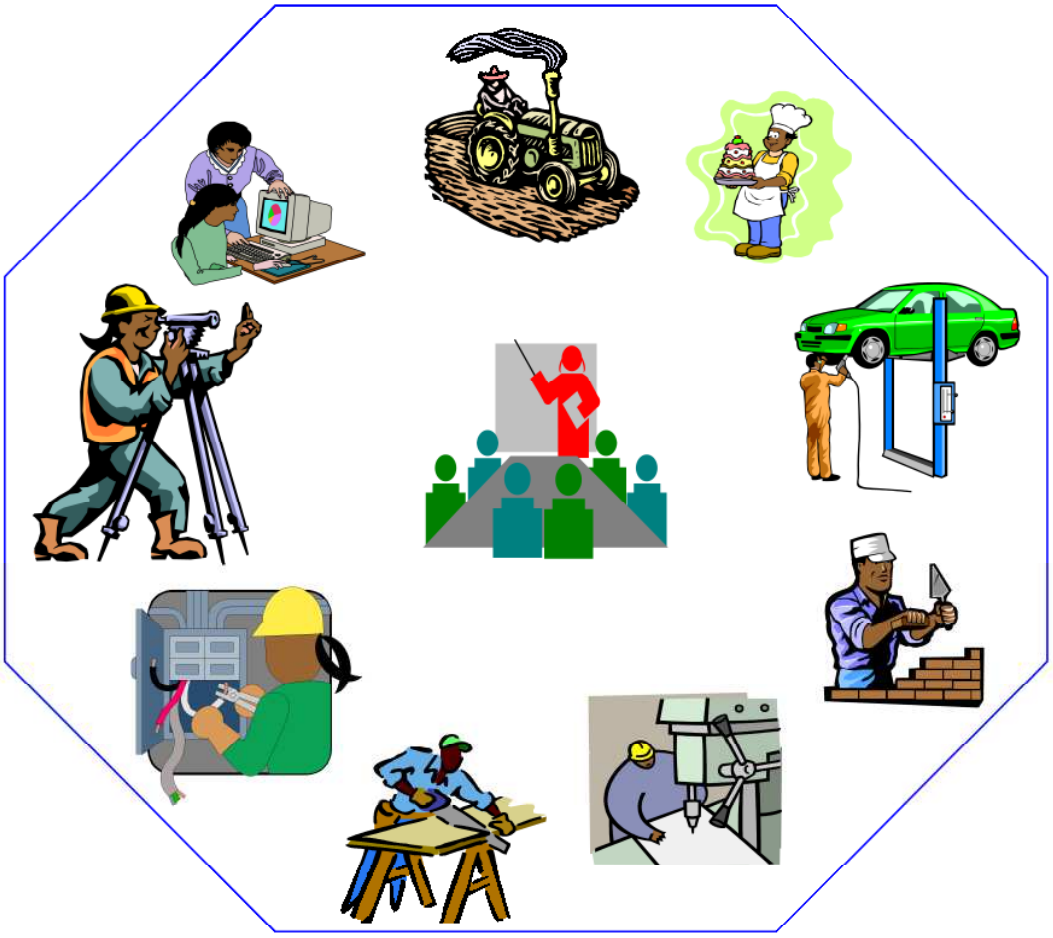
Federal Democratic Republic of Ethiopia

OCCUPATIONAL STANDARD

PHYSICOCHEMICAL LABORATORY OPERATION

NTQF Level II-V



Ministry of Education
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Introduction

Ethiopia has embarked on a process of reforming its TVET-System. Within the policies and strategies of the Ethiopian Government, technology transformation – by using international standards and international best practices as the basis, and, adopting, adapting and verifying them in the Ethiopian context – is a pivotal element. TVET is given an important role with regard to technology transfer. The new paradigm in the outcome-based TVET system is the orientation at the current and anticipated future demand of the economy and the labor market.

The Ethiopia Occupational Standards (EOS) is the core element of the Ethiopian National TVET-Strategy and an important factor within the context of the National TVET-Qualification Framework (NTQF).They are national Ethiopia standards, which define the occupational requirements and expected outcome related to a specific occupation without taking TVET delivery into account.

This document details the mandatory format, sequencing, wording and layout for the Ethiopia Occupational Standard which comprised of Units of Competence.

A Unit of Competence describes a distinct work activity. It is documented in a standard format that comprises:

- Occupational title, NTQF level
- Unit code
- Unit title
- Unit descriptor
- Elements and Performance criteria
- Variables and Range statement
- Evidence guide

Together all the parts of a Unit of Competence guide the assessor in determining whether the candidate is competent.

The ensuing sections of this EOS document comprise a description of the respective occupation with all the key components of a Unit of Competence -

- chart with an overview of all Units of Competence for the respective level including the Unit Codes and Unit of Titles
- contents of each Unit of Competence (competence standard)
- occupational map providing the Technical and Vocational Education and Training (TVET) providers with information and important requirements to consider when designing training programs for this standards, and for the individual, a career path

UNIT OF COMPETENCE CHART

Occupational Standard: Physicochemical Laboratory Operation

Occupational Code: MIN PCL

NTQF Level II

MIN PCL2 01 0114 Record and Present Data	**MIN PCL2 02 0114** Work within a Laboratory/Field Workplace (Induction)	**MIN PCL2 03 0114** Handle and Transport Samples or Equipment
MIN PCL2 04 0114 Conduct Fire Team Operations	**MIN PCL2 05 0114** Operate a Personal Computer	**MIN PCL2 06 0114** Conduct Local Risk Control
MIN PCL2 07 0114 Collect Routine Site Samples	**MIN PCL2 08 0114** Comply with Site Work Processes/Procedures	**MIN PCL2 09 0114** Maintain and Monitor Site Quality Standards
MIN PCL2 10 0114 Apply Initial Response First Aid	**MIN PCL2 11 0114** Participate in Workplace Communication	**MIN PCL2 12 0114** Work in Team Environment
MIN PCL2 13 0114 Develop Business Practice	**MIN PCL2 14 0114** Standardize and Sustain 3S	

NTQF Level III

MIN PCL3 01 0114 Prepare Working Solutions	**MIN PCL3 02 0114** Perform Basic Tests	**MIN PCL3 03 0114** Maintain the Laboratory Fit for Purpose
MIN PCL3 04 0114 Work Safely with Instruments that Emit Ionizing Radiation	**MIN PCL3 05 0114** Participate in Laboratory/Field Workplace Safety	**MIN PCL3 06 0114** Plan and Conduct Laboratory/Field Work
MIN PCL3 07 0114 Contribute to the Achievement of Quality Objectives	**MIN PCL3 08 0114** Apply Critical Control Point Requirements	**MIN PCL3 09 0114** Assist with Fieldwork
MIN PCL3 10 0114 Prepare Practical Science Classes and Demonstrations	**MIN PCL3 11 0114** Monitor Implementation of Work Plan/Activities	**MIN PCL3 12 0114** Apply Quality Control
MIN PCL3 13 0114 Lead Workplace Communication	**MIN PCL3 14 0114** Lead Small Teams	**MIN PCL3 15 0114** Improve Business Practice
MIN PCL3 16 0114 Prevent and Eliminate MUDA		

NTQF Level IV

MIN PCL4 01 0114 Perform Physical Tests	**MIN PCL4 02 0114** Perform Standard Calibrations	**MIN PCL4 03 0114** Process and Interpret Data
MIN PCL4 04 0114 Maintain and Control Stocks	**MIN PCL4 05 0114** Maintain Laboratory/Field Workplace Safety	**MIN PCL4 06 0114** Prepare Practical Science Classes and Demonstrations
MIN PCL4 07 0114 Obtain Representative Samples in Accordance with Sampling Plan	**MIN PCL4 08 0114** Prepare Mineral Samples for Analysis	**MIN PCL4 09 0114** Prepare, Standardize and Use Solutions
MIN PCL4 10 0114 Perform Chemical Tests and Procedures	**MIN PCL4 11 0114** Capture and Manage Scientific Image	**MIN PCL4 12 0114** Perform Mechanical Tests
MIN PCL4 13 0114 Plan and Organize Work	**MIN PCL4 14 0114** Migrate to New Technology	**MIN PCL4 15 0114** Establish Quality Standards
MIN PCL4 16 0114 Develop Individuals and Team	**MIN PCL4 17 0114** Utilize Specialized Communication Skills	**MIN PCL4 18 0114** Manage and Maintain Small/Medium Business Operations
MIN PCL4 19 0114 Apply Problem Solving Techniques and Tools		

NTQF Level V

MIN PCL5 01 0114 Perform Non-standard Calibrations	**MIN PCL5 02 0114** Create or Modify Calibration Procedures	**MIN PCL5 03 0114** Create or Modify Automated Calibration Procedures
MIN PCL5 04 0114 Provide Information to Customers	**MIN PCL5 05 0114** Analyse Data and Report Results	**MIN PCL5 06 0114** Use Laboratory Application Software
MIN PCL5 07 0114 Assist in the Maintenance of Reference Materials	**MIN PCL5 08 0114** Maintain Instruments and Equipment	**MIN PCL5 09 0114** Schedule Laboratory Work for a Small Team
MIN PCL5 10 0114 Monitor the Quality of Test Results and Data	**MIN PCL5 11 0114** Supervise Earthworks Inspection, Sampling and Testing Operations	**MIN PCL5 12 0114** Perform Fire Assay Techniques
MIN PCL5 13 0114 Provide Input to Production Trials	**MIN PCL5 14 0114** Manage Project Quality	**MIN PCL5 15 0114** Facilitate and Capitalize on Change and Innovation
MIN PCL5 16 0114 Establish and Conduct Business Relationships	**MIN PCL5 17 0114** Manage Continuous Improvement Process (Kaizen)	

Occupational Standard: Physicochemical Laboratory Operation Level II	
Unit Title	**Record and Present Data**
Unit Code	**MIN PCL2 01 0114**
Unit Descriptor	This unit of competency covers the ability to record and store data, perform basic calculations of scientific quantities and present information in tables and graph

Elements	Performance Criteria
1. Record and check data	1.1 ***Data*** is entered into laboratory information system or record sheets as directed. 1.2 Data is checked to identify transcription errors or atypical entries. 1.3 Errors in data are rectified using enterprise procedures.
2. Calculate simple scientific quantities	2.1 Statistical values of given data, including mean, median, mode and standard deviation are ***calculated***. 2.2 Scientific quantities are calculated using given formulae and data. 2.3 Calculated quantities are ensured to be consistent with estimations and expectations. 2.4 All calculated quantities are reported with appropriate precision and units.
3. Present data in tables, charts and graphs	3.1 ***Data is presented*** accurately in tables and charts using given formats and scales. 3.2 Obvious ***features*** and trends in data are recognized and reported.
4. Store and retrieve data	4.1 Data is filed and stored in accordance with enterprise procedures. 4.2 Enterprise confidentiality standards are maintained.

Variable	Range
Data Collection	May include: • observations • tests and measurements • surveys.
Calculation of data	May include: • percentages, fractions, decimals • conversions between SI units • areas (m2) and volumes (mL, L, m3) of regular shapes (for example, packaging, moulds) • average mass, mass %, density, specific gravity, moisture, relative and absolute humidity • ratios, such as, mass to mass, mass to volume and volume to volume percentages • industry specific ratios, such as g/cm2 , kg/m2 • concentration (for example, g/100mL, mg/L, mg/µL, dilution

	mL/L)
Data Presentation	May include: • graphs • tables • control charts.
Features of data	May include: • maximum, minimum values • spread of data • increasing/decreasing data, rate of change • outliers, data beyond control limits or normal range.

Evidence Guide	
Critical aspects of Competence	Must demonstrate knowledge and skills competence to: • codes, records and checks data accurately • calculates scientific quantities relevant to their work and presents accurate results in • the required format • recognizes obvious trends in data • maintains the confidentiality of data in accordance with workplace and regulatory requirements
Underpinning Knowledge and Attitudes	Demonstrate knowledge of: • procedures for coding, entering, storing, retrieving and communicating data • procedures for verifying data and rectifying mistakes • procedures for maintaining and filing records, security of data • relevant scientific and technical terminology, such as: precision, accuracy, units, 'out of control'
Underpinning Skills	Demonstrate skills of: • decimals, ratios, proportions and percent • calculation of weight, volumes, percentage • calculation of scientific quantities, such as concentration • unit conversion, multiples and submultiples • use of significant figures, rounding off, estimation, approximation • substitution of data in formulae • Preparation and interpretation of straightforward process control charts.
Resources Implication	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview / Written Test • Observation / Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Physicochemical Laboratory Operation Level II	
Unit Title	**Work within a Laboratory/Field Workplace (Induction)**
Unit Code	**MIN PCL2 02 0114**
Unit Descriptor	This unit of competency covers the induction of an employee into scientific/technical work within a laboratory.

Elements	Performance Criteria
1. Work within enterprise structure and culture	1.1 Broad knowledge of Laboratory ***business ethics***, goals, products and/or scientific/technical services is demonstrated. 1.2 ***Key enterprise sites*** and ***functions*** and their contribution to product range and quality are identified.
2. Work in accordance with workplace agreements and/or legislative requirements	2.1 Key ***workplace information*** is located and applied correctly. 2.2 ***Legislative requirements and procedures*** relating to employment, security, confidentiality and reporting lines are followed. 2.3 All work activities are performed in accordance with relevant environmental management procedures, including ***sustainable energy principles*** and work practices.
3. Provide scientific/technical support	3.1 Workplace roles and responsibilities of scientific/technical personnel are identified. 3.2 Typical tasks and calendar of events in work area are identified. 3.3 The equipment and resources required for everyday work are recognized and located. 3.4 Work instructions are sought and interpreted correctly. 3.5 Work instructions are followed to perform ***scientific/technical*** tasks safely and efficiently. 3.6 Own work area, equipment and materials are maintained in a safe and organized manner according to enterprise policy and procedures clarification if necessary.
4. Organize daily work efficiently	4.1 Work load is assessed and prioritized according to level of responsibility. 4.2 Supervisor is advised if additional resources or support is required to improve performance. 4.3 Duties are undertaken in a positive manner to enhance workplace cooperation and efficiency.
5. Accept responsibility for quality of own work	5.1 Work practices are monitored and adjusted to ensure that the quality of outputs is maintained. 5.2 Opportunities are identified and reported for improvements in procedures, processes and equipment in work area.

6. Identify own learning needs	6.1 Career options and training opportunities in the enterprise are identified. 6.2 Future work requirements and career aspirations are consulted with appropriate personnel to identify own learning needs.

Variable	Range
Business ethics	May include: • following enterprise policy and procedures • behaving honestly and openly • respecting others and treating them with courtesy and impartiality • working diligently and responsibly • ensuring confidentiality of information, including client identification and test results.
Enterprise sites	May include: • laboratories • head office functions • production or processing plants • Supplier services and consultancy services.
Key functions	• production • packaging, warehouse and distribution • quality assurance • purchasing, sales and marketing • Human resources (personnel, training, employee relations).
Workplace information	May include: • notice boards, public address or paging systems • Standard Operating Procedures (SOPs), manuals, work instructions, signs and notices • Material Safety Data Sheets (MSDSs)) • telephone or contract details, email systems, websites • Emergency exits, routes and collection points.
Legislative procedures	May include: • industrial awards, enterprise bargaining agreements and individual contracts • emergencies, accidents and incidents • health, safety and environment • quality assurance, Good Laboratory Practice (GLP), Good Manufacturing Practice (GMP) • customer services.
Legislative requirements	May include: • occupational health and safety • workers compensation • equal employment, anti-discrimination, anti-harassment • ethics, copy right, intellectual property, privacy

	• Environmental protection.
Sustainable energy principles	May include: • examining work practices that involve excessive use of electricity, gas and/or water • switching off equipment when not in use • regularly cleaning filters • recycling and reusing materials wherever feasible • minimizing waste.
Scientific and technical support	May include: • routine site sampling of raw materials and products • packaging, labeling, storing and transporting samples • visual inspection of products and packaging • routine site measurements that take a short time and involve a narrow range of variables or easily recognized control limits • cleaning of equipment • Housekeeping of work areas.

Evidence Guide	
Critical aspects of Competence	Must demonstrate knowledge and skills competence to: • uses Personal Protective Equipment (PPE) and containment facilities as required • follows work instructions to complete tasks within the required timeframe • works ethically • works efficiently when alone and with others • complies with legislative and enterprise requirements in everyday work • maintains the required quality of work outputs.
Underpinning Knowledge and Attitudes	Demonstrate knowledge of: • enterprise objectives, product and service range • enterprise structure and reporting lines • role of quality assurance and/or scientific/technical services in the enterprise • own role, rights, responsibilities, key tasks • workplace procedures that govern personal work, health, safety and environment • basic ethical values and principles, such as respect for the law, responsibility, courtesy, • diligence and confidentiality • use and names of equipment, materials and other resources relevant to work function • Relevant health, safety and environment requirements.
Underpinning Skills	Demonstrate skills to: • Identify hazardous chemicals • Apply safety procedure in the Laboratory

Resources Implication	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview / Written Test • Observation / Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Physicochemical Laboratory Operation Level II	
Unit Title	**Handle and Transport Samples or Equipment**
Unit Code	**MIN PCL2 03 0114**
Unit Descriptor	This unit of competency covers the ability to pick up and transport samples or test/calibration equipment in accordance with enterprise procedures designed to ensure the integrity of subsequent test results.

Elements	Performance Criteria
1. Prepare for pickup	1.1 ***Access*** is prepared to pick up sequence and any license/permit requirements with supervisor. 1.2 Vehicle and communication devices are checked in working order. 1.3 Required transport containers and materials are checked in the vehicle.
2. Pick up and transport items	2.1 The number and nature of items to be transported are confirmed up on arrival. 2.2 Items are ensured to match paperwork. 2.3 Enterprise requirements are applied to the transport of samples and/or equipment. 2.4 Alert laboratory personnel are identified to any special needs that on documents accompanying the items. 2.5 Required documentation is completed at pickup point 2.6 Items are stowed in the specified transport containers and under the required conditions. 2.7 Sample integrity is maintained at all times. 2.8 Items are delivered to reception point in accordance with enterprise procedures. 2.9 Confidentiality of information is maintained.
3. Maintain transport equipment	3.1 Vehicle is ***maintained*** according to enterprise requirement. 3.2 State of transport containers is maintained to ensure they are fit for purpose. 3.3 Requisition stocks of consumable materials are maintained as required. 3.4 Stocks of collecting equipment are replenished at collection centre as required.
4. Maintain a safe work environment	4.1 Established s***afety practices*** and personal protective equipment are used to ensure personal safety and the employees protected from the possible ***hazards*** that of others. 4.2 Spills are cleaned up, if they occur, using enterprise procedures. 4.3 The generation of waste is minimized.

	4.4 Dispose of all waste is done in accordance with enterprise procedures.

Variable	Range
Access	May include: • enterprise protocols regarding customer liaison and communication • vehicle log books • protocols for use of pagers, mobile telephones and two-way radios • Material Safety Data Sheets (MSDSs)) • precautions for safe handling and handling of specific materials (for example, toxic, • infective, radioactive, dangerous goods) • precautions for the transport of volatile and unstable fluids • incident/accident report forms • Spillage and waste containment and disposal protocol and containment materials.
Maintenance	could involve: • use of appropriate sample containers (glass, plastic, opaque) • use of appropriate preservatives • wrapping container in foil to exclude light • temperature control, which may involve prevention of direct contact between the sample • and coolant • use of appropriate equipment boxes (insulated, shockproof, waterproof) • restraint of containers to prevent movement • checking sample viability during transport while avoiding unnecessary handling
Safety practices	May include: • use of Material Safety Data Sheets (MSDSs)) • use personal protective equipment, such as gloves, safety glasses, goggles, coveralls • correct labeling of hazardous materials • handling and storing hazardous material and equipment in accordance with labels, MSDS, • manufacturer's instructions, enterprise procedures and regulations • regular cleaning and/or decontaminating of equipment and vehicle
Hazards	May include: • chemicals, such as acids and hydrocarbons • sharps, broken glassware • manual handling of heavy sample bags and containers and equipment

Evidence Guide	
Critical aspects of Competence	Must demonstrate knowledge and skills competence to: • prepare the vehicle/trolley/ for the required sample and consumables transportation in the Laboratory

	• check communication devices so contact is possible between the courier, reception • center, and routine pickup locations (as necessary) • deal with individuals, customers, clients and reception staff effectively and courteously • record details of item exchange in relevant sections of chain of custody forms (as required) • maintain the integrity of collected samples or equipment during transport • contain and clean up spillage or breakages • use appropriate techniques and equipment to safely dispose of waste materials • maintain confidentiality in all aspects of work • report problems, accidents or incidents in accordance with enterprise procedures.
Underpinning Knowledge and Attitudes	Demonstrate knowledge of: • the relationship between effective communication with clients and customers and • enterprise business • the need for appropriate and timely transport • control measures for minimizing exposure to hazardous materials and equipment • effect of changes in environmental conditions, vibration, shock on samples • procedures for the containment and cleanup of spillages and breakages • need for efficient waste containment and disposal practices • need for maintenance of equipment used in the processes of handling and transporting samples. • Relevant health, safety and environment requirements.
Underpinning Skills	Demonstrate skills to: • enterprise procedures for responding to emergencies • contact details for key personnel. • labile nature of chemical and environmental samples • possible effects of exposure to radioactive materials.
Resources Implication	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview / Written Test • Observation / Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Physicochemical Laboratory Operation Level II	
Unit Title	**Conduct Fire Team Operations**
Unit Code	**MIN PCL2 04 0114**
Unit Descriptor	This unit covers the conducting of fire team operations in resources and infrastructure industries. It includes the planning and preparing for work, fighting or containing fires and finalising operations.

Elements	Performance Criteria
1. Plan and prepare for work	1.1 ***Compliance documentation*** relevant to fire team operations is accessed, interpreted and applied. 1.2 Personal safety requirements and the individual's role in the fire team are identified and confirmed. 1.3 Fire risks in the site and the likely impact and responses to cite specific hazards are identified and clarified. 1.4 ***Types of fire fighting appliances*** are identified and their applications confirmed. 1.5 Location and range of appliances held at relevant fire boards, depots, sub-stations and stations by site visit are identified and confirmed.
2. Fight or contain fires	2.1 Notification of fire operations is received, clarified and confirmed from the appropriate authority. 2.2 Move to the fire site in accordance with site procedures. 2.3 Details are identified and passed, or the type, nature, source and intensity of the ***fire*** are received and clarified to appropriate authorities. 2.4 Appliances and equipment appropriate to the fire circumstances are selected and applied in accordance with manufacturer and/or site instructions. 2.5 Conditions in the fire area are continually monitored and fire fighting techniques/applications modified to reduce the impact of identified and ***potential hazards***. 2.6 Unnecessary risks to the individual and other team members are avoided and evacuation procedures followed in accordance with site rules. 2.7 Isolation procedures are applied in accordance with site rules.
3. Finalize the operation	3.1 Fire recurrence is avoided by the appropriate processes, including watering, rake down and chemical means. 3.2 Fire area is isolated, roped-off, secured and monitored in accordance with site procedures.

	3.3 Appliances and equipment are cleaned, inspected and replaced in the designated location or process for maintenance and repair. 3.4 Debriefs are undertaken and records completed in accordance with site procedures.

Variable	Range
Relevant compliance documentation	may include: • legislative, organization and laboratory requirements and procedures • manufacturer's guidelines and specifications • Relevant Ethiopian standards • code of practice • Employment and workplace relations legislation • Equal Employment Opportunity and Disability Discrimination legislation
Types of fire fighting appliances	may include: • extinguishers • hoses - water • expansion foam • expansion foam generator • spanners • nozzles • breaches • hand tools • water pumps
Types of fire	are: • as per Ethiopian standards
Potential hazards	may include: • smoke • heat • roof and rib • buildings • chemicals • gases • ventilation

Evidence Guide	
Critical aspects of Competence	Must demonstrate knowledge and skills competence to: • the requirements, procedures and instructions for conducting fire team operations • implementation of requirements, procedures and techniques for the safe, effective and efficient completion of fire team operations • working with others to undertake and complete the fire team operations that meets all of the required outcomes

	• consistent timely completion of fire team operations that safely, effectively and efficiently meets the required outcomes
Underpinning Knowledge and Attitudes	Demonstrate knowledge of: • legislative and site rules • causes, characteristics, hazards and responses to the types of fire • site gases and characteristics • basic site geology and survey information related to fire operations • basic building structural information related to fire operations • firefighting equipment • fire fighting techniques • isolation and tagging procedures • basic teamwork • critical situation dynamics and control • communication and reporting procedures • initial response First Aid
Underpinning Skills	Demonstrate skills to: • apply legislative, organization and site requirements and procedures • apply operational safety requirements • access, interpret and apply technical fire operational information • apply hazard and potential hazard identification procedures • assess required responses • apply evacuation procedures • apply fire fighting techniques • administer First Aid • use hand tools • work as a team member • apply isolation and tagging
Resources Implication	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview / Written Test • Observation / Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Physicochemical Laboratory Operation Level II	
Unit Title	**Operate a Personal Computer**
Unit Code	**MIN PCL2 05 0114**
Unit Descriptor	This unit describes the performance outcomes, skills and knowledge required to start up a personal computer or business computer terminal; to correctly navigate the desktop environment; and to use a range of basic functions. No licensing, legislative, regulatory or certification requirements apply to this unit at the time of endorsement.

Elements	Performance Criteria
1. Start computer, system information and features	*1.1* Workspace, furniture and equipment are adjusted to suit user ***ergonomic requirements*****.** 1.2 ***Work organization*** is ensured to meet organizational and ***Occupational Health and Safety (OHS) requirements*** for computer operation. 1.3 Computer is started or logged on according to user procedures. 1.4 Basic functions and features are identified using system information. 1.5 Desktop configuration is customised, if necessary, with assistance from appropriate persons. 1.6 Help functions are used as required.
2. Navigate and manipulate desktop environment	2.1 Features are opened, closed and accessed by selecting correct ***desktop icons***. 2.2 Desktop windows are opened, resized and closed by using correct window functions and roles. 2.3 Shortcuts are created from the desktop, if necessary, with assistance from appropriate persons.
3. Organize files using basic directory and folder structures	3.1 Folders/subfolders are created with suitable names. 3.2 Files are saved with suitable names in appropriate folders. 3.3 Folders/subfolders and files are renamed and moved as required. 3.4 Folder/subfolder and ***file attributes*** are identified. 3.5 Folders/subfolders and files are moved using cut and paste, and drag and drop techniques. 3.6 Folders/subfolders and files are saved to ***appropriate media*** where necessary. 3.7 Folders/subfolders and files are searched for using appropriate software tools.

	3.8 Deleted folder/subfolders and files are restored as necessary.
4. Print information	4.1 Information is printed from installed printer. 4.2 Progress of print jobs is viewed and deleted as required. 4.3 Default printer is changed if installed and required.
5. Shut down computer	5.1 All open applications are closed. 5.2 Computer is shut-down according to user procedures.

Variable	Range
Ergonomic requirements	may include: • avoiding radiation from computer screens • chair height, seat and back adjustment • document holder • footrest • keyboard and mouse position • lighting • noise minimization • posture • screen position • workstation height and layout
Work organization	may include: • exercise breaks • mix of repetitive and other activities • rest periods • Visual Display Unit (VDU) eye testing
Occupational health and safety requirements	may include: • OHS guidelines related to the use of the screen equipment, computing equipment and peripherals, ergonomic work stations, security procedures, customization requirements • statutory requirements
Desktop icons	may include: • directories/folders • files • network devices • recycle bin and waste basket
File attributes	may include: • dates • size
Appropriate media	may include: • CDs • diskettes • local hard drive • other locations on a network • USB/ Flash/Thumb drives • zip disks

Evidence Guide	
Critical aspects of Competence	Must demonstrate knowledge and skills competence to: • navigation and manipulation of the desktop environment within the range of assigned workplace tasks • organizational requirements for simple documents and filing conventions • application of simple keyboard functions to produce documents with a degree of speed and accuracy relevant to the level of responsibility required.
Underpinning Knowledge and Attitudes	Demonstrate knowledge of: • key provisions of relevant legislation from all levels of government that may affect aspects of business operations, such as: ➢ OHS ➢ basic ergonomics of computer use ➢ main types and parts of computers, and basic features of different operating systems ➢ suitable file naming conventions.
Underpinning Skills	Demonstrate skills to: • literacy skills to identify work requirements, to comprehend basic workplace documents, to interpret basic user manuals and to proofread simple documents • communication skills to identify lines of communication, to request advice, to effectively question, to follow instructions and to receive feedback • problem-solving skills to solve routine problems in the workplace, while under direct supervision • technology skills to use equipment safely while under direction, basic keyboard and mouse skills and procedures relating to logging on and accessing a computer • basic typing techniques and strategies.
Resources Implication	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview / Written Test • Observation / Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Physicochemical Laboratory Operation Level II	
Unit Title	**Conduct Local Risk Control**
Unit Code	**MIN PCL2 06 0114**
Unit Descriptor	This unit covers the conduct of local risk control in resources and infrastructure industries. It includes identifying hazards; assessing risk and identifying unacceptable risk; identifying, assessing and implementing risk treatments; and completing records and reports.

Elements	Performance Criteria
1. Identify hazards	1.1 ***Compliance documentation*** relevant to conducting local risk control is accessed, interpreted and applied. 1.2 Work area conditions are inspected to identify potential ***hazards*** in the workplace. 1.3 Existing procedures are applied to deal with recognised hazards. 1.4 The type and scope of unresolved hazards and their likely impact are recognised.
2. Assess risk and identify unacceptable risk	2.1 ***Consequence*** is assessed and determined if the event should occur. 2.2 ***Likelihood*** of the event is considered and determined. 2.3 Criteria are identified for the acceptability/unacceptability of the ***risk*** or source from the appropriate party. 2.4 Risk against criteria is assessed to identify if it warrants '***unacceptable risk'*** status and either action or refer to the appropriate party.
3. Identify, assess and implement risk treatments	3.1 All possible ***risk treatment*** options are identified and considered. 3.2 Options are identified by preliminary analysis and consideration of possible options. 3.3 Options, including the identification of resource requirements are analysed. 3.4 Most appropriate action is selected for dealing with the situation. 3.5 The course of action is planed and prepared in detail and required resources are acquired/obtained. 3.6 The risk treatment is implemented. 3.7 Risk management processes are reviewed.
4. Complete records and reports	4.1 Information on the course of action and implementation is communicated.

	4.2 ***Records and reports*** are completed for hazards and actions from personal risk assessment as specified by legislation and site requirements.

Variable	**Range**
Relevant compliance documentation	may include: • legislative, organization and site requirements and procedures • Ethiopian standards • code of practice • Employment and Workplace Relations legislation • Equal Employment Opportunity and Disability Discrimination legislation
Hazards	is defined as: • a source of potential harm or a situation with a potential to cause loss may include: • equipment • stored energy • methods • plans • people • the work environment
Consequence	is defined as: • the outcome of an event or situation expressed qualitatively or quantitatively, being a loss, injury, disadvantage or gain
Likelihood	is used as: • a qualitative description of probability and frequency
Risk	is defined as: • The chance of something happening that will have an impact upon objectives. It is measured in terms of consequences and likelihood
Criteria for the acceptability***/*** unacceptability of the risk	must be determined by: • the organization's internal policy, goals and/ or objectives in reference to relevant legislation
Risk treatment	is defined as: • selection and implementation of appropriate options for dealing with risk
Frequency	is defined as: • a measure of likelihood expressed as the number of occurrences of an event in a given time
Probability	is defined as: • the measure of the chance of occurrence expressed as a number between 0 and 1
Risk treatment	may include:

options	• eliminating the hazard • substitution • engineering controls • administrative controls (procedures, etc) • personal protective equipment.
Records and reports	may include: • hazard reporting forms • supervisor/deputy/OCE reports • incident reports • near miss reports • shift reports • JSAs • Take 5 • Step Back

Evidence Guide	
Critical aspects of Competence	Must demonstrate knowledge and skills competence to: • knowledge of the requirements, procedures and instructions to conduct local risk control • implementation of requirements, procedures and techniques for the safe, effective and efficient conduct of local risk control • working with others to undertake and conduct of local risk control that meets all of the required outcomes • consistent timely completion of conducting local risk control that safely, effectively and efficiently meets the required outcomes
Underpinning Knowledge and Attitudes	Demonstrate knowledge of: • risk management processes and methods, including: identifying hazards, assessing risks, determining acceptability of risks, identifying controls • AS/NZS 4360-2004 Risk Management • specific worksite risk management procedures • specific worksite safety systems information • specific worksite communication, reporting and recording procedures
Underpinning Skills	Demonstrate skills to: • apply legislative, organization and site requirements and procedures • speak clearly and directly, listen carefully to instructions and information, respond to and clarify directions • collect, analyze and organize information • access, interpret and apply site information • work with other team members • apply teamwork to a range of situations • apply problems solving skills

	• apply decision making skills • show initiative in adapting to changing work conditions or contexts • apply time management • take responsibility for self organization of work priorities • apply mathematical skills to perform a basic risk ranking of hazards • interpret and apply Material Safety Data Sheets (MSDS)
Resources Implication	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview / Written Test • Observation / Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Physicochemical Laboratory Operation Level II	
Unit Title	**Collect Routine Site Samples**
Unit Code	**MIN PCL2 07 0114**
Unit Descriptor	This unit covers the collection of routine site samples in resources and infrastructure industries. It includes the requirements for the preparation for sampling, conducting sample collection; preparing samples, dispatching samples and maintaining the sampling environment.

Elements	Performance Criteria
1. Prepare for sampling	1.1. ***Compliance documentation*** relevant to the collection of routine site samples is accessed, interpreted and applied. 1.2. The purpose, priority and scope of the ***sample*** request or plan are confirmed. 1.3. Liaise is done with relevant personnel to arrange site access and all necessary clearances/permits. 1.4. ***Site hazards*** are identified and reviewed enterprise ***safety procedures***. 1.5. Procedures are used and documented to ensure ***representative sampling***. 1.6. Quantity, location, frequency or time of sampling and ***types of samples*** to be collected are confirmed. 1.7. Required ***sampling tools and equipment*** are assembled.
2. Conduct sample collection	2.1 Samples are collected as specified in sample request or plan. 2.2 Sample integrity is preserved throughout collection. 2.3 Samples are placed in suitable containers and labelled accurately. 2.4 Samples are stored and transported. 2.5 Characteristics of sampling environment are identified and recorded in particular any non-standard aspects. 2.6 Sampling equipment is maintained in a clean and safe working condition.
3. Prepare samples	3.1 Sample is verified, documentation and required equipment are checked for preparation. 3.2 ***Sample preparation*** is performed according to plan using recommended procedures. 3.3 Loss of material is contained and sample protected against contamination. 3.4 Samples are recovered and cleaned using techniques and equipment specified for the particular sample.

	3.5 Residues and samples are stored or disposed of following OHS and environmental guidelines.
4. Prepare samples for dispatch	4.1 Core samples are labelled, stored and transported to ***maintain integrity of sample***. 4.2 Appropriate reference materials, standards and controls are used. 4.3 Loss of material is contained and sample protected against contamination. 4.4 Any change is documented to preparation methods. 4.5 Samples are forwarded for analysis to external laboratories. 4.6 Samples are stored, tested and disposed.
5. Maintain a safe work environment	5.1 Established work practices and personal protective equipment are used to ensure personal safety and that of others. 5.2 Environmental impacts of sampling and generation of waste are ***minimized***. 5.3 All wastes are disposed of in accordance with enterprise procedures.

Variable	**Range**
Compliance documentation	may include: • legislative, organization and site requirements and procedures • manufacturer's guidelines and specifications • Ethiopian standards • code of practice • Employment and workplace relations legislation • Equal Employment Opportunity and Disability Discrimination legislation
Samples	may include: • soils • rocks • minerals • fossils • hydrocarbons • drill core • stream sediment • mine samples • gas or air samples • water, wastewater, storm water, sewage, sludges • construction materials • solid wastes • raw materials

	• final products • hazardous materials and/or dangerous goods • atmospheric or airborne contaminants
Site hazards	may include: • solar radiation, dust and noise • wildlife, such as snakes, spiders, domestic animals • biohazards, such as micro-organisms and agents associated with soil, air, water • chemicals, such as acids and hydrocarbons • sharps, broken glassware • manual/handling of heavy sample bags and containers • crushing, entanglement, cuts associated with moving machinery and hand tools • falling objects, uneven surfaces, heights, slopes, wet surfaces, trenches, confined spaces • vehicle handling in rough terrain, boat handling in rough or flowing water
Safety procedures	may include: • use of Materials Safety Data Sheets (MSDS) • use of personal protective equipment, such as hard hats, heavy protection, gloves, safety glasses, goggles, faceguards, coveralls, gown, body suits, respirators, safety boots • correct labeling of hazardous materials • handling and storing hazardous material and equipment in accordance with labels, MSDS, manufacturer's instructions, enterprise procedures and regulations • regular cleaning and/or decontamination of equipment • machinery guards • signage, barriers, service isolation tags, traffic control, flashing lights • lockout and tag out procedures
Representative sampling	may include: • size • frequency • location
Types of samples	may include: • grab samples • disturbed or undisturbed materials • composite samples, such as time, flow proportioned, horizontal/vertical cross section • quality control samples, such as controls, background, duplicate, blanks
Sampling tools and equipment	may include: • hand tools • carrying devices

	• portable power tools • front-end loader, backhoe, excavator, drill rig • shovels, augers, bucket • sampling frames, sampling tubes, dip tubes, spears, flexible bladders, syringes • access valves • sample thief • weighted sample bottles, bottles, plastic/metal containers and disposable buckets • sterile containers, pipettes, inoculating loops, disposable spoons • pumps, stainless steel bailers • mechanical gravity separator • high specific gravity liquids • hand magnet • isodynamic magnetic separator • electrostatic separator • crusher • ultrasonic cleaner • panning and hand jigging • hydraulic rock splitter • diamond saw • sledge hammer • crushers • screens
Sample preparation	may include: • marking up • splitting • sub-sampling • sealing • size reduction • specific gravity • magnetic suspension • core-cutting • crushing/grinding • sieving • riffling • blending • homogenization • coning • quartering • preparing sub-sample including: stain/polish • petrological and electron microscope/electron microprobes
Maintenance of integrity of samples	could include: • appropriate containers and lids (for example, glass, plastic, amber, opaque)

	• sealing of sample containers • purging of sample lines and bores • decontamination of sampling tools between collection of consecutive samples • use of appropriate preservatives (for example, sodium azide, toluene or antibiotics) • wrapping container in foil or wet newspaper • temperature control, which may involve prevention of direct contact between the sample and coolant • transfer of sterile sample into sterile container • monitoring of storage conditions • enterprise/legal traceability through appropriate sample labeling and records
Minimising environmental impacts	may involve: • replacement of soils and vegetation • driving to minimize soil erosion and damage to fauna and vegetation • disposal of surplus, spent or purged materials • recycling of non-hazardous wastes • appropriate disposal of hazardous waste • cleaning of vehicles to prevent transfer of pests and contaminants

Evidence Guide	
Critical aspects of Competence	Must demonstrate knowledge and skills competence to: • the requirements, procedures and instructions for the collection of routine site samples • implementation of requirements, procedures and techniques for the safe, effective and efficient collection of routine site samples • working with others to undertake and complete the collection of routine site samples that meets all of the required outcomes • consistent timely completion of the collection of routine site samples that safely, effectively and efficiently meets the required outcomes
Underpinning Knowledge and Attitudes	Demonstrate knowledge of: • key terminology and concepts, such as: ➢ sample, contamination, traceability, integrity, chain of custody ➢ purpose for which the samples have been collected ➢ the function of key sampling equipment/materials and principles of operation ➢ hazards, risks and enterprise safety procedures associated with routine sampling is undertaken • enterprise procedures dealing with: ➢ sampling

	➢ waste management, clean up and spillage ➢ handling, transport and storage of dangerous goods • health, safety and environment requirements
Underpinning Skills	Demonstrate skills to: • apply legislative, organization and site requirements and procedures • apply established work practices • wear personal protective equipment • apply plan, report, map, specification interpretation skills • apply record maintenance and operations monitoring procedures • apply worksite communication procedures
Resources Implication	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview / Written Test • Observation / Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Physicochemical Laboratory Operation Level II	
Unit Title	**Comply with Site Work Processes/Procedures**
Unit Code	**MIN PCL2 08 0114**
Unit Descriptor	This unit covers the compliance with site work processes/procedures in the resources and infrastructure industries.

Elements	Performance Criteria
1. Plan and prepare for work outcomes	1.1. ***Relevant work procedures*/*standards*** are accessed, interpreted and clarified. 1.2. ***Roles and responsibilities*** for individual work are identified and confirmed with the appropriate persons. 1.3. ***Work plans*** that will ensure compliance with mine procedures and safe work outcomes are prepared.
2. Apply work procedures to individual work activities	2.1 Allocated work is carried out to site procedures/standards. 2.2 Roles and responsibilities are adjusted and confirmed to meet changing circumstances personnel. 2.3 Work processes are monitored, incidents reported and local risk control processes applied to minimize injury, loss, equipment damage and environmental harm, in accordance with site safety and health management system. 2.4 Non compliance in the application of site procedures and recommend improvements are identified and reported to relevant site personnel. 2.5 ***Relevant documentation*** is completed in accordance with site requirements/standards.

Variable	Range
Relevant work procedures/standards	may include: • relevant legislation • relevant Ethiopian standards relating to safety and health management systems • organization or site policies, procedures and work instructions • safety and health management systems • principle hazard management plans • standard operating procedures • code of practice, recognised standards or guidelines • manufacturer's instructions • Employment and workplace relations legislation • Equal Employment Opportunity and Disability Discrimination legislation

Roles and responsibilities	may include: • identification of hazards • roles and responsibilities defined in site safety and health management systems • obligations and duties of care under safety legislation • criteria for evaluation of own work • measures to avoid injury and illness • criteria for measurement and minimization of risk • processes to ensure "right first time" approach • adherence to relevant work procedures
A work plan	may include: • is the plan of routine or non-routine activities which may or may not be documented • may be SLAMS (Stop, Look, Assess, Manage)
Relevant documentation	may include: • site based incident reporting forms • safe work guidelines or work instructions • risk based self check lists • hazard reporting systems

Evidence Guide	
Critical aspects of Competence	Must demonstrate knowledge and skills competence to: • knowledge of the requirements, procedures and instructions for compliance with site work processes/procedures • implementation of requirements, procedures and techniques for the safe, effective and efficient application of site work processes/procedures, while complying with site risk management, safety, environmental and communication requirements, including: ➢ accessing, identifying and applying site procedures/standards ➢ identifying, agreeing and adjusting performance in line with potential changing circumstances ➢ planning and completing work to achieve agreed outcomes ➢ monitoring processes, reporting incidents and safely applying risk control processes to minimize injury, loss, equipment damage and environmental harm ➢ contributing to the site safety health management system • completing required documentation
Underpinning Knowledge and Attitudes	Demonstrate knowledge of: • site safety and health management systems • work planning processes • site and equipment safety requirements • technical and operational capability and limitations of resources and equipment being used

	• relevant safety and health legislation including obligations under duty of care
Underpinning Skills	Demonstrate skills to: • access, interpret and apply site procedures/standards • communicate effectively in the workplace • monitor and recommend changes to overcome non compliance with site procedures/standards • maintain relevant site documents and reports • identify hazards in the workplace • apply risk management practices
Resources Implication	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview / Written Test • Observation / Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Physicochemical Laboratory Operation Level II	
Unit Title	**Maintain and Monitor Site Quality Standards**
Unit Code	**MIN PCL2 09 0114**
Unit Descriptor	This unit covers the maintenance and monitoring of site quality standards in the resources and infrastructure industries.

Elements	Performance Criteria
1. Plan, prepare for quality work outcomes	1.1. ***Compliance documentation including quality standards*** relevant to the work activity is accessed, interpreted and applied. 1.2. ***Performance indicators*** for individual work are identified and agreed on with the appropriate persons. 1.3. Ensure work is completed within time, quality, cost and productivity parameters. 1.4. Work is planned to facilitate the achievement of quality standards.
2. Apply quality systems to individual work activities	2.1 Work is carried out to relevant quality procedures. 2.2 Performance indicators are adjusted and agreed on to meet changing circumstances with appropriate personnel. 2.3 Procedure improvements are suggested and implemented with relevant people including corrective actions. 2.4 ***Relevant quality documentation*** is completed in accordance with site requirements.
3. Monitor and report quality standards on a worksite	3.1 Quality of outputs is monitored and non-compliance identified. 3.2 Work processes are monitored, incidents reported and local risk control processes applied to minimize quality non-compliance. 3.3 Information about variations in quality is communicated to ***appropriate personnel***.

Variable	Range
Compliance documentation and quality standards	may include: • legislative, organization and site requirements and procedures • manufacturer's guidelines and specifications • Relevant Ethiopian standards • site management plans • code of practice, recognised standards or guidelines • approved code of practice • systems of health and safety • customer specifications

	• Employment and workplace relations legislation • Equal Employment Opportunity and Disability Discrimination legislation
Performance indicators	may include: • time parameters • quantity • productivity parameters • quality parameters • cost parameters • time targets for own work • criteria for evaluation of own work • measures to avoid wastage • criteria for measurement of internal and external customer satisfaction • processes to ensure 'right first time' approach
Relevant quality documentation	may include: • daily production reports • specific product or process reports or records
Appropriate personnel	may include: • those for whom one has responsibility • line managers • staff representatives • colleagues • customers • suppliers

Evidence Guide	
Critical aspects of Competence	Must demonstrate knowledge and skills competence to: • knowledge of the requirements, procedures and instructions for maintaining and monitoring site quality standards • implementation of requirements, procedures and techniques for the safe, effective and efficient completion of maintenance and monitoring of site quality standards • working with others to undertake and complete the maintenance and monitoring of site quality standards that meets all of the required outcomes • consistent timely completion of maintenance and monitoring of site quality standards that safely, effectively and efficiently meets the required outcomes.
Underpinning Knowledge and Attitudes	Demonstrate knowledge of: • site/enterprise quality systems and processes • work planning processes • technical and operational capability and limitations of resources and workplace equipment • company and statutory guidelines, procedures and practices

	• reporting procedures
Underpinning Skills	Demonstrate skills to: • apply legislative, organization and site requirements and procedures for maintaining and monitoring site quality standards • maintain, monitor and recommend changes to system documents including reporting documents, work systems and/or plant • solve problems, particularly in teams, paying particular attention to safety issues and adjusting performance indicators to reflect changed circumstances • show initiative in adapting to changing work conditions or contexts particularly when working across a variety of work areas • access, interpret and apply information on relevant organization policies, procedures and instructions • use mathematical ideas and techniques to complete quality documentation
Resources Implication	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview / Written Test • Observation / Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Physicochemical Laboratory Operation Level II	
Unit Title	**Apply Initial Response First Aid**
Unit Code	**MIN PCL2 10 0114**
Unit Descriptor	This unit covers the application of initial response First Aid in the mining industry. It includes: assessing the situation; applying first aid; and recording and reporting the situation.

Elements	Performance Criteria
1. Assess the situation	1.1. ***Physical hazards*** are identified to own and others' health and safety. 1.2. Immediate ***risk*** to self, and health and safety of the casualty, are minimized by controlling hazards in accordance with site and OHS requirements. 1.3. Casualty's ***vital signs*** and physical condition are assessed in accordance with workplace procedures.
2. Apply First Aid	2.1 ***First Aid management*** is provided in accordance with established ***First Aid*** procedures. 2.2 Casualty is reassures in a caring and calm manner and made comfortable. 2.3 First Aid ***resources and equipment*** appropriate to the identified risks and hazard controls are used. 2.4 First Aid or appropriate medical assistance is sought from appropriate personnel using relevant ***communication media and equipment***, to site requirements. 2.5 ***Casualty's condition*** is monitored and responded in accordance with effective ***First Aid principles*** and site procedures. 2.6 Casualty management is finalised according to casualty's needs and First Aid principles.
3. Record and report incident	3.1 Details of casualty's physical condition, changes in conditions, management and response to management are accurately recorded in line with organizational procedures. 3.2 Details of casualty's condition and management activities are accurately conveyed to emergency services/relieving personnel. 3.3 Reports to supervisors are prepared in a timely manner, and all relevant facts presented according to established site procedures.

Variable	Range
Physical hazards	May include: • workplace hazards

	• environmental hazards • proximity of other people • hazards associated with the casualty management processes
Risks	May include: • worksite equipment, machinery and substances • environmental risks • bodily fluids • risk of further injury to the casualty • risks associated with the proximity of other workers and bystanders
Vital signs	May include: • breathing • circulation • consciousness
First Aid management	May include: • workplace policies and procedures • industry/site specific regulations, codes etc. • OHS requirements • state and territory workplace health and safety requirements • allergies the casualty may have • location and nature of the workplace • environmental conditions such as: electricity, biological risks, weather, motor vehicle accidents • location of emergency services personnel • use and availability of First Ad equipment and resources • infection control
Initial response First Aid	May include: • cardio-pulmonary resuscitation • expired air resuscitation • bleeding control • basic patient management • spinal injury awareness • immediate burns treatment • unconscious casualty procedure • identification of fractures • sprains • strains • the treatment of shock
Resources and equipment	May include: • pressure bandages • thermometers • First Aid kit • eyewash • thermal blankets • pocket face masks • rubber gloves

	• dressing • spacer device • cervical collars
Communication media and equipment	May include: • mobile phone • UHF/VHF radio • flags • flares • 2-way radio • email • electronic equipment
Casualty's condition	May include: • abdominal injuries • allergic reactions • bleeding • burns - thermal, chemical, friction, electrical • cardiac conditions • chemical contamination • cold injuries • crush injuries • dislocations • drowning • envenom - snake, spider, insect and marine bites • environmental conditions such as hypothermia, dehydration, heat stroke • eye injuries • fractures • head injuries • minor skin injuries • neck and spinal injuries • needle-stick injuries • poisoning and toxic substances • asthma and/or choking • shock • smoke inhalation • soft tissue injuries, including sprains, strains, dislocations • substance abuse, including drugs • unconsciousness, including not breathing and no pulse
Established First Aid principles may include:	• checking the site for danger to self, casualty and others and minimizing the danger • checking and maintaining the casualty's airway, breathing and circulation

Evidence Guide	
Critical aspects of	Must demonstrate knowledge and skills competence to:

Competence	• knowledge of the requirements, procedures and instructions for the application of initial response First Aid • implementation of requirements, procedures and techniques for the safe, effective and efficient application of initial response First Aid • working with others to undertake and complete the initial response First Aid that meets all of the required outcomes • consistent timely application of initial response First Aid that safely, effectively and efficiently meets the required outcomes
Underpinning Knowledge and Attitudes	Demonstrate knowledge of: • initial response First Aid • manual handling procedures • incident reporting systems and procedures • basic anatomy and physiology • dealing with confidentiality • knowledge of the First Aiders' skills and limitations • OHS legislation and regulations • how to gain access to and interpret Materials Safety Data Sheets (MSDS) • basic anatomy and physiology • duty of care • resuscitation • bleeding control • care of unconscious • legal requirements • airway management
Underpinning Skills	Demonstrate skills to: • access, interpret and apply relevant safety rules and procedures • prepare and process reports • show assertiveness • communicate effectively • make decisions • apply infection control measures
Resources Implication	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview / Written Test • Observation / Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Physicochemical Laboratory Operation Level II	
Unit Title	**Participate in Workplace Communication**
Unit Code	**MIN PCL2 11 0114**
Unit Descriptor	This unit covers the knowledge, skills and attitudes required to gather, interpret and convey information in response to workplace requirements.

Elements	Performance Criteria
1. Obtain and convey workplace information	1.1 Specific and relevant information is accessed from ***appropriate sources***. 1.2 Effective questioning, active listening and speaking skills are used to gather and convey information. 1.3 Appropriate ***medium*** is used to transfer information and ideas. 1.4 Appropriate non- verbal communication is used. 1.5 Appropriate lines of communication with supervisors and colleagues are identified and followed. 1.6 Defined workplace procedures for the location and ***storage*** of information are used. 1.7 Personal interaction is carried out clearly and concisely.
2. Participate in workplace meetings and discussions	2.1 Team meetings are attended on time. 2.2 Own opinions are clearly expressed and those of others are listened to without interruption. 2.3 Meeting inputs are consistent with the meeting purpose and established ***protocols***. 2.4 ***Workplace interactions*** are conducted in a courteous manner. 2.5 Questions about simple routine workplace procedures and matters concerning working conditions of employment are asked and responded to. 2.6 Meetings outcomes are interpreted and implemented.
3. Complete relevant work related documents	3.1 Range of ***forms*** relating to conditions of employment is completed accurately and legibly. 3.2 Workplace data is recorded on standard workplace forms and documents. 3.3 Basic mathematical processes are used for routine calculations. 3.4 Errors in recording information on forms/ documents are identified and properly acted upon. 3.5 Reporting requirements to supervisor are completed according to organizational guidelines.

Variable	Range
Appropriate sources	May include but not limited to: • Team members • Suppliers • Trade personnel • Local government • Industry bodies
Medium	May include but not limited to: • Memorandum • Circular • Notice • Information discussion • Follow-up or verbal instructions • Face to face communication
Storage	May include but not limited to: • Manual filing system • Computer-based filing system
Protocols	May include but not limited to: • Observing meeting • Compliance with meeting decisions • Obeying meeting instructions
Workplace interactions	May include but not limited to: • Face to face • Telephone • Electronic and two way radio • Written including electronic, memos, instruction and forms, non-verbal including gestures, signals, signs and diagrams
Forms	May include but not limited to: • Personnel forms, telephone message forms, safety reports

Evidence Guide	
Critical Aspects of Competency	Demonstrates skills and knowledge to: • Prepare written communication following standard format of the organization • Access information using communication equipment • Make use of relevant terms as an aid to transfer information effectively • Convey information effectively adopting the formal or informal communication
Underpinning Knowledge and Attitudes	Demonstrate knowledge of: • Effective communication • Different modes of communication • Written communication • Organizational policies

	• Communication procedures and systems • Technology relevant to the enterprise and the individual's work responsibilities
Underpinning Skills	Demonstrate skills to: • Follow simple spoken language • Perform routine workplace duties following simple written notices • Participate in workplace meetings and discussions • Complete work related documents • Estimate, calculate and record routine workplace measures • Do basic mathematical processes of addition, subtraction, division and multiplication • relate to people of social range in the workplace • Gather and provide information in response to workplace Requirements
Resource Implications	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview / Written Test • Observation / Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Physicochemical Laboratory Operation Level II	
Unit Title	**Work in Team Environment**
Unit Code	**MIN PCL2 12 0114**
Unit Descriptor	This unit covers the skills, knowledge and attitudes to identify role and responsibility as a member of a team.

Elements	Performance Criteria
1. Describe team role and scope	1.1 The ***role and objective of the team*** are identified from available ***sources of information***. 1.2 Team parameters, reporting relationships and responsibilities are identified from team discussions and appropriate external sources.
2. Identify own role and responsibility within team	2.1 Individual role and responsibilities within the team environment are identified. 2.2 Roles and responsibility of other team members are identified and recognized. 2.3 Reporting relationships within team and external to team are identified.
3. Work as a team member	3.1 Effective and appropriate forms of communications used and interactions undertaken with team members who contribute to known team activities and objectives. 3.2 Effective and appropriate contributions are made to complement team activities and objectives, based on individual skills and competencies and ***workplace context***. 3.3 Protocols are observed in reporting using standard operating procedures. 3.4 Contribute to the development of team work plans based on an understanding of team's role and objectives and individual competencies of the members.

Variable	Range
Role and objective of team	May include but not limited to: • Work activities in a team environment with enterprise or specific sector • Limited discretion, initiative and judgment maybe demonstrated on the job, either individually or in a team environment
Sources of information	May include but not limited to: • Standard operating and/or other workplace procedures • Job procedures • Machine/equipment manufacturer's specifications and instructions • Organizational or external personnel

	• Client/supplier instructions • Quality standards • OHS and environmental standards
Workplace context	May include but not limited to: • Work procedures and practices • Conditions of work environments • Legislation and industrial agreements • Standard work practice including the storage, safe handling and disposal of chemicals • Safety, environmental, housekeeping and quality guidelines

Evidence Guide	
Critical aspects of competence	Demonstrates skills and knowledge to: • Operate in a team to complete workplace activity • Work effectively with others • Convey information in written or oral form • Select and use appropriate workplace language • Follow designated work plan for the job • Report outcomes
Underpinning Knowledge and Attitude	Demonstrate knowledge of: • Communication process • Team structure • Team roles • Group planning and decision making
Underpinning Skills	Demonstrate skills to: • Communicate appropriately, consistent with the culture of the workplace
Resource Implications	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview / Written Test • Observation / Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Physicochemical Laboratory Operation Level II	
Unit Title	**Develop Business Practice**
Unit Code	**MIN PCL2 13 0114**
Unit Descriptor	This unit specifies the outcomes required to establish a business operation from a planned concept. It includes researching the feasibility of establishing a business operation, planning the setting up of the business, implementing the plan and reviewing operations once commenced.

Elements	Performance Criteria
1. Identify business opportunity	1.1 ***Business opportunities*** are investigated and identified. 1.2 Feasibility study is undertaken to determine likely ***business viability***. 1.3 Market research on product or service is undertaken. 1.4 Assistance with feasibility study of ***specialist and relevant parties*** is sought as required. 1.5 Impact of emerging or changing technology including e-commerce, on business operations is evaluated. 1.6 Practicability of business opportunity is assessed in line with perceived risks, returns sought and resources available. 1.7 Business plan is completed for operation.
2. Identify personal business skills	2.1 Financial and business skills available are identified and taken into account when business opportunities are researched. 2.2 ***Personal skills/attributes*** are assessed and matched against those perceived as necessary for a particular business opportunity 2.3 ***Business risks*** are identified and assessed according to resources available and personal preferences.
3. Plan for establishment of business operation	3.1 Business structure and operations are determined and documented. 3.2 Procedures are developed and documented to guide operations. 3.3 Financial backing is secured for business operation. 3.4 Business legal and regulatory requirements are identified and complied. 3.5 ***Human and physical resources*** required to commence business operation are determined. 3.6 Recruitment strategies are developed and implemented.

4. Implement establishment plan	4.1 Marketing of business operation is undertaken. 4.2 Physical and human resources are obtained to implement business operation. 4.3 ***Operational unit*** is established to support and coordinate business operation. 4.4 Monitoring process is developed and implemented for managing operation. 4.5 ***Legal documents*** are carefully maintained and relevant records are kept and updated to ensure validity and accessibility. 4.6 Contractual procurement rights for goods and services including ***contracts with relevant people****,* negotiated and secured as required in accordance with the business plan. 4.7 Options for leasing/ownership of business premises identified and contractual arrangements are completed in accordance with the business plan.
5. Review implementation process	5.1 Review process for implementation of business operation is developed and implemented. 5.2 Improvements in business operation and associated management process are identified. 5.3 Identified improvements are implemented and monitored for effectiveness.

Variable	**Range**
Business opportunities	May include but not limited to: • expected financial viability • skills of operator • amount and types of finance available • returns expected or required by owners • likely return on investment • finance required • lifestyle issues
Business viability	May include but not limited to: • opportunities available • market competition • timing/ cyclical considerations • skills available • resources available • location and/ or premises available • risk related to a particular business opportunity, especially • in regard to Occupational Health and Safety and • environmental considerations
Specialist and	May include but not limited to:

relevant parties	• Chamber of commerce • Financial planners and financial institution representatives, business planning specialists and marketing specialists • accountants • lawyers and providers of legal advice • government agencies • industry/trade associations • online gateways • business brokers/business consultants
Personal skills/attributes	May include but not limited to: • technical and/ or specialist skills • business knowledge and skills • entrepreneurship • willingness to take risks
Business risks	May include but not limited to: • occupational health and safety and environmental • considerations • relevant legislative requirements • security of investment • market competition • security of premises/ location • supply and demand • resources available
Human and physical resources	May include but not limited to: • software and hardware • office premises • communications equipment • specialist services through outsourcing, contracting and • consultancy • staff • vehicles
Operational unit	May include but not limited to: • office location staffed with required personnel and equipped to service and support business • home-based site or other location such as leased or owned property
Legal documents	May include but not limited to: • partnership agreements, constitution documents, statutory books for companies (Register of Members, Register of Directors and Minute Books), Certificate of Incorporation, Franchise Agreements and financial documentation, appropriate software for financial records • recordkeeping including personnel, financial, taxation, OHS and environmental
Contracts with relevant people	May include but not limited to: • owners, suppliers, employees, landlords, agents, distributors,

	customers or any person with whom the business has, or seeks to have, a performance-based relationship

Evidence Guide	
Critical Aspects of Competence	Demonstrates skills and knowledge in: • that a business operation has been planned and implemented from initial research into feasibility of the business and completion of the plan, through to implementing the plan and commencing operations • the ability to evaluate the results of research and assess the likely viability and practicability of a business opportunity, taking into account the current business/market climate and resources available
Underpinning Knowledge and Attitudes	Demonstrate knowledge of: • Federal and regional government legislative requirements affecting business operations, especially in regard to Occupational Health and Safety (OHS), Equal Employment Opportunity (EEO), industrial relations and anti-discrimination • Technical or specialist skills relevant to the business operation • Financing options • Business systems and operations • Relevant marketing, management, sales and financial concepts • Methods for researching business opportunities • Principles of risk management relevant to the business • Methods of identifying relevant specialist services to complement the business • Forms and administrative systems • Services available and charges • Planning and control systems (sales, • Advertising and promotion, distribution and logistics • Financial recording systems • Legal rights and responsibilities • Record keeping duties • Operational factors relating to the business (provision of professional services, products)
Underpinning Skills	Demonstrate skills of: • Literacy skills to interpret legal requirements, company policies and procedures and immediate, day-to-day demands • Marketing skills • Business planning skills • Entrepreneurial skills • Problem-solving skills • OHS skills • Time management skills • Belief in services and products offered by the business • Communication skills including questioning, clarifying, reporting,

	and giving and receiving constructive feedback • Technical and analytical skills to interpret business documents, reports and financial statements and projections • Ability to relate to people from a range of social, cultural and ethnic backgrounds and physical and mental abilities • Problem solving skills to develop contingency plans • Using computers and software packages to record and manage data and to produce reports • Literacy skills to enable interpretation of business information, numeracy skills for data analysis to aid research • Research skills to identify a business opportunity and to conduct a feasibility study • Analytical skills to assess personal attributes and to identify business risks • Observation skills for identifying appropriate people, resources and to monitor work
Resource Implications	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview / Written Test • Observation / Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Physicochemical Laboratory Operation Level II	
Unit Title	**Standardize and Sustain 3S**
Unit Code	**MIN PCL2 14 0114**
Unit Descriptor	This unit of competence covers the knowledge, skills and attitudes required by worker to standardize and sustain 3S to his/her workplace. It covers responsibility for the day- to-day operations of the workplace and ensuring that continuous improvements of Kaizen elements are initiated and institutionalized.

Elements	Performance Criteria
1. Prepare for work.	1.1 Work instructions are used to determine job requirements, including method, material and equipment. 1.2 Job specifications are read and interpreted following working manual. 1.3 ***OHS requirements***, including dust and fume collection, breathing apparatus and eye and ear personal protection needs are observed throughout the work. 1.4 ***Safety equipment and tools*** are identified and checked for safe and effective operation. 1.5 ***Tools and equipment*** are prepared and used to implement 3S.
2. Standardize 3S.	2.1 Plan is prepared and used to standardize 3S activities. 2.2 ***Tools and techniques*** to standardize 3S are prepared and implemented based on ***relevant procedures***. 2.3 Checklists are followed for standardize activities and ***reported*** to ***relevant personnel***. 2.4 The workplace is kept to the specified standard. 2.5 Problems are avoided by standardizing activities.
3. Sustain 3S.	3.1 Plan is prepared and followed to standardize 3S activities. 3.2 ***Tools and techniques*** to sustain 3S are discussed, prepared and implemented based on relevant procedures. 3.3 Workplace is inspected regularly for compliance to specified standard and sustainability of 3S techniques. 3.4 Workplace is cleaned up after completion of job and before commencing next job or end of shift. 3.5 Situations are identified where compliance to standards is unlikely and actions specified in procedures are taken. 3.6 Improvements are recommended to lift the level of compliance in the workplace.

	3.7 Checklists are followed to sustain activities and reported to relevant personnel. 3.8 Problems are avoided by sustaining activities.

Variable	Range
OHS requirements	May include but not limited to: • Are to be in accordance with legislation/ regulations/codes of practice and enterprise safety policies and procedures. This may include protective clothing and equipment, use of tooling and equipment, workplace environment and safety, handling of material, use of fire fighting equipment, enterprise first aid, hazard control and hazardous materials and substances. • Personal protective equipment is to include that prescribed under legislation/regulations/codes of practice and workplace policies and practices. • Safe operating procedures are to include, but are not limited to the conduct of operational risk assessment and treatments associated with workplace organization. • Emergency procedures related to this unit are to include but may not be limited to emergency shutdown and stopping of equipment, extinguishing fires, enterprise first aid requirements and site evacuation.
Safety equipment and tools	May include but not limited to: • dust masks / goggles • glove • working cloth • first aid • safety shoes
Tools and equipment	May include but not limited to: • paint • hook • sticker • signboard • nails • shelves • chip wood • sponge • broom • pencil • shadow board/ tools board
Tools and techniques	May include but not limited to: • 5S Job Cycle Charts • Visual 5S • The Five Minute 5S • Standardization level checklist • 5S checklist

	• The five Whys and one How approach(5W1H) • Suspension • Incorporation • Use Elimination
Relevant procedures	May include but not limited to: • Assign 3S responsibilities • Integrate 3S duties into regular work duties • Check on 3S maintenance level • OHS measures such as signage, symbols / coding and labeling of workplace and equipment • Creating conditions to sustain your plans • Roles in implementation
Reporting	May include but not limited to: • verbal responses • data entry into enterprise database • brief written reports using enterprise report formats
Relevant personnel	May include but not limited to: • supervisors, managers and quality managers • administrative, laboratory and production personnel • internal/external contractors, customers and suppliers
Tools and techniques	May include but not limited to: • 5S slogans • 5S posters • 5S photo exhibits and storyboards • 5S newsletter • 5S maps • 5S pocket manuals • 5S department/benchmarking tours • 5S months • 5S audit • Awarding system • Big cleaning day • Patrolling system may include: ➢ Top management Patrol ➢ 5S Committee members and Promotion office Patrol ➢ Mutual patrol ➢ Self-patrol ➢ Checklist patrol ➢ Camera patrol

Evidence Guide	
Critical Aspects of Competence	Demonstrates skills and knowledge to: • Discuss the relationship between Kaizen elements. • Standardize and sustain 3S activities by applying appropriate tools and techniques.
Underpinning	Demonstrates knowledge of:

Knowledge and Attitudes	• Elements of Kaizen • Ways to improve Kaizen elements • Benefits of improving kaizen elements • Relationship between Kaizen elements • The fourth pillar of 5S • Benefits of standardizing and sustaining 3S • Procedures for standardizing and sustaining 3S activities • Tools and techniques to sustain 3S • Relevant Occupational Health and Safety (OHS) and environment requirements • Plan and report • Method of communication
Underpinning Skills	Demonstrates skills of: • improving Kaizen elements by applying 5S • standardizing and sustaining procedures and techniques to avoid problems • technical drawing • procedures to standardizing 3S activities • analyzing and preparing shop layout of the workplace • standardizing and sustaining checklists • preparing and implementing tools and techniques to sustain 3S • working with others • reading and interpreting documents • observing situations • solving problems by applying 5S • communication skills • preparing labels, slogans, etc. • gathering evidence by using different means • using Kaizen board properly in accordance the procedure • reporting activities and results using report formats
Resources Implication	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview / Written Test • Observation / Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

NTQF Level III

Occupational Standard: Physicochemical Laboratory Operation Level III	
Unit Title	**Prepare Working Solutions**
Unit Code	**MIN PCL3 01 0114**
Unit Descriptor	This unit of competency covers the ability to prepare working solutions and to check that existing stocks are suitable for use.

Elements	Performance Criteria
1. Safely use laboratory chemicals, glassware and equipment	1.1. Appropriate ***safety precautions*** are applied for use of ***laboratory equipment*** and ***hazardous*** chemical materials. 1.2. Appropriate laboratory glassware and measuring equipment are used. 1.3. Glassware and equipment are cleaned and stored in accordance with enterprise procedures.
2. Make up working solutions	2.1 The relevant standard methods are identified for ***solution preparation***. 2.2 Solutions are prepared by making use of appropriate ***metrology***. 2.3 Assemble specified laboratory equipment. 2.4 Materials and solvent of specified purity are selected and prepared. 2.5 Appropriate quantities of reagents are measured for solution preparation and data recorded. 2.6 Labels are prepared and solution details logged on in laboratory register. 2.7 Solutions are transferred to appropriately labelled containers.
3. Check existing& quality of stock solutions	3.1 Shelf life of working solutions is monitored according to laboratory procedures. 3.2 Out-of-date is replaced or solutions are rejected according to laboratory procedures. 3.3 ***Quality of solutions*** is ***monitored*** by making use of routine titrimetric analyses, if appropriate, to determine if solutions are fit for purpose.

Variable	Range
Safety precautions	may include: • use of MSDS • use of personal protective equipment, such as safety glasses, gloves and coveralls, high temperature resistant cloth • correct labeling of reagents and hazardous materials • handling and storing hazardous materials and equipment in accordance with labels, MSDS, manufacturer's instructions, and enterprise procedures and regulations • regular cleaning and/or decontamination of equipment and work

	areas
Laboratory equipment	may include: • pH meters • balances • magnetic stirrers, water baths and hot plates • measuring cylinders, beakers, conical flasks, volumetric flasks, pipettes and burettes • filter papers and funnels • fume cupboards
Hazards chemicals	may include: • corrosive chemicals, such as acids and alkalis • sources of heat, such as burners • sharps and broken glassware • spillages
Solution preparations	may include: • solutions required for analytical and limit tests in chemical laboratories, such as Sulphates, chlorides and heavy metals, precious metals • solutions required for laboratory cleaning and disinfection, such as 70% ethanol and hypochlorite
Concepts of metrology	may include: • that all measurements are estimates • measurements belong to a population of measurements of the measured parameters • repeatability • precision • accuracy • significant figures • sources of error • uncertainty • traceability
Monitoring quality of solutions	may include: • noting turbidity to exclude absorption of moisture • noting deposits to exclude microbial contamination or chemical degradation • noting crystals to exclude evaporation • conducting titrations to check concentration • noting colour changes indicating a pH shift with solutions containing indicators • checking expiry dates on solution containers
Occupational Health and Safety (OHS) and environmental management requirements	may include: • 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

Evidence Guide	
Critical aspects of Competence	Must demonstrate knowledge and skills competence to: • prepare working solutions in compliance with relevant standards, appropriate procedures and/or enterprise requirements • follow OHS procedures to safely use laboratory chemicals glassware and equipment • make up working solutions according enterprise procedures • check existing stocks of solutions as being fit for purpose.
Underpinning Knowledge and Attitudes	Demonstrate knowledge of: • relevant biological, chemical, food and laboratory terminology • principles of metrology • the international system of units (SI) • concentration terms, such as % w/w, % w/v, % v/v, ppm (mg/L) and molarity • basic theory of acids, bases, salts, buffers and neutralisation • enterprise procedures for preparing solutions • calculations required to prepare specified amounts of solutions of specified concentration • appropriate OHS procedure for preparing, handling and disposal of solutions • use of Material Safety Data Sheets (MSDS) • relevant health, safety and environment requirements
Underpinning Skills	Demonstrate skills to: • use appropriate materials, equipment and procedures to prepare solutions • follow appropriate Occupational Health and Safety (OHS), and hygiene procedures, if appropriate • use all equipment safely and efficiently • use enterprise procedures to calculate concentrations • identify solutions not fit for use • use titrations to determine the concentration of solutions • label, store and dispose of solutions appropriately • record and present data appropriately
Resources Implication	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview / Written Test • Observation / Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Physicochemical Laboratory Operation Level III	
Unit Title	**Perform Basic Tests**
Unit Code	**MIN PCL3 02 0114**
Unit Descriptor	This unit of competency covers the ability to perform tests and measurements using standard methods.

Elements	Performance Criteria
1. Interpret test requirements	1.1. Test request is reviewed to identify samples to be tested, test method and equipment involved as per relevant ***code of practice***. 1.2. ***Hazards*** are identified and enterprise controls associated with the sample, preparation methods, reagents and/or equipment.
2. Prepare sample	2.1 Sample description is recorded, compared with specification, discrepancies are recorded and reported. 2.2 ***Sample is prepared*** in accordance with appropriate standard methods.
3. Check equipment before use	3.1 Test ***measuring equipment*** is set up in accordance with test method. 3.2 Pre-use and safety checks are performed in accordance with enterprise procedures and manufacturer's instructions. 3.3 Faulty or unsafe equipment is identified and reported to appropriate personnel. 3.4 Calibration status of equipment is checked and any out of calibration items are reported to appropriate personnel.
4. Perform tests on samples	4.1 Sample and standards to be tested are identified, prepared and weighed or ***measured*** as per the ***standard procedures***. 4.2 Tests are conducted in accordance with enterprise procedures which fulfils appropriate ***concept of metrology***. 4.3 Data is recorded in accordance with enterprise procedures. 4.4 Calculations on data are performed as required. 4.5 Out of specification or atypical results are identified and reported promptly to appropriate personnel. 4.6 Equipment is shut down in accordance with operating procedures.
5. Maintain a safe work environment	5.1 Established safe work practices and personal protective equipment are used to ensure personal safety and that of other laboratory personnel.

	5.2 ***The generation of wastes and environmental impacts is minimized***. 5.3 Safe disposal of laboratory and hazardous wastes is ensured. 5.4 Equipment and reagents are cleaned, cared for and stored as required.

Variable	**Range**
Codes of practice	Where reference is made to industry codes of practice, Ethiopian relevant standards, it is expected the latest version will be used
Hazards	may include: • electric shocks • solar radiation, dust and noise • chemicals, such as sulphuric acid, fluorides and hydrocarbons • aerosols • sharps, broken glassware and hand tools • flammable liquids • dry ice and liquid nitrogen • fluids under pressure • sources of ignition • occupational overuse syndrome, slips, trips and falls • manual handling, working at heights and working in confined spaces • crushing, entanglement and cuts associated with moving machinery or falling objects
Preparation of samples	may include: • sub-sampling or splitting using procedures, such as riffling, coning and quartering, manual and mechanical splitters • diluting samples • physical treatments, such as ashing, dissolving, filtration, sieving, centrifugation and comminution • moulding, casting or cutting specimens
Common measuring equipment	may include: • PH Meter • DO and EC • photometer • analogue and digital meters and charts/recorders • basic chemical test kits • dipsticks and site test kits (e.g. HACK) • timing devices • temperature measuring devices, such as thermometers and thermocouples
Measurements	may include: • qualitative

	• quantitative • production/process parameters, such as temperature, flow and pressure • gas levels in a confined space
Standards procedures and/or enterprise requirement	may include: • Ethiopian relevant standards • calibration and maintenance schedules • enterprise recording and reporting procedures • equipment manuals • equipment start up, operation and shutdown procedures • MSDS and safety procedures • material, production and product specifications • national measurement regulations and guidelines • principles of Good Laboratory Practice (GLP) • production and laboratory schedules • quality manuals • Standard Operating Procedures (SOPs)
Concepts of metrology	may include: • that all measurements are estimates • measurements belong to a population of measurements of the measured parameters • repeatability • precision • accuracy • significant figures • sources of error • uncertainty • traceability
Typical tests carried out by laboratory/field assistants	may include: • visual/optical tests of appearance, colour, texture, identity, turbidity, refractive index (alcohol content and Baume/Brix) • physical tests: • density, specific gravity and compacted density • moisture content and water activity • particle size, particle shape and size distribution • chemical tests: ➢ gravimetric ➢ titrimetric ➢ colorimetric ➢ Electrical Conductivity (EC) and pH ➢ specific ions using dipsticks and kits ➢ nutrients (e.g. nitrates and orthophosphates) using basic kits ➢ ashes, including sulphated ashes • packaging tests: ➢ compressive strength and impact resistance

	➢ permeability and/or leakage • mechanical tests: ➢ Emerson class ➢ concrete slump
Enterprise controls to address hazards	may include: • use of MSDS • use of signage, barriers and service isolation tags • use of personal protective equipment, such as hard hats, hearing protection, sunscreen lotion, gloves, safety glasses, goggles, face guards, coveralls, gowns, body suits, respirators and safety boots • use of appropriate equipment, such as biohazard containers and cabinets and laminar flow cabinets • recognising and observing hazard warnings and safety signs • labeling of samples, reagents, aliquoted samples and hazardous materials • handling and storage of all hazardous materials and equipment in accordance with labeling, MSDS and manufacturer's instructions, and enterprise procedures and regulations • cleaning and decontaminating equipment and work areas regularly using recommended procedures • following established manual handling procedures for tasks involving manual handling
Minimising environmental impacts	may involve: • recycling of non-hazardous waste, such as chemicals, batteries, plastic, metals and glass • appropriate disposal of hazardous waste • correct disposal of excess sample/test material • correct storage and handling of hazardous chemicals
Occupational Health and Safety (OHS) and environmental management requirements	may include: • 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

Evidence Guide	
Critical aspects of Competence	Must demonstrate knowledge and skills competence to: • accurately interpret enterprise procedures or standard methods • complete all tests within the required timeline without

	sacrificing safety, accuracy or quality • demonstrate close attention to the accuracy and precision of measurements and the data obtained • maintain the security, integrity and traceability of all samples, data/results and documentation.
Underpinning Knowledge and Attitudes	Demonstrate knowledge of: • concepts of metrology • the international System of Units (SI) • purpose of test • principles of the standard method • pre-use equipment checks • relevant standards/specifications and their interpretation • sources of uncertainty in measurement and methods for control • enterprise and/or legal traceability requirements • interpretation and recording of test result, including simple calculations • procedures for recognition/reporting of unexpected or unusual results • relevant health, safety and environment requirements
Underpinning Skills	Demonstrate skills to: • interpreting enterprise procedure or standard methods accurately • using safety information, such as Material Safety Data Sheets (MSDS) and performing procedures safely • checking test equipment before use • completing all tests within required timeline without sacrificing safety, accuracy or quality • calculating, recording and presenting results accurately and legibly • maintaining security, integrity and traceability of all samples, data/results and documentation • cleaning and maintaining equipment
Resources Implication	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview / Written Test • Observation / Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Physicochemical Laboratory Operation Level III	
Unit Title	**Maintain the Laboratory Fit for Purpose**
Unit Code	**MIN PCL3 03 0114**
Unit Descriptor	This unit of competency covers the general cleaning of work surfaces, cleaning and storage of equipment and the monitoring of laboratory stocks under direct supervision.

Elements	Performance Criteria
1. Clean work preparation areas	1.1 Preparation areas are ***cleaned*** using appropriate cleaning agents and enterprise procedures. 1.2 Spillages are removed, if they occur, using appropriate agents, personal protective equipment and enterprise procedures. 1.3 Wastes are collected and segregated in accordance with enterprise procedures, relevant codes and regulations.
2. Clean and store equipment	2.1 Used equipment is collected and inspected for faults and, where necessary, remove from service. 2.2 Appropriate agents, apparatus and techniques are used to clean equipment. 2.3 Clean ***equipment*** and ***consumables*** are stored in the designated locations and manner.
3. Monitor stocks of materials and equipment	3.1 Stock checks are performed and records of usage maintained as directed. 3.2 Labeled ***stocks*** are stored for safe and efficient retrieval, and ***communicated*** with appropriate personnel of impending stock shortages to maintain continuity of supply.
4. Maintain a safe work environment	4.1 Established ***safe work practices*** and personal protective equipment are used to ensure personal safety and that of other personnel. 4.2 Potential ***hazards*** and/or ***maintenance issues*** in own work area is reported to designated personnel. 4.3 The generation of wastes and environmental impacts is minimized. 4.4 Wastes are disposed of in accordance with enterprise procedures, relevant codes and regulations.

Variable	Range
Cleaning	May include: • standards for the segregation of wastes as per the relevant standard of Ethiopia • confined space legislation • Ethiopia relevant Dangerous Goods Code • Ethiopia relevant Code for Transport of Dangerous Goods

	• guidelines for the operation of classes of laboratories • National Code of Practice for the labeling of workplace substances
Equipment	May include: • autoclaves • Cutting, Crushing , grinding and drying equipments • balances • blenders, centrifuges and separating equipment • dishwashers, refrigerators, freezers, ovens, microwave ovens, water baths • fume hoods • gas cylinders • glassware (burettes, pipettes); plastic ware; glass, plastic, quartz cuvettes • hotplates, mantles, burners, muffle furnace • thermometers, thermohygrographs, instrument chart recorders, hydrometers, pH meters • and ion selective electrodes • ultrasonic cleaners.
Consumables	May include: • consumable items, such as syringes, pipette tips, weigh boats • disposable clothing and PPE • distilled water, reagents, chemicals, disinfectants, detergents, agar media and plates • equipment spares, such as fuses, bulbs, batteries • oils/lubricants, fuels, industrial gases, cryogenics, such as dry ice and liquid nitrogen • paper, stationery • Reference samples and standards.
Stock	May include: • usage, loans, breakage • data sheets • calibration and maintenance history • handbooks, warranty documents, catalogues, manuals, MSDSs.
Communication	May include: • laboratory, production, administration, cleaning staff • internal/external contractors • Emergency personnel.
Established safe work practices	May include: • ensuring access to service shut off points • recognizing and observing hazard warnings and safety signs • labeling of samples, reagents, aliquot samples and hazardous materials • use of personal protective equipment, such as hard hats, hearing protection, gloves, safety • glasses, goggles, face guards, coveralls, gown, body suits, respirators and safety boots

	• applying containment procedures through the use of appropriate equipment, such as • laminar flow cabinets and physical containment facilities • use of Material Safety Data Sheets (MSDS) • handling and storage of all hazardous materials and equipment in accordance with • labeling, materials safety data sheets and manufacturer's instructions • identifying and reporting operating problems or equipment malfunctions • following established manual handling procedures for tasks involving manual handling • reporting to appropriate personnel of abnormal emissions, discharges and airborne • contaminants, such as noise, light, solids, liquids, water/waste water, gases, smoke, • vapor, fumes, odor and particulates
Hazards	may include: • electric shock • aerosols from broken centrifuge tubes, pipetting • solar radiation, dust, noise • sources of ignition, flammable liquids and gases • sharps, broken glassware and hand tools • chemicals, such as acids, heavy metals, pesticides, hydrocarbons • cryogenics, such as dry ice and nitrogen • fluids under pressure, such as steam, industrial gas cylinders • occupational overuse syndrome, slips, trips and falls • manual handling, working at heights and in confined spaces • crushing, entanglement, cuts associated with moving machinery or falling objects • Pedestrian and vehicular traffic.
Maintenance issues	could involve: • spillages, leakages, breakages, contamination • stock requirements, shortages • potential hazards, incidents and emergencies • hygiene issues • equipment malfunction • recycling and waste disposal.
Safety	May include: • Relevant Ethiopia standard of Safety in laboratories Parts 1–10 • Relevant Ethiopia standard of Hand washing facilities • Relevant Ethiopia standard of Fume hoods
Occupational Personal protection	May include: • Relevant Ethiopia standard of Emergency procedures guide for hazardous materials • Relevant Ethiopia standard of storage of goods

	• Relevant Ethiopia standard of Safety storage and handling of information cards • Relevant Ethiopia standard of Storage and handling of flammable and combustible liquids • Relevant Ethiopia standard of Storage and handling or corrosive liquids • Relevant Ethiopia standard of Storage and handling of toxic substance • Relevant Ethiopia standard of Storage and handling of gases in cylinders

Evidence Guide	
Critical aspects of Competence	Must demonstrate knowledge and skills competence to: • Clean work preparation areas and store equipment • Monitor stocks of materials and equipment • Maintain a safe work environment
Underpinning Knowledge and Attitudes	Demonstrate knowledge of: • enterprise procedures for the cleaning of work preparation areas, materials, equipment, minimization, disposal of waste monitoring laboratory stocks • storage requirements for specific materials and equipment • information contained in Material Safety Data Sheets (MSDSs)) for materials handled • regularly during the performance of maintenance tasks • Relevant health, safety and environment requirements.
Underpinning Skills	Demonstrate skills to: • safely cleans work preparation areas and equipment using appropriate cleaning agents, • apparatus and techniques • safely removes spillages and disposes of wastes • minimizes the exposure to hazards of self, others and the laboratory • safely stores equipment and materials using enterprise procedures, relevant codes and • guidelines • monitors and reports stock levels and the condition of laboratory materials and equipment • keeps accurate, up to date records • reports potential hazards and maintenance issues using enterprise procedures.
Resources Implication	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview / Written Test • Observation / Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Physicochemical Laboratory Operation Level III	
Unit Title	**Work Safely with Instruments that Emit Ionizing Radiation**
Unit Code	**MIN PCL3 04 0114**
Unit Descriptor	This unit of competency covers the ability to safely store, transport and operate instruments that emit ionizing radiation following established safe work practices and in accordance with licensing requirements.

Elements	Performance Criteria
1. Store instrument safely and securely	1.1 State or ***legislative requirements*** are identified for storage facilities and associated document processes. 1.2 Instruments are stored in accordance with State or legislative requirements and documented procedures. 1.3 Instruments are secured to prevent unauthorized access. 1.4 Instruments' movements and usage are recorded in accordance with documented procedures.
2. Transport instruments safely and securely	2.1 Vehicle suitable for the purpose is selected. 2.2 Regulation signage is attached in accordance with State. 2.3 Territory requirements are carried to indicate radioactive sources. 2.4 Ensure that ***instruments and equipment*** are properly located and fixed in place. 2.5 Security of instruments is ensured when the vehicle is unattended.
3. Use instruments safely and maintain security	3.1 ***Safe working practices*** are followed to minimize own exposure to radiation. 3.2 Radiation dosimeter is used to monitor own exposure to radiation. 3.3 Safe work practices are followed to minimize exposure of others to radiation. 3.4 Safe work practices are followed to protect the instrument from damage and to protect the employee from the possible ***hazards***. 3.5 Instrument security is maintained.
4. Monitor radiation levels	4.1 Operation and calibration status of radiation survey meter are checked. 4.2 Radiation survey is performed following documented procedures. 4.3 Typical conditions and/or problems are reported to appropriate personnel.
5. Maintain records	5.1 Observations, data and results are recorded in accordance with enterprise procedures.

	5.2 Confidentiality of enterprise information is maintained.
6. Perform emergency procedures	6.1 Potential emergency situations are identified. 6.2 Emergencies are responded in accordance with documented procedures. 6.3 Emergency situations are reported to appropriate personnel.

Variable	Range
Appropriate legislative requirements	May include: • Codes of Practice prepared by: ➢ Ethiopia Radiation Protection and Nuclear Safety Agency (ERPANSA) ➢ National Health and Medical Research Council (NHMRC) • State and territory legislation dealing with health and environmental protection • Standard Operating Procedures (SOPs) • equipment manuals • equipment start-up, operation and shutdown procedures • calibration and maintenance schedules • quality manuals • enterprise recording and reporting procedures • production and laboratory schedules • material, production and product specifications • licensing requirements.
Instruments and equipment	May include: • soil moisture/density gauges • borehole logging probes • fluid density/level detectors • battery chargers • radiation monitors/doimeters • motor vehicles • Photometers(XRF) • storage areas for nuclear sources • documentation, including user manuals, enterprise safety manuals • radiation warning signs.
Safe working practices	May include: • time (reduce the exposure time) • distance (maintain greatest distance possible at all times) • shielding (interpose as much radiation shielding between yourself and the radiation source as possible). • Frequent inspection of the instruments
Hazards and problems	May include: • jamming of the source rod in the exposed position • incidents during transportation • fire

	• theft of equipment containing radioactive sources • on-site accidents • keeping other personnel clear of instrument • Instrument breakdown.

Evidence Guide	
Critical aspects of Competence	Must demonstrate knowledge and skills competence to: • keeps other personnel clear of radiation sources • demonstrates emergency procedures • performs and documents radiation surveys • places the instrument into storage • safely transports the instrument in a motor vehicle • safely handles and uses the instrument • observes, interprets and reports atypical situations • communicates problems to appropriate personnel promptly.
Underpinning Knowledge and Attitudes	Demonstrate knowledge of: • health, safety and emergency procedures relevant to radioactive devices • factors affecting radiation intensity • principles of external radiation protection and practical methods of minimizing radiation exposure • methods of measuring and detecting ionizing radiation • nature of radiation, different types of radiation, their characteristics, sources and shielding • methods • physiological effects of ionizing radiation • State or Territory licensing requirements • national Codes of Practice • General guidelines for safe handling of radiation sources.
Underpinning Skills	Demonstrate skills to: • performing radiation surveys using radiation monitors • using radiation dosimeters • transporting instruments containing radioactive materials • storing instruments containing radioactive materials • using instruments containing radioactive materials • maintaining instruments containing radioactive materials.
Resources Implication	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview / Written Test • Observation / Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Physicochemical Laboratory Operation Level III	
Unit Title	**Participate in Laboratory/Field Workplace Safety**
Unit Code	**MIN PCL3 05 0114**
Unit Descriptor	This unit of competency covers the ability to apply enterprise OHS policies and procedures dealing with the identification and control of hazards, working safely at all times, emergency Response and contributing to the maintenance of workplace safety.

Elements	Performance Criteria
1. Identify, control and report OHS and environmental hazards	1.1 Immediate work area for ***hazards is routinely checked*** prior to commencing and during work. 1.2 ***Hazards are addressed*** within area of responsibility. 1.3 Hazards and incidents are reported to designated personnel according to ***Industry standards, codes and guidelines***.
2. Conduct work safely	2.1 Appropriate personal protective clothing and equipment are selected, fitted and used. 2.2 Enterprise procedures are followed when carrying out work tasks. 2.3 All work areas are kept clean and free from obstacles. 2.4 Enterprise standards of personal hygiene are maintained. 2.5 Hazardous materials and dangerous goods are stored, transported and dispose of safely.
3. Follow incident and emergency response procedures	3.1 ***Incident and emergency*** situations are identified. 3.2 Incident and emergency situations are reported and recorded according to enterprise procedures. 3.3 Incident and emergency procedures are followed as appropriate to the nature of emergency, using emergency equipment according to enterprise procedures.
4. Contribute to OHS in the workplace	4.1 OHS and environmental issues are raised with designated personnel in accordance with ***enterprise policy & procedures*** and legislated rights and obligations of employees. 4.2 OHS activities are made participatory in within scope of responsibilities.

Variable	Range
Hazards	May include: • electric shock • solar radiation, dust, noise • chemicals, such as acids, heavy metals, pesticides,

	hydrocarbons • aerosols from broken centrifuge tubes, pipetting • radiation, such as alpha, beta, gamma, X-ray, neutron • sharps, broken glassware and hand tools • flammable liquids • cryogenics, such as dry ice and nitrogen • fluids under pressure, such as steam ,argon gas, acetylene in atomic absorption spectrometry • sources of ignition • high temperature ashing processes • disturbance or interruption of services • occupational overuse syndrome, slips, trips and falls • manual handling, working at heights and in confined spaces • crushing, entanglement, cuts associated with moving machinery or falling objects • pedestrian and vehicular traffic
Routine checks	May include: • general housekeeping checks, such as obstructions which may cause trip hazards • checking of safety equipment, such as eye wash stations • checking reagents and equipment are safe to use • checking availability of emergency equipment • checking functionality of personal protective equipment.
Addressing hazards	May include: • hazard and incident reporting and investigation procedures • elimination • substitution, such as review of nature of substances or processes used isolation, such as: • use of appropriate equipment, such as , laminar flow cabinets administrative procedures, such as: • ensuring access to service shut off points • recognizing and observing hazard warnings and safety signs • labeling of samples, reagents, aliquot samples and hazardous materials • handling and storage of all hazardous materials and equipment in accordance with • labeling, materials safety data sheets and manufacturer's instructions • identifying and reporting operating problems or equipment malfunctions • cleaning and decontaminating equipment and work areas regularly using recommended procedures • applying containment procedures • following established manual handling procedures for tasks

	involving manual handling • use of appropriate equipment and procedures to avoid personal contamination • and contamination of others • following risk control measures to minimize environmental hazards • use of practices which minimize waste • reporting to appropriate personnel of abnormal emissions, discharges and airborne • contaminants, such as noise, light, solids, liquids, water/waste water, gases, smoke, • vapor, fumes, odor and particulates • minimizing exposure to radiation, such as lasers, electromagnetic and ultraviolet • use of Material Safety Data Sheets (MSDS) • use of signage, barriers and service isolation tags • use of personal protective equipment, such as hard hats, hearing protection, sunscreen • lotion, gloves, safety glasses, goggles, face guards, coveralls, gown, body suits, respirators and safety boots.
Industry standards, codes and guidelines	May include: • Relevant Ethiopian standard Safety in laboratories • Relevant Ethiopian standard Hand washing facilities • Relevant Ethiopian standard Fume hoods • Relevant Ethiopian standard Occupational personal protection, and other relevant standards for protective, clothing • Relevant Ethiopian standard Emergency procedures guide for hazardous materials • Relevant Ethiopian standard Storage of goods • Relevant Ethiopian standard Safety storage and handling of information cards • Relevant Ethiopian standard Storage and handling of flammable and combustible liquids • Relevant Ethiopian standard Storage and handling or corrosive liquids • Relevant Ethiopian standard Storage and handling of toxic substances • standards for the segregation of wastes, Relevant Ethiopian standard • Relevant Ethiopian standard Dangerous Goods Code • Relevant Ethiopian standard Code for Transport of Dangerous Goods • guidelines for the operation of classes of laboratories • National Code of Practice for the labeling of workplace substances ,Relevant Ethiopian standard

Incident and emergency	May include: • workplace injury and accidents — cutting, stabbing, puncturing, crushing, immersion • in water, suffocation, hypothermia, burns, heat stress, animal bites, allergic reactions, • assaults • biological, chemical or radioactive spills; fire; bomb threat; security threat; explosion.
Enterprise policies and procedures	May include: • all OHS specific procedures, such as for hazard and incident reporting, communication, • consultation and issue resolution and risk management • controlling known hazards • minimizing environmental threats • minimizing and disposing of waste • responding to safety, emergency, fire and incidents • selecting/using personal protective clothing and equipment.

Evidence Guide	
Critical aspects of Competence	Must demonstrate knowledge and skills competence to: • demonstrates the ability to recognize potential incidents and take appropriate corrective action • can demonstrate workplace fire drill, incident, first aid and emergency evacuation procedures • follows OHS and environmental policies and procedures for hazard identification and risk • control, including the use, storage and maintenance of personal protective equipment • follows enterprise instructions and procedures relating to storage, transport and disposal of dangerous goods • follows instructions designed to ensure the correct labeling of samples and reagents • uses equipment to protect health and safety • communicates health and safety and environmental issues promptly with designated personnel.
Underpinning Knowledge and Attitudes	Demonstrate knowledge of: • roles, rights and responsibilities of self and employer • signage, symbols and signals relating to OHS • hazards commonly found in own job and work area and standard risk controls • location and purpose of personal protective equipment and emergency/hazard control • equipment in the work area, including first aid facilities and personnel • use, care and storage requirements for personal protective clothing and equipment used

	• location of advice and information on OHS issues, including Material Safety Data Sheets(MSDSs) • requirements and procedures for reporting OHS hazards and incidents, including injuries, • illness and near misses • the processes for raising a health and safety issue or concern • safe work practices, including handling, storage and disposal of hazardous substances and • requirements for labeling of hazardous substances • work practices for use of handling equipment and any task-specific manual handling • techniques as required by work role, according to enterprise procedures • Standard operating procedures for equipment used and key safety elements of the procedures. • environmental impacts and effects of interaction with hazards in the work area • enterprise procedures and instructions that govern personal work, incidents and • emergencies • reporting requirements for OHS issues and potentially hazardous situations.
Underpinning Skills	Demonstrate skills to: • site layout, including emergency exits, location and use of safety alarms, emergency • response system, procedures and personnel • Enterprise OHS and environmental policies and procedures.
Resources Implication	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview / Written Test • Observation / Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Physicochemical Laboratory Operation Level III	
Unit Title	**Plan and Conduct Laboratory/Field Work**
Unit Code	**MIN PCL3 06 0114**
Unit Descriptor	This unit of competency covers the ability to plan and complete tasks individually or in a team context. The tasks involve established routines and procedures using allocated resources With access to readily available guidelines and advice.

Elements	Performance Criteria
1. Plan and organize daily work activities	1.1 Allocated ***work activities*** and required resources are clarified if necessary. 1.2 All work is performed ***ethically and professionally***. 1.3 Work activities are prioritized as directed. 1.4 Work activities are broken down into small achievable components and efficient sequences. 1.5 Work plan is reviewed in response to new information, urgent requests, changed situations or instructions from appropriate personnel. 1.6 Work plan is updates and changes are communicated to appropriate personnel.
2. Complete allocated work	2.1 Relevant ***workplace procedures*** for required tasks are located. 2.2 Task(s) following prescribed and routine work related sequences is/are undertaken. 2.3 Assistance from relevant personnel is sought when difficulties cannot be handled. 2.4 Completion of activities is recorded to confirm outputs in accordance with plan.
3. Identify and resolve work problems	3.1 Problems or opportunities are recognized for improved work performance. 3.2 Agreed ***problem solving*** strategies are applied to consider possible causes and solutions. 3.3 Appropriate sources of help are identified and accessed. 3.4 Available alternatives are considered and kept open before agreeing on the most appropriate action.
4. Work in a team environment	4.1 Cooperate & ***organize with team members to*** negotiate and achieve agreed outcomes, timelines and priorities. 4.2 Personal abilities and limitations are recognized when undertaking team tasks.

	4.3 Personal role and responsibility within the team are confirmed for particular outputs. 4.4 Sensitivity to the diversity of other team members' backgrounds and beliefs is demonstrated.
5. Update knowledge and skills as required	5.1 Own strengths and weaknesses are recognized and advantage of skill development opportunities is taken.

Variable	Range
Workplace activities	May include: • set up and pre-use checks of laboratory equipment • calibration status checks • sampling and testing following standard procedures • Maintenance and cleaning tasks.
All work is performed ethically and professionally	May include: • following enterprise policy and procedures, regulations and legislation • behaving honestly and openly • respecting others and treating them with courtesy and impartiality • working diligently and responsibly
Workplace procedures	May include: • standard operating procedures SOPs • job cards, batch cards, production schedules • job descriptions • Methods, recipes, procedures and protocols.
Problem solving	May include: • accessing relevant documentation • identifying inputs and outputs • sequencing a process • identifying and rectifying a problem step • obtaining timely help • implementing preventative strategies wherever possible.
Organize with team members	May include: • be ongoing with responsibility for particular services or functions, or project based • have a mixture of full and part-time employees and contractors, laboratory, construction and production personnel • be separated by distance and work at sites outside laboratory facilities.
The team operate	May include: • small, medium and large contexts • internal and external environments • enterprise guidelines covering access and equity principles and practices, licensing • requirements, industrial awards, enterprise bargaining agreements, Codes of Practice

	• agreed responsibility and accountability requirements • appropriate goals, objectives given resource parameters.

Evidence Guide	
Critical aspects of Competence	Must demonstrate knowledge and skills competence to: • Plan and organize daily work activities • Complete allocated work • Identify and resolve work problems • Work in a team Environment • Update knowledge and skills as required
Underpinning Knowledge and Attitudes	Demonstrate knowledge of: • enterprise procedures covering: ➢ customer service ➢ quality ➢ OHS and environmental legislative requirements ➢ technical work that the candidate routinely performs • workplace agreements and employment conditions, such as: ➢ workers compensation ➢ industrial awards enterprise agreements ➢ equal employment opportunity ➢ anti discrimination and anti-harassment ➢ ethical background relevant to the nature of the work, such as • problem solving strategies • interpersonal communication and conflict resolution techniques • Relevant health, safety and environment requirements.
Underpinning Skills	Demonstrate skills to: • clarifies tasks and recognizes resource needs • follows relevant procedures • recognizes potential disruptions or changed circumstances and modifies work plan • in conjunction with relevant personnel • compensates for a variety of working environments (indoor, outdoor and night) • seeks assistance from relevant personnel when difficulties arise • achieves quality outcomes within timelines • works effectively with team members who may have diverse work styles, cultures and perspectives • promotes cooperation and good relations in the team
Resources Implication	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview / Written Test • Observation / Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Physicochemical Laboratory Operation Level III	
Unit Title	**Contribute to the Achievement of Quality Objectives**
Unit Code	**MIN PCL3 07 0114**
Unit Descriptor	This unit of competency covers the development of a working knowledge of quality principles and their application in laboratory/field work.

Elements	Performance Criteria
1. Apply quality control procedures	1.1 Data is recorded for quality control purposes. 1.2 Quality control tasks are conducted in accordance with ***quality manuals and work place procedure***. 1.3 Non-conformances are recognized and ***reported*** in keeping with job role and ***quality control procedures***.
2. Contribute to quality improvements	2.1 Own work practices are reviewed for opportunities to continuously improve performance. 2.2 Opportunities are identified and reported for improvements in procedures, processes and equipment in work area.
3. Maintain commitment to enterprise quality standards in own work	3.1 An objective of 'right first time' is maintained. 3.2 Work is conducted in accordance with ***sustainable energy work practices***. 3.3 Waste and rework are minimized in accordance with enterprise guidelines. 3.4 'Job ownership' for whole tasks is demonstrated through commitment to finish and follow-up. 3.5 Ensure that personal actions conform with the code of ethics relevant to the workplace.
4. Assist in maintaining customer relationships	4.1 An understanding of the business goals, products and services of the enterprise is demonstrated when dealing with customers in relation to own function. 4.2 Communication is done appropriately with customers in keeping with knowledge and authority limitations and quality requirements.
5. Update knowledge and skills as required	5.1 Own strengths and limitations are recognized and advantage taken for ***quality improvement opportunities***.

Variable	Range
Quality manuals and workplace	May include: • ISO/IEC 17025 General requirements for the competence of

procedures	testing and calibration • Laboratories: ➢ ISO 9000 series Quality management and quality assurance standards ➢ Ethiopian relevant standard Good laboratory practice • Codes of Practice, such as Good Laboratory Practice (GLP) and Good Manufacturing Practice (GMP) • Relevant Ethiopian standard Principles of good laboratory practice • Customer specific requirements/standards.
Reporting	May include: • verbal responses • data entry into Laboratory Information Management System (LIMS) or enterprise databases • Brief written reports using enterprise proformas.
Quality control procedures	May include: • standards imposed by regulatory and licensing bodies • enterprise quality procedures • working to a customer brief and associated quality procedures • checklists to monitor job progress against agreed time, costs and quality standards • the use of hold points to evaluate conformance • the use of inspection and test plans to check compliance.
Sustainable energy principles and work practices	May include: • examining work practices that use excessive electricity • switching off equipment when not in use • regularly cleaning filters • insulating rooms and buildings to reduce energy use • recycling and reusing materials wherever practicable • minimizing process waste.
Quality improvement opportunities	could include: • improved methods for sampling, testing and recording data • improved hygiene and sanitation procedures • minimization of waste and rework • improved laboratory layout and work flow.

Evidence Guide	
Critical aspects of Competence	Must demonstrate knowledge and skills competence to: • applies required quality control procedures during sampling, testing and the recording of data • provides quality products and services to customers in keeping with their role • resolves simple customer requirements • minimizes waste and rework • contributes to improvements in productivity and quality

	through teamwork and • Commitment to personal work standards.
Underpinning Knowledge and Attitudes	Demonstrate knowledge of: • role of internal and external audits • quality requirements of the candidate's job role and function(s) • continuous improvement and waste minimization principles • recording, reporting and document control requirements. • relevant health, safety and environment requirements.
Underpinning Skills	Demonstrate skills to: • products and services provided by the enterprise • layout of the enterprise, divisions, and laboratory • organizational structure of the enterprise • lines of communication • role of laboratory services to the enterprise and customers • scheduling of tests and procedures to meet customer requirements • Enterprise procedures associated with the candidate's regular technical duties.
Resources Implication	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview / Written Test • Observation / Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Physicochemical Laboratory Operation Level III	
Unit Title	**Apply Critical Control Point Requirements**
Unit Code	**MIN PCL3 08 0114**
Unit Descriptor	This unit of competency covers the ability to monitor critical, quality and regulatory control points related to a person's work responsibilities.

Elements	Performance Criteria
1. Provide routine input to the HACCP plan	1.1 Information about ***control points*** is obtained in the manufacturing process. 1.2 Control points are located for own work area responsibilities. 1.3 Relevant checks and inspections on ***product/ materials*** and equipment are performed to establish conformance to meet chemical safety requirements. 1.4 Variations or common faults are identified. 1.5 Inspection results are recorded and reported to appropriate personnel.
2. Contribute to the continuous improvement of the HACCP plan	2.1 Non-conformance to the HACCP plan is recognized. 2.2 Likely causes for non-conformance are identified. 2.3 Non-conformances are recorded and reported to appropriate personnel.

Variable	Range
Control points	refer to: • HACCP plans/documents/procedures • product safety plan • production/quality procedures/requirements • State/national legislation • Standard Operating Procedures (SOPs) • quality manuals • Good Manufacturing Practice (GMP).
Products/materials	May include: • raw materials • ingredients • adjuncts/process aids • consumables • finished product • chemicals

Evidence Guide	
Critical aspects of Competence	Must demonstrate knowledge and skills competence to: • correctly monitors the critical, quality and regulatory control

	points for their own work • area responsibilities • prevents contamination from occurring or recurring • records information using the enterprise reporting system • collects and analyses data to identify variation from limits • takes approved corrective action(s) as required • supports continuous improvement through observation and communication.
Underpinning Knowledge and Attitudes	Demonstrate knowledge of: • the HACCP plan, including: ➢ the critical control points, control limits ➢ consequences of non-conforming products being identified • continuous improvement practices • quality policy, procedures and responsibilities • the methods used to monitor each critical, quality, regulatory control point • equipment and instrument calibration requirement • methods for systematically investigating and responding to problems • control points and their potential impact on work systems • Relevant health, safety and environment requirements.
Underpinning Skills	Demonstrate skills to: • products and services provided by the enterprise • layout of the enterprise, divisions, and laboratory • organizational structure of the enterprise • lines of communication • role of laboratory services to the enterprise and customers • scheduling of tests and procedures to meet customer requirements • Enterprise procedures associated with the candidate's regular technical duties.
Resources Implication	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview / Written Test • Observation / Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Physicochemical Laboratory Operation Level III	
Unit Title	**Assist with Fieldwork**
Unit Code	**MIN PCL3 09 0114**
Unit Descriptor	This unit of competency describes the ability to perform tasks associated with organization of field work, field surveys and field camp operations.

Elements	Performance Criteria
1. Assist with organization of fieldwork	1.1 Supplies and ***equipmen***t are purchased as specified by senior staff. 1.2 Supplies and equipment are assembled and checked against inventory. 1.3 Supplies and equipment are packed appropriately for safe transport.
2. Perform tasks related to field camp operations	2.1 Unpacked items are checked against inventory. 2.2 Supplies and equipment are stored as specified. 2.3 Supplies are restocked as necessary. 2.4 Sanitation facilities are checked as required. 2.5 Camp waste is disposed of in accordance with safety and environmental requirements.
3. Perform tasks related to field surveys	3.1 Equipment is assembled for ***field work*** as per project specifications. 3.2 Samples are collected in accordance with enterprise procedures and ethics and other legislative requirements. 3.3 Samples are stored in accordance with special requirements for continued wellbeing, viability or integrity of sample. 3.4 Simple field measurements are performed as directed. 3.5 Records of environmental data are collected and maintained as directed. 3.6 Survey wastes are disposed of in accordance with safety and environmental requirements.
4. Demonstrate basic field survival skills	4.1 Specified ***safety procedures*** are followed to protect ***hazards.*** 4.2 Specified survival procedures are followed in the event of emergencies and accidents. 4.3 Suitable clothing are worn as protection against solar radiation, extreme temperatures and impact injury.
5. Assist with the close down of field	5.1 Supplies, equipment and samples are packed appropriately for safe return transport. 5.2 Used equipment is checked and cleaned to prevent

camp	deterioration and contamination. 5.3 Supplies and equipment are returned to storage at enterprise location. 5.4 A stock take of equipment and supplies is conducted for replenishment where required. 5.5 The dispatch of collected samples is assisted for laboratory analysis.

Variable	Range
Items of equipment	May include: • pH meters, dissolved oxygen probes, portable colorimeters, field microscopes, hand centrifuges, sieves and filters • chemical field test kits • environmental monitoring systems • equipment required for the collection of samples • equipment suitable for the safe collection and disposal of non biological wastes • basic first aid equipment • data loggers • communication systems, such as two-way radio, conventional codes and symbols for signaling • tools, vehicle recovery equipment and spare parts • navigation and communication equipment, including global positioning system.
Field work tasks	May include: • written fieldwork procedures, standard operating procedures and operating manuals • basic test procedures (validated and authorized) • basic sampling procedures (labeling, preparation, storage, transport and disposal) • safety requirements for equipment, materials or products • permits for wildlife capture and handling • animal welfare and ethics requirements, Codes of Practice • cleaning, hygiene and personal hygiene requirements • environmental requirements related to disposal of waste • incident and accident/injury reports • instructions to comply with new legislation, standards, guidelines and codes • first aid kit and survival manual.
Safety procedures	May include: • use of personal protective equipment, such as sunscreen, hat, safety glasses, gloves, safety boots • ‘stay with vehicle’ and other basic survival techniques • use of a regular communication schedule • handling, storage and disposal of all hazardous

	materials/waste in accordance with MSDS, labels, enterprise procedures and regulations.
Hazards	May include: • solar radiation, dust, noise • personnel getting lost • incidents or emergencies, such as snake or animal bites • severe weather conditions • manual handling of heavy objects • vehicle and boat handling in rough/remote conditions • moving machinery, hand tools.

Evidence Guide	
Critical aspects of Competence	Must demonstrate knowledge and skills competence to: • Assist with organization of fieldwork • Perform tasks related to field camp operations • Perform tasks related to field surveys • Demonstrate basic field survival skills • Assist with the closedown of field camp
Underpinning Knowledge and Attitudes	Demonstrate knowledge of: • terminology relevant to the physical chemistry, biology and ecology of samples and specimens • enterprise procedures relating to sample collection, maintenance and storage • enterprise procedures relating to field testing of samples • specific legislation and Codes of Practice related to sample • principles of safety relating to fieldwork, such as use of LPG, operation of generators, • use of protective clothing • communication procedures using two-way radio and satellite phone • basic field survival strategies, such as map reading, use of compass, ‘stay with vehicle’ • in the event of accident or emergency • documentation in accordance with enterprise procedures and legislative requirements • relevant health, safety and environment requirements.
Underpinning Skills	Demonstrate skills to: • completes tasks (associated with the organization, set up, maintenance and close down • of a field camp) efficiently and safely • collects samples in accordance with enterprise procedures and legislative requirements• maintains and stores samples in accordance with special requirements for continued • wellbeing, viability and integrity of sample • records data according to enterprise procedures and legislative requirements

	• prepares documentation accurately and in accordance with requirements • performs all fieldwork in accordance with safety and environmental requirements. • disposes of wastes in accordance with safety and environmental requirements.
Resources Implication	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview / Written Test • Observation / Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Physicochemical Laboratory Operation Level III	
Unit Title	**Prepare Practical Science Classes and Demonstrations**
Unit Code	**MIN PCL3 10 0114**
Unit Descriptor	This unit of competency covers the ability to manage the day-to-day running of science teaching laboratories and the preparation of practical experiments, demonstrations and field trips. Personnel are required to assess and treat risks associated with practical activities.

Elements	Performance Criteria
1. Ensure safe work practices	1.1 ***Risk assessments*** are organized and performed to identify ***hazards*** and analyze ***risks control*** associated with planned practical activities. 1.2 Appropriate controls for identified hazards are selected and implemented and their effectiveness is monitored. 1.3 Preparation and conduct of practical activities are performed in accordance with relevant regulations, codes, guidelines and enterprise procedures. 1.4 Personal protective clothing and equipment are selected, fitted, used and ensured that it is used by students and teachers. 1.5 Ensure materials and ***equipment*** are handled, prepared, stored and disposed of safely. 1.6 ***Incidents and emergencie***s are addressed as they arise.
2. Plan work schedule	2.1 Schedule of classes and demonstrations is planned in consultation with teaching staff to ensure timely delivery. 2.2 Communication is done effectively with staff and students using appropriate negotiation and conflict resolution skills. 2.3 Work activities are prioritized and time is managed to meet deadlines. 2.4 Work plan is modified to deal with contingencies as they arise.
3. Organize experiments and demonstrations	3.1 Materials and equipment are collected from appropriate sources. 3.2 Pre-use checks are performed, ***material and equipment*** prepared and made ready for use. 3.3 Practical skills, techniques and use of materials and equipment are ***demonstrated***, as required. 3.4 Cleanup operations and recycling or disposal of wastes are organized. 3.5 Experiments and demonstrations are trialed and variations or

	alternatives recommended.
4. Manage resources	4.1 Practical activities are operated within approved budgets. 4.2 Stocks of materials and equipment are maintained and controlled. 4.3 Storerooms, preparation areas and laboratories fit for purpose are maintained. 4.4 Materials and equipment are evaluated and selected and recommendations made for purchase. 4.5 Materials and equipment are ordered, received and stored using enterprise procedures. 4.6 Quotes and bookings are organized for transport and accommodation for field trips, as necessary. 4.7 Laboratory equipment is serviced and/or repaired where feasible. 4.8 Arrange for the servicing or repair of equipment by appropriate personnel or accredited service agents.

Variable	**Range**
Risk assessment	May include: • effectiveness of existing controls • likelihood of each consequence considering exposure and hazard level • combining these in some way to obtain a level of risk.
Hazards	May include: • electric shock • solar radiation, dust, noise • exposure to extreme weather conditions • chemicals, such as acids, heavy metals, hydrocarbons • aerosols from broken centrifuge tubes, pipetting • radiation, such as alpha, beta, gamma, X-ray • sharps, broken glassware and hand tools • flammable liquids • cryogenics, such as dry ice and nitrogen • fluids under pressure, such as steam, argon gas, acetylene • in atomic absorption spectrometry • sources of ignition • high temperature ashing processes • disturbance or interruption of services • occupational overuse syndrome, slips, trips and falls • manual handling, working at heights and in confined spaces • crushing, entanglement, cuts associated with moving machinery or falling objects
Risk control	May include:

	• 1 eliminating risk • substituting with a lesser hazard • isolating personnel from hazard • engineering controls • applying administrative controls, for example, procedures and training • 6 using personal protective equipment.
Equipment	May include: • analytical instruments, such as UV/VIS and AAS spectrometers • autoclaves • balances • blenders, centrifuges and separating equipment • dishwashers, refrigerators, freezers, ovens, microwave ovens, water baths • fume hoods • gas cylinders • glassware (burettes, pipettes); plastic ware; glass, plastic, quartz cuvettes • hotplates, mantles, burners, muffle furnaces • light and fluorescence microscopes • microtomes • teaching aids, such as VCR and DVD players, computers • thermometers, pH meters and ion selective electrodes • ultrasonic cleaners
Incidents and emergencies	May include: • workplace injury and accidents • chemical spills • leakage of radioactivity • fire accident • Security threats.
Sources of materials and equipment	may include: • field trips, including land- and sea-based • botanic gardens and parks • abattoirs • commercial suppliers • other institutions • blood bank • shops.
Demonstration of techniques and use of equipment	May include: • teaching staff • other technical staff • students during practical classes • students doing projects or postgraduate studies.
Relevant standards, enterprise procedure	May include: • Relevant Ethiopia Standard Safety in laboratories

and test methods	• Relevant Ethiopia Standard Hand washing facilities • Relevant Ethiopia Standard Fume hoods • Relevant Ethiopia Standard Occupational personal protection, and other relevant standards for protective, clothing • Relevant Ethiopia Standard Emergency procedures guide for hazardous materials • Relevant Ethiopia Standard Storage of goods • Relevant Ethiopia Standard Safety storage and handling of information cards • Relevant Ethiopia Standard Storage and handling of flammable and combustible liquids • Relevant Ethiopia Standard Storage and handling of corrosive liquids • Relevant Ethiopia Standard Storage and handling of toxic substances • Relevant Ethiopia Standard for the segregation of wastes • Relevant Ethiopia Standard Dangerous Goods Code • Relevant Ethiopia Standard for Transport of Dangerous Goods • guidelines for the operation of classes of laboratories • National Code of Practice for the labeling of workplace substances
Hazard control measures	May include: • ensuring access to service shut-off points • recognizing and observing hazard warnings and safety signs • use of Material Safety Data Sheets (MSDS) • labeling of samples, reagents, aliquot samples and hazardous materials • handling and storing hazardous materials and equipment in accordance with labeling, materials safety data sheets and manufacturer's instructions • identifying and reporting operating problems or equipment malfunctions • cleaning and decontaminating equipment and work areas regularly using enterprise procedures • using personal protective clothing and equipment, such as hats, hearing protection, gloves, • safety glasses, coveralls, gown, body suits, respirators and safety boots • applying containment procedures through the use of appropriate equipment, such as laminar flow cabinets • following established manual handling procedures for tasks involving manual handling • reporting abnormal emissions, discharges and airborne contaminants, such as noise, light, solids, liquids, water/waste water, gases, smoke, vapour, fumes, odour and

	particulates to • Appropriate personnel.
Contingencies	May include: • new information • urgent requests • modified activities • changed situations • late instructions from appropriate personnel • Substitution of reagents.
Resource management	May include: • preparation of operational plans • schedules and budgets • handling of petty cash and reconciliation of bank statements • contacting suppliers and completing order requisition forms • use of an enterprise credit card.

Evidence Guide	
Critical aspects of Competence	Must demonstrate knowledge and skills competence to: • Ensure safe work practices • Plan work schedule • Organize experiments • and demonstrations • Manage resources
Underpinning Knowledge and Attitudes	Demonstrate knowledge of: • scientific terminology used in common practical activities • relevant legislation, regulations, codes governing practical activities • technical details of sampling, testing, equipment and instrumentation used in common • practical activities • enterprise procedures for the purchase, handling and storage of materials and equipment • principles of budgeting, operational planning and efficient resource use • principles of risk assessment and risk management, hierarchy of control • problem solving techniques and contingency planning • relevant enterprise health, safety and environment requirements.
Underpinning Skills	Demonstrate skills to: • clarifies/designs practical activities and assesses resource needs • works with teaching staff and students to assess risks, develop and implement controls and • monitors their effectiveness • prepares laboratory experiments and demonstrations on time

	with the correct materials • and equipment • works with teaching staff and students to ensure all practical activities are performed • safely (through demonstrations and monitoring of practical activities) • manages contingencies and resources within level of responsibility • maintains the laboratory fit for purpose • liaises with suppliers to obtain stocks of materials and equipment using enterprise • Procedures • works effectively with students and staff who may have diverse work styles, cultures and perspectives.
Resources Implication	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview / Written Test • Observation / Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Physicochemical Laboratory Operation Level III	
Unit Title	**Monitor Implementation of Work Plan/Activities**
Unit Code	**MIN PCL3 11 0114**
Unit Descriptor	This unit covers competence required to oversee and monitor the quality of work operations within an enterprise. This unit may be carried out by team leaders or supervisors.

Elements	Performance Criteria
1. Monitor and improve workplace operations	1.1 Efficiency and service levels are monitored on an ongoing basis. 1.2 Operations in the workplace support overall enterprise goals and quality assurance initiatives. 1.3 Quality ***problems*** and issues are promptly identified and adjustments are made accordingly. 1.4 Procedures and systems are changed in consultation with colleagues to improve efficiency and effectiveness. 1.5 Colleagues are consulted about ways to improve efficiency and service levels.
2. Plan and organize workflow	2.1 Current workload of colleagues is accurately assessed. 2.2 Work is scheduled in a manner which enhances efficiency and customer service quality. 2.3 Work is delegated to appropriate people in accordance with principles of delegation. 2.4 Workflow is assessed against agreed objectives and timelines and colleagues are assisted in prioritisation of workload. 2.5 Input is provided to appropriate management regarding staffing needs.
3. Maintain workplace records	3.1 ***Workplace records*** are accurately completed and submitted within required timeframes. 3.2 Where appropriate completion of records is delegated and monitored prior to submission.
4. Solve problems and make decisions	4.1 Workplace problems are promptly identified and considered from an operational and customer service perspective. 4.2 Short term action is initiated to resolve the immediate problem where appropriate. 4.3 Problems are analysed for any long term impact and potential solutions are assessed and actioned in consultation with relevant colleagues. 4.4 Where problem is raised by a team member, they are encouraged to participate in solving the problem. 4.5 Follow up action is taken to monitor the effectiveness of solutions in the workplace.

Variables	Range
Problems	May include but not limited to: • difficult customer service situations • equipment breakdown/technical failure • delays and time difficulties • competence
Workplace records	May include but is not limited to: • staff records and regular performance reports

Evidence Guide	
Critical Aspects of Competence	Demonstrates skills and knowledge in: • ability to effectively monitor and respond to a range of common operational and service issues in the workplace • understanding of the role of staff involved in workplace monitoring • knowledge of quality assurance, principles of workflow planning, delegation and problem solving
Underpinning Knowledge and Attitudes	Demonstrate knowledge of: • roles and responsibilities in monitoring work operations • overview of leadership and management responsibilities • principles of work planning and principles of delegation • typical work organization methods appropriate to the sector • quality assurance principles and time management • problem solving and decision making processes • industrial and/or legislative issues which affect short term work organization as appropriate to industry sector
Underpinning Skills	Demonstrate skills to: • monitor and improve workplace operations • plan and organize workflow • maintain workplace records
Resource Implications	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview / Written Test • Observation / Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Physicochemical Laboratory Operation Level III	
Unit Title	**Apply Quality Control**
Unit Code	**MIN PCL3 12 0114**
Unit Descriptor	This unit covers the knowledge, attitudes and skills required in applying quality control in the workplace.

Elements	Performance Criteria
1. Implement quality standards	1.1 Agreed quality standard and procedures are acquired and confirmed. 1.2 Standard procedures are introduced to organizational staff/personnel. 1.3 Quality standard and procedures documents are provided to employees in accordance with the organization policy. 1.4 Standard procedures are revised / updated when necessary.
2. Assess quality of service delivered	2.1 Services delivered are ***quality checked*** against organization ***quality standards*** and specifications. 2.2 Service delivered are evaluated using the appropriate evaluation ***quality parameters*** and in accordance with organization standards. 2.3 Causes of any identified faults are identified and corrective actions are taken in accordance with organization policies and procedures.
3. Record information	3.1 Basic information on the quality performance is recorded in accordance with organization procedures. 3.2 Records of work quality are maintained according to the requirements of the organization.
4. Study causes of quality deviations	4.1 Causes of deviations from final outputs or services are investigated and reported in accordance with organization procedures. 4.2 Suitable preventive action is recommended based on organization quality standards and identified causes of deviation from specified quality standards of final service or output.
5. Complete documentation	5.1 Information on quality and other indicators of service performance is recorded. 5.2 All service processes and outcomes are recorded.

Variable	Range
Quality check	May include but not limited to: • Check against design / specifications • Visual inspection and Physical inspection

Quality standards	May include but not limited to: • Materials • Components • Process • Procedures
Quality parameters	May include but not limited to: • Standard Design / Specifications • Material Specification

Evidence Guide	
Critical Aspects of Competence	Demonstrates skills and knowledge to: • Check completed work continuously against organization standard • Identify and isolate faulty or poor service • Check service delivered against organization standards • Identify and apply corrective actions on the causes of identified faults or error • Record basic information regarding quality performance • Investigate causes of deviations of services against standard • Recommend suitable preventive actions
Underpinning Knowledge	Demonstrates knowledge of: • Relevant quality standards, policies and procedures • Characteristics of services • Safety environment aspects of service processes • Evaluation techniques and quality checking procedures • Workplace procedures and reporting procedures
Underpinning Skills	Demonstrates skills to: • interpret work instructions, specifications and standards appropriate to the required work or service • carry out relevant performance evaluation • maintain accurate work records • meet work specifications and requirements • communicate effectively within defined workplace procedures
Resource Implications	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview / Written Test • Observation / Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Physicochemical Laboratory Operation Level III	
Unit Title	**Lead Workplace Communication**
Unit Code	**MIN PCL3 13 0114**
Unit Descriptor	This unit covers the knowledge, attitudes and skills needed to lead in the dissemination and discussion of information and issues in the workplace.

Elements	Performance Criteria
1. Communicate information about workplace processes	1.1 Appropriate ***communication method*** is selected. 1.2 Multiple operations involving several topics areas are communicated accordingly. 1.3 Questions are used to gain extra information. 1.4 Correct sources of information are identified. 1.5 Information is selected and organized correctly. 1.6 Verbal and written reporting is undertaken when required. 1.7 Communication skills are maintained in all situations.
2. Lead workplace discussion	2.1 Response to workplace issues is sought. 2.2 Response to workplace issues are provided immediately. 2.3 Constructive contributions are made to workplace discussions on such issues as production, quality and safety. 2.4 Goals/objectives and action plan undertaken in the workplace are communicated.
3. Identify and communicate issues arising in the workplace	3.1 Issues and problems are identified as they arise. 3.2 Information regarding problems and issues are organized coherently to ensure clear and effective communication. 3.3 Dialogue is initiated with appropriate staff/personnel. 3.4 Communication problems and issues are raised as they arise.

Variable	Range
Methods of communication	May include but not limited to: • Non-verbal gestures • Verbal • Face to face • Two-way radio • Speaking to groups • Using telephone • Written • Using Internet • Cell phone

Evidence Guide	
Critical Aspects of Competence	Demonstrates skills and knowledge to: • Deal with a range of communication/information at one time • Make constructive contributions in workplace issues • Seek workplace issues effectively • Respond to workplace issues promptly • Present information clearly and effectively written form • Use appropriate sources of information • Ask appropriate questions • Provide accurate information
Underpinning Knowledge and Attitudes	Demonstrates knowledge of: • Organization requirements for written and electronic communication methods • Effective verbal communication methods
Underpinning Skills	Demonstrates skills to: • Organize information • Understand and convey intended meaning • Participate in variety of workplace discussions • Comply with organization requirements for the use of written and electronic communication methods
Resources Implication	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview / Written Test • Observation / Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Physicochemical Laboratory Operation Level III	
Unit Title	**Lead Small Teams**
Unit Code	**MIN PCL3 14 0114**
Unit Descriptor	This unit covers the skills, knowledge and attitudes required to determine individual and team development needs and facilitate the development of the work group.

Elements	Performance Criteria
1. Provide team leadership	1.1 ***Learning and development needs*** are systematically identified and implemented in line with ***organizational requirements***. 1.2 Learning plan to meet individual and group training and developmental needs is collaboratively developed and implemented. 1.3 Individuals are encouraged to self-evaluate performance and identify areas for improvement. 1.4 ***Feedback on performance*** of team members is collected from relevant sources and compared with established team learning process.
2. Foster individual and organizational growth	2.1 Learning and development program goals and objectives are identified to match the specific knowledge and skills requirements of Competence standards. 2.2 ***Learning delivery methods*** are appropriate to the learning goals, the learning style of participants and availability of equipment and resources. 2.3 Workplace learning opportunities and coaching/ mentoring assistance are provided to facilitate individual and team achievement of competencies. 2.4 Resources and timelines required for learning activities are identified and approved in accordance with organizational requirements.
3. Monitor and evaluate workplace learning	3.1 Feedback from individuals or teams is used to identify and implement improvements in future learning arrangements. 3.2 Outcomes and performance of individuals/teams are assessed and recorded to determine the effectiveness of development programs and the extent of additional support. 3.3 Modifications to learning plans are negotiated to improve the efficiency and effectiveness of learning. 3.4 Records and reports of competence are maintained within organizational requirement
4. Develop team commitment	4.1 Open communication processes to obtain and share information is used by team.

and cooperation	4.2 Decisions are reached by the team in accordance with its agreed roles and responsibilities. 4.3 Mutual concern and camaraderie are developed in the team.
5. Facilitate accomplishment of organizational goals	5.1 Team members actively participated in team activities and communication processes. 5.2 Teams' members developed individual and joint responsibility for their actions. 5.3 Collaborative efforts are sustained to attain organizational goals.

Variable	Range
Learning and development needs	May include but not limited to: • Coaching, mentoring and/or supervision • Formal/informal learning program • Internal/external training provision • Work experience/exchange/opportunities • Personal study • Career planning/development • Performance appraisals • Workplace skills assessment • Recognition of prior learning
Organizational requirements	May include but not limited to: • Quality assurance and/or procedures manuals • Goals, objectives, plans, systems and processes • Legal and organizational policy/guidelines and requirements • Safety policies, procedures and programs • Confidentiality and security requirements • Business and performance plans • Ethical standards • Quality and continuous improvement processes and standards
Feedback on performance	May include but not limited to: • Formal/informal performance appraisals • Obtaining feedback from supervisors and colleagues • Obtaining feedback from clients • Personal and reflective behavior strategies • Routine and organizational methods for monitoring service delivery
Learning delivery methods	May include but not limited to: • On the job coaching or mentoring • Problem solving • Presentation/demonstration • Formal course participation • Work experience and Involvement in professional networks • Conference/seminar attendance and induction

Evidence Guide	
Critical Aspects of Competence	Demonstrates skills and knowledge to: • identify and implement learning opportunities for others • give and receive feedback constructively • facilitate participation of individuals in the work of the team • negotiate learning plans to improve the effectiveness of learning • prepare learning plans to match skill needs • access and designate learning opportunities
Underpinning Knowledge and Attitude	Demonstrates knowledge of: • coaching and mentoring principles • understanding how to work effectively with team members who have diverse work styles, aspirations, cultures and perspective • understanding how to facilitate team development and improvement • understanding methods and techniques for eliciting and interpreting feedback • understanding methods for identifying and prioritizing personal development opportunities and options • knowledge of career paths and competence standards in the industry
Underpinning Skills	Demonstrates skills to: • read and understand a variety of texts, prepare general information and documents according to target audience; spell with accuracy; use grammar and punctuation effective relationships and conflict management • receive feedback and report, maintain effective relationships and conflict management • organize required resources and equipment to meet learning needs • provide support to colleagues • organize information; assess information for relevance and accuracy; identify and elaborate on learning outcomes • facilitation skills to conduct small group training sessions • relate to people from a range of social, cultural, physical and mental backgrounds
Resources Implication	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview / Written exam • Observation / Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the workplace or in a simulated workplace setting.

Occupational Standard: Physicochemical Laboratory Operation Level III	
Unit Title	**Improve Business Practice**
Unit Code	**MIN PCL3 15 0114**
Unit Descriptor	This unit covers the skills, knowledge and attitudes required in promoting, improving and growing business operations.

Elements	Performance Criteria
1. Diagnose the business	1.1 ***Data required*** for diagnosis is determined and acquired. 1.2 ***Competitive advantage*** of the business is determined from the data. 1.3 ***SWOT analysis*** of the data is undertaken.
2. Benchmark the business	2.1 Sources of relevant benchmarking data are identified. 2.2 ***Key indicators*** for benchmarking are selected in consultation with key stakeholders. 2.3 Like indicators of own practice are compared with benchmark indicators. 2.4 Areas for improvement are identified.
3. Develop plans to improve business performance	3.1 A consolidated list of required improvements is developed. 3.2 Cost-benefit ratios for required improvements are determined. 3.3 Work flow changes resulting from proposed improvements are determined. 3.4 Proposed improvements are ranked according to agreed criteria. 3.5 An action plan is developed and agreed to implement the top ranked improvements. 3.6 ***Organizational structures*** are checked to ensure they are suitable.
4. Develop marketing and promotional plans	4.1 The practice vision statement is reviewed. 4.2 Practice ***objectives*** are developed/ reviewed. 4.3 Target markets are identified/ refined. 4.4 ***Market research data*** is obtained. 4.5 ***Competitor analysis*** is obtained. 4.6 ***Market position*** is developed/ reviewed. 4.7 ***Practice brand*** is developed. 4.8 ***Benefits*** of practice/practice products/services are identified. 4.9 ***Promotion tools*** are selected/ developed.

5. Develop business growth plans	5.1 Plans are developed to increase ***yield per existing client***. 5.2 Plans are developed to add new clients. 5.3 Proposed plans are ranked according to agreed criteria. 5.4 An action plan is developed and agreed to implement the top ranked plans. 5.5 Practice work practices are reviewed to ensure they support growth plans.
6. Implement and monitor plans	6.1 Implementation plan is developed in consultation with all relevant stakeholders. 6.2 Indicators of success of the plan are agreed. 6.3 Implementation is monitored against agreed indicators. 6.4 Implementation is adjusted as required.

Variable	**Range**
Data required includes:	May include but not limited to: • organization capability • appropriate business structure • level of client service which can be provided • internal policies, procedures and practices • staff levels, capabilities and structure • market, market definition • market changes/market segmentation • market consolidation/fragmentation • revenue • level of commercial activity • expected revenue levels, short and long term • revenue growth rate • break even data • pricing policy • revenue assumptions • business environment • economic conditions • social factors • demographic factors • technological impacts • political/legislative/regulative impacts • competitors, competitor pricing and response to pricing • competitor marketing/branding • competitor products
Competitive advantage	May include but not limited to: • services/products • fees • location

	• timeframe
SWOT analysis	May include but not limited to: • internal strengths such as staff capability, recognized • quality • internal weaknesses such as poor morale, • under-capitalization, poor technology • external opportunities such as changing market and • economic conditions • external threats such as industry fee structures, strategic • alliances, competitor marketing
Key indicators	May include but not limited to: • salary cost and staffing • personnel productivity (particularly of principals) • profitability • fee structure • client base • size staff/principal • overhead/overhead control
Organizational structures	May include but not limited to: • Legal structure (partnership, Limited Liability Company, etc.) • organizational structure/hierarchy • reward schemes
Objectives should be 'SMART'	May include but not limited to: • S: Specific • M: Measurable • A: Achievable • R: Realistic • T: Time defined
Market research data	May include but not limited to: • data about existing clients • data about possible new clients • data from internal sources • data from external sources such as: ➢ trade associations/journals ➢ Yellow Pages small business surveys ➢ libraries ➢ Internet ➢ Chamber of Commerce ➢ client surveys ➢ industry reports ➢ secondary market research • primary market research such as: ➢ telephone surveys ➢ personal interviews ➢ mail surveys
Competitor	May include but not limited to:

analysis	• competitor offerings • competitor promotion strategies and activities • competitor profile in the market place
Market position should :	May include but not limited to: • product • the good or service provided • product mix • the core product - what is bought • the tangible product - what is perceived • the augmented product - total package of consumer • features/benefits • product differentiation from competitive products • new/changed products • Price and pricing strategies (cost plus, supply/demand, ability to pay, etc.) • Pricing objectives (profit, market penetration, etc.) • cost components • market position • distribution strategies • marketing channels • promotion • promotional strategies • target audience • communication • promotion budget
Practice brand	May include but not limited to: • practice image • practice logo/letter head/signage • phone answering protocol • facility decor • slogans • templates for communication/invoicing • style guide • writing style • AIDA (attention, interest, desire, action)
Benefits	May include but not limited to: • features as perceived by the client • benefits as perceived by the client
Promotion tools	May include but not limited to: • networking and referrals • seminars • advertising • press releases • publicity and sponsorship • brochures • newsletters (print and/or electronic)

	• websites • direct mail • telemarketing/cold calling
Yield per existing client	May include but not limited to: • raising charge out rates/fees • packaging fees • reduce discounts • sell more services to existing clients

Evidence Guide	
Critical Aspects of Competence	Demonstrates skills and knowledge in: • ability to identify the key indicators of business performance • ability to identify the key market data for the business • knowledge of a wide range of available information sources • ability to acquire information not readily available within a business • ability to analyze data and determine areas of improvement • ability to negotiate required improvements to ensure implementation • ability to evaluate systems against practice requirements • and form recommendations and/or make recommendations • ability to assess the accuracy and relevance of information
Underpinning Knowledge and Attitudes	Demonstrates knowledge of: • data analysis • communication skills • computer skills to manipulate data and present information • negotiation skills • problem solving • planning skills • marketing principles • ability to acquire and interpret relevant data • current product and marketing mix • use of market intelligence • development and implementation strategies of promotion and growth plans
Underpinning Skills	Demonstrates skill in: • data analysis and manipulation • ability to acquire and interpret required data, current practice systems and structures and sources of relevant benchmarking data • applying methods of selecting relevant key benchmarking indicators • communication skills • working and consulting with others when developing plans for the business • planning skills, negotiation skills and problem solving

	• using computers to manipulate, present and distribute information
Resources Implication	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview / Written Test • Observation / Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Physicochemical Laboratory Operation Level III	
Unit Title	**Prevent and Eliminate MUDA**
Unit Code	**MIN PCL3 16 0114**
Unit Descriptor	This unit of competence covers the knowledge, skills and attitude required by a worker to prevent and eliminate MUDA/wastes in his/her their workplace. It covers responsibility for the day-to-day operation of the work and ensures Kaizen elements are continuously improved and institutionalized.

Elements	Performance Criteria
1. Prepare for work.	1.1 Work instructions are used to determine job requirements, including method, material and equipment. 1.2 Job specifications are read and interpreted following working manual. 1.3 ***OHS requirements***, including dust and fume collection, breathing apparatus and eye and ear personal protection needs are observed throughout the work. 1.4 Appropriate material is selected for work. 1.5 ***Safety equipment and tools*** are identified and checked for safe and effective operation.
2. Identify MUDA.	2.1 Plan of MUDA identification is prepared and implemented. 2.2 Causes and effects of MUDA are discussed. 2.3 ***Tools and techniques*** are used to draw and analyze current situation of the work place. 2.4 Wastes/MUDA are identified and measured based on ***relevant procedures***. 2.5 Identified and measured wastes are reported to relevant personnel.
3. Eliminate wastes/MUDA.	3. 1. Plan of MUDA elimination is prepared and implemented. 3. 2. Necessary attitude and ***the ten basic principles for improvement*** are adopted to eliminate waste/MUDA. 3. 3. Tools and techniques are used to eliminate wastes/MUDA based on the procedures and OHS. 3. 4. Wastes/MUDA are reduced and eliminated in accordance with OHS and organizational requirements. 3. 5. Improvements gained by elimination of waste/MUDA are reported to relevant bodies.

4. Prevent occurrence of wastes/MUDA.	4.1 Plan of MUDA prevention is prepared and implemented. 4.2 Standards required for machines, operations, defining normal and abnormal conditions, clerical procedures and procurement are discussed and prepared. 4.3 Occurrences of wastes/MUDA are prevented by using ***visual and auditory control methods***. 4.4 Waste-free workplace is created using ***5W and 1H***sheet. 4.5 The completion of required operation is done in accordance with standard procedures and practices. 4.6 The updating of standard procedures and practices is facilitated. 4.7 The capability of the work team that aligns with the requirements of the procedure is ensured.

Variable	**Range**
OHS requirements	May include but not limited to: • Are to be in accordance with legislation/ regulations/codes of practice and enterprise safety policies and procedures. This may include protective clothing and equipment, use of tooling and equipment, workplace environment and safety, handling of material, use of fire fighting equipment, enterprise first aid, hazard control and hazardous materials and substances. • Personal protective equipment is to include that prescribed under legislation/regulations/codes of practice and workplace policies and practices. • Safe operating procedures are to include, but are not limited to the conduct of operational risk assessment and treatments associated with workplace organization. • Emergency procedures related to this unit are to include but may not be limited to emergency shutdown and stopping of equipment, extinguishing fires, enterprise first aid requirements and site evacuation.
Safety equipment and tools	May include but not limited to: • dust masks / goggles • glove • working cloth • first aid • safety shoes
Tools and techniques	May include but not limited to: • Plant Layout • Process flow • Other Analysis tools • Do time study by work element • Measure Travel distance

	• Take a photo of workplace • Measure Total steps • Make list of items/products, who produces them and who uses them & those in warehouses, storages etc. • Focal points to Check and find out existing problems • 5S • Layout improvement • Brainstorming • Andon • U-line • In-lining • Unification • Multi-process handling & Multi-skilled operators • A.B. control (Two point control) • Cell production line • TPM (Total Productive Maintenance)
Relevant procedures	May include but not limited to: • Make waste visible • Be conscious of the waste • Be accountable for the waste. • Measure the waste.
The ten basic principles for improvement	May include but not limited to: • Throw out all of your fixed ideas about how to do things. • Think of how the new method will work- not how it won. • Don't accept excuses. Totally deny the status quo. • Don't seek perfection. A 5o percent implementation rate is fine as long as it's done on the spot. • Correct mistakes the moment they are found. • Don't spend a lot of money on improvements. • Problems give you a chance to use your brain. • Ask "why?" at least five times until you find the ultimate cause. • Ten people's ideas are better than one person's. • Improvement knows no limits.
Visual and auditory control methods	May include but not limited to: • Red Tagging • Sign boards • Outlining • Andons • Kanban, etc.
5W and 1H	May include but not limited to: • Who • What • Where • When • Why

	• How

Evidence Guide	
Critical Aspects of Competence	Demonstrates skills and knowledge to: • discuss why wastes occur in the workplace • discuss causes and effects of wastes/MUDA in the workplace • analyze the current situation of the workplace by using appropriate tools and techniques • identify, measure, eliminate and prevent occurrence of wastes by using appropriate tools and techniques • use 5W and 1H sheet to prevent
Underpinning Knowledge and Attitudes	Demonstrates knowledge of: • Targets of customers and manufacturer/service provider • Traditional and kaizen thinking of price setting • Kaizen thinking in relation to targets of manufacturer/service provider and customer • value • The three categories of operations • the 3“MU” • waste/MUDA • wastes occur in the workplace • The 7 types of MUDA • The Benefits of identifying and eliminating waste • Causes and effects of 7 MUDA • Procedures to identify MUDA • Necessary attitude and the ten basic principles for improvement • Procedures to eliminate MUDA • Prevention of wastes • Methods of waste prevention • Definition and purpose of standardization • Standards required for machines, operations, defining normal and abnormal conditions, clerical procedures and procurement • Methods of visual and auditory control • TPM concept and its pillars. • Relevant Occupational Health and Safety (OHS) and environment requirements • Plan and report • Method of communication
Underpinning Skills	Demonstrates skills to: • draw & analyze current situation of the work place • use measurement apparatus (stop watch, tape, etc.) • calculate volume and area • use and follow checklists to identify, measure and eliminate wastes/MUDA • identify and measure wastes/MUDA in accordance with OHS and procedures

	• use tools and techniques to eliminate wastes/MUDA in accordance with OHS procedure • apply 5W and 1H sheet • update and use standard procedures for completion of required operation • work with others • read and interpret documents • observe situations • solve problems • communicate • gather evidence by using different means • report activities and results using report formats
Resources Implication	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview / Written Test • Observation / Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

NTQF Level IV

Occupational Standard: Physicochemical Laboratory Operation Level IV	
Unit Title	**Perform Physical Tests**
Unit Code	**MIN PCL4 01 0114**
Unit Descriptor	This unit of competency covers the ability to interpret physical test requirements, prepare samples, conduct pre-use and calibration checks on equipment and perform routine physical tests.

Elements	Performance Criteria
1. Interpret and schedule test requirements	1.1. Test request is reviewed to identify samples to be tested, test method and equipment/instruments involved. 1.2. ***Hazards*** and enterprise control measures associated with the sample, preparation/test methods and/or equipment are identified. 1.3. Work sequences are planned to optimize throughput of multiple samples, if appropriate.
2. Receive and prepare samples	2.1 Samples are logged on using ***Standard Operating Procedures (SOPs)***. 2.2 Sample description is recorded, compared with specification and discrepancies are noted and reported. 2.3 Samples and standards are ***prepared*** in accordance with ***physical testing requirements*.** 2.4 Traceability of samples is ensured from receipt to reporting of results.
3. Check equipment before use	3.1 Equipment/instruments are set up in accordance with ***test*** method requirements. 3.2 Pre-use and safety checks are performed in accordance with relevant enterprise and operating procedures. 3.3 Faulty or unsafe components and equipment are identified and reported to appropriate personnel. 3.4 Equipment calibration is checked using specified procedures, if applicable. 3.5 Out of calibration equipment/instruments is/are quarantined.
4. Test samples to determine physical properties	4.1 Equipment/instruments are operated in accordance with test method requirements. 4.2 Tests/procedures on all samples and standards are performed, if appropriate, in accordance with specified methods or ***physical test procedure***. 4.3 Equipment/instruments are shut down in accordance with operating procedures.

5. Process and interpret data	5.1 ***Test*** data noting atypical observations is ***recorded***. 5.2 Calculated values are ensured to be consistent with expectations. 5.3 Uncertainty of measurement is estimated and documented in accordance with enterprise procedures, if required. 5.4 Results are recorded and reported in accordance with enterprise procedures. 5.5 Trends in data and/or results are interpreted and out of specification or atypical results are reported promptly to appropriate personnel. 5.6 Obvious procedure or equipment problems have led to atypical data or results is/are determined.
6. Maintain a safe work environment	6.1 Established safe work practices and personal protective equipment are used to ensure personal safety and that of other laboratory personnel. 6.2 The generation of wastes and environmental impacts is minimized. 6.3 The safe collection of laboratory and ***hazardous control*** is ensured for subsequent disposal. 6.4 Equipment and materials are cared for and stored as required.
7. Maintain laboratory records	7.1 Approved data is entered into laboratory information management system. 7.2 Confidentiality and security of enterprise information and laboratory data are maintained. 7.3 Equipment and calibration logs are maintained in accordance with enterprise procedures.

Variable	**Range**
Hazards	may include: • microbiological organisms and agents, associated with soil, air and water • chemicals, such as acids and solvents • radiation, such as alpha, beta, gamma, X-ray and neutron • sharps, broken glassware and hand tools • flammable liquids and gases • cryogenics, such as dry ice and liquid nitrogen • fluids under pressure, such as steam and industrial gases • sources of ignition • burners and ovens • disturbance or interruption of services • crushing, entanglement and cuts associated with moving machinery (grinders)

Standards Operating Procedures (SOPs)	May include: • ISO 1000-1998 The international System of Units (SI) and its application • ISO 17025-2005 General requirements for the competence of testing and calibration laboratories • ISO 9000 Set:2008 Quality management systems set • calibration and maintenance schedules • data quality procedures • enterprise recording and reporting procedures • equipment start up, operation and shutdown procedures • Material Safety Data Sheets (MSDS) • material, production and product specifications • national measurement regulations and guidelines • principles of Good Laboratory Practice (GLP) • production and laboratory schedules • quality manuals, equipment and procedures manuals • SOPs
Preparation of samples	include processes, such as: • drying, washing, grinding, sieving, melting and moisture conditioning • cutting, trimming or machining of test specimens, etching
Physical test requirement	may include: • matter, interatomic and intermolecular forces and states of matter • mass, weight, forces, pressure, energy, friction and slip resistance • properties of gases, pressure/volume/temperature, density, diffusion and compressibility • cohesive/adhesive forces, hydrostatic pressure, fluid flow, viscosity and friction • thermal expansion, thermal conductivity and coefficients of expansion • changes of state, energy content, enthalpy change and endothermic and exothermic processes • electromagnetic spectrum, primary/secondary colours, reflection, refraction diffraction and interference of light • electrical concepts, including electric field, voltage, current, resistance and AC/DC • electromagnetic concepts, including magnetic field and flux, and electromagnetic induction • sound concepts, including wave properties, amplitude, frequency and loudness (dB) • elasticity, hardness, strength of materials, plasticity, permeability and dispersion • electrical safety concepts including voltage, current, resistance, conductors/insulators and AC/DC

Test and sample preparation equipment/materials	may include: • crushers, Melchers, grinders, mills, riffles and sieves • moulds, bags and containers • ovens, microwaves and water baths • mass balances • microscopes • dimension apparatus (e.g. callipers and micrometer) • rammers, compression rigs and load cells • chemical reagents and volumetric glassware • temperature measuring devices, such as thermometers and thermocouples • pH and conductivity meters • analogue and digital meters, charts/recorders, data loggers and computers
Physical tests and procedures	may include: • precise measurement of position, orientation and dimensions: ➢ three-dimensional setup of manufacturing tools using inclinometers, venires and laser ➢ thickness using verier, X-ray and gamma ray ➢ particle size using sieving and laser ➢ dimensional stability involving expansion, contraction and weathering ➢ movement using strain gauge and accelerometer • mass, density and specific gravity: ➢ moisture/density relationship ➢ compaction ➢ loose and compacted density • thermal tests: ➢ thermal conductivity ➢ coefficients of expansion (e.g. linear and volume) ➢ melt flow index ➢ calorimetric, (e.g. specific heat and latent heat) ➢ combustion properties (e.g. enthalpy and energy content) ➢ drying times ➢ thermal stability of products • optical tests: ➢ flatness and surface finish ➢ refractive index ➢ optical rotation ➢ transmission/absorption of filters ➢ colour matching of products • acoustic tests: ➢ absorption, reflection and transmission ➢ intensity, attenuation and loudness (dB) ➢ amplitude and frequency • electrical tests: ➢ conductance, resistance and insulation

	➢ temperature dependence of dielectrics • magnetic tests: ➢ permeability ➢ receptivity, hysteresis loss and coactivity ➢ intrinsic induction
Tests	may include methods for: • control of starting materials, in-process materials and finished products • investigation of sources of construction materials • basic troubleshooting of enterprise processes
Records	may include: • test and calibration results • equipment use, maintenance and servicing history • faulty or unsafe equipment
Hazard control measures	may include: • ensuring access to service shut-off points • recognising and observing hazard warnings and safety signs • labeling of samples and hazardous materials • handling and storage of hazardous materials and equipment in accordance with labeling, MSDS and manufacturer's instructions • identifying and reporting operating problems or equipment malfunctions • cleaning equipment and work areas regularly using enterprise procedures • using personal protective clothing and equipment, such as gloves, safety glasses, coveralls and safety boots • following established manual handling procedures • reporting abnormal emissions, discharges and airborne contaminants, such as noise, light, solids, liquids, water/waste water, gases, smoke, vapour, fumes, odour and particulates to appropriate personnel

Evidence Guide	
Critical aspects of Competence	Must demonstrate knowledge and skills competence to: • interpret test methods/procedures accurately • prepare and test samples in accordance with specified methods • perform calibration checks (if required) • safely operate test equipment/instruments to enterprise standards and/or manufacturer's specifications • apply basic knowledge of physical properties of materials to interpret gross features of data and make relevant conclusions • identify atypical results, such as out of normal range or an artefact • trace and source obvious causes of an artefact • communicate problems to a supervisor or outside service

	technician • calculate, record and communicate results in accordance with enterprise procedures • maintain security, integrity and traceability of samples, sub-samples, test data/results and documentation.
Underpinning Knowledge and Attitudes	Demonstrate knowledge of: • physical principles and concepts underpinning the test/procedure • purpose of tests • function of key components of the equipment/instrument • effects on test of modifying equipment/instrument variables • sample preparation procedures • concepts of metrology • basic equipment/method troubleshooting procedures • enterprise and/or legal traceability requirements • relevant health, safety and environment requirements
Underpinning Skills	Demonstrate skills to: • using instruments for qualitative and/or quantitative analysis • interpreting test methods and procedures • sample preparation procedures • performing calibration checks • metrology techniques underpinning test/procedure including estimating uncertainty • using instruments for qualitative and/or quantitative analysis • maintaining and evaluating reagents • troubleshooting basic equipment/method • preparing calibration graphs and calculating results using appropriate units and precision • applying theoretical knowledge to interpret gross features of data and make relevant conclusions such as identifying atypical results as out of normal range or an artefact • tracing and sourcing obvious causes of an artefact • recording and communicating results in accordance with enterprise procedures • maintaining security, integrity, traceability of samples, sub-samples, test data, results and documentation
Resources Implication	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview / Written Test • Observation / Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Physicochemical Laboratory Operation Level IV	
Unit Title	**Perform Standard Calibrations**
Unit Code	**MIN PCL4 02 0114**
Unit Descriptor	This unit of competency covers the ability to calibrate test and measurement equipment without deviation in accordance with standard calibration procedures and documented test methods.

Elements	Performance Criteria
1. Prepare items for calibration	1.1 The authorized calibration procedure is selected in accordance with enterprise procedures. 1.2 ***Hazards*** are identified and the appropriate personal protective equipment, safety equipment and procedures used. 1.3 All measuring equipments are confirmed to meet the laboratory's specification requirements and complied fully with the ***standard calibration*** procedures. 1.4 Specified ***reference material*** and associated equipment are assembled and set up prior to testing. 1.5 Performance of reference standards and measuring equipment is verified prior to use and adjusted or calibrated as necessary. 1.6 Potential sources of measurement error are identified and minimized.
2. Perform calibration	2.1 Individual tests are performed without variance according to the documented procedure to ensure repeatability of measurement. 2.2 Readings have confirmed the result of a valid measurement and record data as required (as-found or before adjustment). 2.3 Device under test is adjusted to bring readings within specification and data (as-left or after adjustment) recorded if required. 2.4 Resulting test data is analyzed to detect trends or inconsistencies that would significantly affect the accuracy or validity of test results. 2.5 Appropriate advice is sought when interpretation of results is outside authorized scope of approval.
3. Document results	3.1 Compliance/non-compliance is documented with requirements of test and or specifications. 3.2 Uncertainty of measurement is estimated and documented in accordance with enterprise procedures, if required. 3.3 The results of each test/calibration are recorded accurately ,unambiguously and objectively.

	3.4 Confidentiality of enterprise information is ensured.
4. Finalise calibration	4.1 A final report on the job/item detailing testing carried out, traceability, statement of compliance and relevant information is prepared and issued as required. 4.2 Any non-compliance is reported and next course of action verified with supervisor. 4.3 Calibration labels, equipment stickers, quality control tags and tamper resistant seals are attached as required in enterprise procedures. 4.4 Test equipment/measurement standards and results are stored in accordance with enterprise procedures.

Variable	**Range**
Hazards	May include: • electric shock • disturbance or interruption of services • manual handling of heavy equipment boxes • sources of electromagnetic radiation (lasers, RF generators/transmitters) • fluids under pressure • heat sources, such as ovens.
Standard calibrations	May include: • common types of test equipment, such as: anemometers, balances, barometers, calipers, • environmental chambers, hygrometers, manometers, masses, micrometers, pressure • equipment, spectrophotometers, tape measures, rules, temperature (digital) indicating • systems, thermometers, thermocouples, timing devices, vibration analysis equipment, • weighing instruments • electrical reference standards, such as: air-lines, analogue meters, attenuators, bridges manual • balance, capacitors, DC voltage references, digital instruments (calibrators, • DMMs, electronic transfer standards), inductors, instrument and ratio transformers, • instrument transformer test sets, potentiometers, resistors, RF power meters, RF • thermostat mounts and thermal converters, shunts, time interval and frequency standards, • transfer standards AC-DC, voltage dividers, volt ratio boxes, watthour references • working standards, instruments and testing equipment, such

	as: EMC test equipment, field • strength meters, flammability test equipment, gauges/test fingers/test pins, hipot testers, • impact hammers, impulse testers, instrument calibrators, network analyzers, signal • Generators, spectrum and harmonic analyzers.
Reference material	May include: • color standards • graded granular materials • hardness blocks
Quality	May include: • ISO/IEC 17025 General requirements for the competence of testing and calibration laboratories • ISO 5725–1, 6 Accuracy (trueness and precision) of measurement methods and results • ISO 9000–1 Quality management and quality assurance standards • ISO 9004–1 Quality management and quality system elements • ISO 9004–4 Quality management and quality system elements • quality improvement • ISO 10012 Quality assurance requirements for measurement equipment • industry/sector specific guideson ‘Quantifying Uncertainty in Analytical Measurement’ • Material Safety Data Sheets (MSDSs)) • enterprise recording and reporting procedures, Standard Operating Procedures (SOPs) • quality manuals, equipment and operating/technical manuals • test methods and calibration procedures (validated and authorized) • test methods and calibration procedures published by: international, national or regional • standards, reputable technical organizations, scientific texts or journals, equipment manufacturers • incident and accident/injury reports • Schematics, work flows, laboratory layouts, production and laboratory schedules.
Safety procedures	May include: • use of personal protective equipment, such as hearing protection, gloves, safety glasses, • coveralls • ensuring access to service shut-off points • handling and storing hazardous materials and equipment in accordance with labels, • MSDS, manufacturer’s instructions, enterprise procedures and

	regulations • Regular cleaning of equipment and work areas.

Evidence Guide	
Critical aspects of Competence	Must demonstrate knowledge and skills competence to: • maintains very close attention to procedures, accuracy and precision of measurement to • ensure integrity of test/calibration results (especially during lengthy tests) • critically examines each calibration step to ensure repeatability and validity of data • applies all relevant procedures and regulatory requirements to ensure the quality and integrity of the services or data he/she provides • prepares test/calibration documentation that is accurate and complies with requirements • operates equipment correctly and safely • recognizes problems or departures in systems and documentation and initiates actions to prevent or minimize them • recognises and reports opportunities for improvements to procedures.
Underpinning Knowledge and Attitudes	Demonstrate knowledge of: • purpose of metrology and calibration, including common terminology, concepts, principles, procedures, and applications • role in the measurement and testing system in Ethiopia • traceability, including legal requirements for traceability • requirements for the competence of testing and calibration laboratories (for example, • AS ISO/IEC 17025) as they affect job role and responsibilities • selection and application of appropriate test methods and calibration procedures • hierarchy and appropriate selection of reference materials and instruments • non-conformance/non-compliance procedures and protocols associated with equipment, • reference material and calibration procedures • use of calibration and correction charts • calculation procedures to give results in appropriate accuracy, precision and units • troubleshooting procedures for equipment and test methods • methods for statistical analysis (means, ranges, standard deviations) and estimation of • uncertainty of measurement (may include the use of software)

	• reporting procedures and legislative requirements • handling, transport, storage and operation of reference and working standards • laboratory environmental control requirements • enterprise and/or legal traceability requirements • Relevant health, safety and environmental requirements. • layout of the enterprise, divisions and laboratory • organizational structure of the enterprise • lines of communication • Role of laboratory services for the enterprise and customers.
Underpinning Skills	Demonstrate skills to: • Prepare items for calibration • Perform calibration • Document results • Finalise calibration
Resources Implication	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview / Written Test • Observation / Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Physicochemical Laboratory Operation Level IV	
Unit Title	**Process and Interpret Data**
Unit Code	**MIN PCL4 03 0114**
Unit Descriptor	This unit of competency covers the ability to retrieve data, evaluate formulae and perform scientific calculations, present and interpret information in tables and graphs and keep accurate records.

Elements	Performance Criteria
1. Retrieve and check data	1.1 Data is ***recorded*** and retrieved using appropriate files and/or application software. 1.2 The quality of data is verified using enterprise procedures. 1.3 Errors in data are rectified using enterprise procedures.
2. Calculate scientific quantities	2.1 Statistical values are calculated for given data. 2.2 ***Scientific quantities*** and associated uncertainties are calculated using given formulae and data. 2.3 Calculated quantities are ensured to be consistent with estimations and expectations. 2.4 All calculated quantities are reported using the appropriate units and correct number of significant figures.
3. Present data in tables, charts and graphs	3.1 Data is presented in clearly labeled tables and charts. 3.2 Data is graphed using appropriate scales to span the range of data or display trends. 3.3 All data are reported using the appropriate units and number of significant figures.
4. Interpret data in tables, charts and graphs	4.1 Significant features of graphs, such as gradients, intercept, maximum and minimum values, and limit lines are interpreted. 4.2 Trends in data are recognised and reported.
5. Keep accurate records and maintain their confidentiality	5.1 Information is transcribed accurately. 5.2 The accuracy of records is verified following enterprise procedures. 5.3 Workplace records are filed and stored in accordance with enterprise procedures. 5.4 All reference documents are filed logically and kept up-to-date and secured. 5.5 Enterprise confidentiality standards are observed.

Variable	Range
Records	May include:

	• purchase of equipment and materials, service records • safety procedures • History of calibration and test results.
Calculated scientific quantities	May include: • percentage and absolute uncertainties in measurements and test results • weight and volumes (mL, L, m3) of regular shapes, such as packaging • average mass, mass percentage, density, specific gravity, moisture, relative and absolute humidity, viscosity, permeability • ratios, such as mass to mass, mass to volume and volume to volume percentages • concentration, such as molarity, g/100mL, mg/L, mg/µL, ppm, ppb, dilution mL/L • average count, colonies per swab surface, cell counts, such as live and dead/total • process variables, such as pressure, gauge pressure, velocity, flow rates • % content of moisture, ash, fat, protein, alcohol, sulphur dioxide, trace metals, such as calcium or zinc
Reference materials	May include: • Material Safety Data Sheets (MSDSs)) • equipment manuals and warranty, supplier catalogues, handbooks • sampling and test procedures, Standard Operating Procedures (SOPs) • enterprise quality manual, customer quality plan • validation of the equipment and associated software where applicable • validation of spreadsheets developed in house for assay and process calculations • OHS regulations, guidelines and procedures • Relevant Ethiopian Standard and International Standards, National Measurement Act.

Evidence Guide	
Critical aspects of Competence	Must demonstrate knowledge and skills competence to: • can code, record and check the documentation of data • calculates statistical quantities relevant to his/her work and presents accurate results in the required format • calculates scientific quantities relevant to his/her work and presents accurate results in the required format • recognizes anomalies and trends in data • maintains the confidentiality of data in accordance with workplace and regulatory requirements

	• keeps records up-to-date and secure.
Underpinning Knowledge and Attitudes	Demonstrate knowledge of: • procedures for coding, entering, storing, retrieving and communicating data • procedures for verifying data and rectifying mistakes • procedures for maintaining and filing records, security of data • relevant scientific and technical terminology, such as precision, accuracy, • 'out of control' traceability.
Underpinning Skills	Demonstrate skills to: • perform calculations involving fractions, decimals, ratios, proportions and percent • perform calculations of mean, median, mode, range and standard deviation • perform calculations of perimeters, areas, volumes, angles • perform calculations of scientific quantities (for example, concentration) • use scientific notation, convert units involving multiples and submultiples • use significant figures, round off, estimate, approximate • calculate and interpret absolute and percentage uncertainties • transpose and evaluate formulae • prepare graphs, tables and charts (pie, bar, histogram) and interpret trends • prepare and interpret process control charts.
Resources Implication	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview / Written Test • Observation / Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Physicochemical Laboratory Operation Level IV	
Unit Title	**Maintain and Control Stocks**
Unit Code	**MIN PCL4 04 0114**
Unit Descriptor	This unit of competency covers the ability to order, maintain and control the use of laboratory materials and/or equipment in the work area.

Elements	Performance Criteria
1. Maintain and control stocks of materials or equipment	1.1 Stocks are labeled, documented and stored in accordance with relevant standards and specific ***safety procedures***. 1.2 Stock rotation procedures are followed to maximize use of stocks within permitted shelf life. 1.3 Stock discrepancies are identified and redundant or outdated stocks replaced to maintain stocks at prescribed level. 1.4 Damaged/worn equipment is identified and replaced or arranged for repairs or disposal as appropriate. 1.5 QC sampling and testing procedures are initiated when appropriate. 1.6 Stock problems outside own knowledge and authority limitations are reported to relevant personnel.
2. Order and receive materials and equipment	2.1 Requirements of customers and suppliers are determined using appropriate ***communication*** and interpersonal skills. 2.2 Demand for stock is determined by taking into account peak and seasonal variations in stock usage and production conditions. 2.3 Approved orders are placed and/or followed up using enterprise systems and procedures. 2.4 Condition of received goods is checked and appropriate action taken.
3. Maintain stock records	3.1 All relevant details are ***recorded*** accurately using the specified forms/computer system. 3.2 Written information is ensured to be legible and indelible. 3.3 All records are filed in the designated place.
4. Maintain a safe work environment	4.1 Established safe work practices and personal protective equipment are used to ensure personal safety and that of other laboratory personnel. 4.2 The generation of ***hazardous*** wastes and environmental impacts is minimized. 4.3 The safe collection of redundant/outdated stocks is ensured for subsequent disposal.

Variable	Range
Safety procedures	May include: • use of personal protective equipment, such as hearing protection, gloves, safety glasses, • coveralls, safety boots • ensuring access to service shut-off points • handling and storing hazardous materials and equipment in accordance with labels, • MSDS, manufacturer's instructions, enterprise procedures and regulations • Regular cleaning of equipment and work areas.
Communication	May include: • telephone, fax, email, mail • online information systems, inventories, print records, databases, catalogues • filing systems
Records	May include: • stock usage • orders, progress of orders • equipment servicing and repairs • current inventories • QC sampling, testing and stock rotation.
Hazards	May include: • electric shock • chemicals, such as acids and hydrocarbons • microbiological organisms associated with blood and blood products • radioisotopes • sharps, such as broken glassware • disturbance or interruption of services • manual handling of heavy boxes • Fluids under pressure, industrial gas bottles.

Evidence Guide	
Critical aspects of Competence	Must demonstrate knowledge and skills competence to: • confirms customer requirements with senior personnel where there is doubt • accesses online databases and/or catalogues efficiently • interprets labeling information (lot number, batch, date) and MSDSs correctly • applies procedures for safe handling, storage and transport of stocks • uses required safety and manual handling equipment and procedures • performs QC sampling and testing and rotates stock in

	accordance with SOPs • follows workplace procedures for predicting and/or determining demand for stock • maintains stock at prescribed levels for their work area, through regular inspections, • timely ordering of replacement items and follow up of late orders • copes with peak and seasonal variations in stock usage and production conditions • follows workplace procedures for researching, ordering and receipt of stock • completes and records all documentation accurately • demonstrates effective and appropriate communication and interpersonal skills when dealing with customers and suppliers.
Underpinning Knowledge and Attitudes	Demonstrate knowledge of: • technical terminology relating to ordering and storage of stocks • laboratory stock, product and service information • common usage and International Union of Pure and Applied Chemistry (IUPAC) name • for relevant chemical reagents, (if applicable) • types of chemical reactions and rationale for recommended storage systems • enterprise procedures and quality system requirements for stock control • Codes of Practice and regulations concerning the handling, storage and transport of the stock involved • relevant health, safety and environment requirements.
Underpinning Skills	Demonstrate skills to: • ordering, purchase and receipt of stocks • verification of temperature control for delivered and stored stocks (for example, reagents • containing enzymes) • organization of compatible batch or lot numbers • storage of stocks, stock control, rotation of stock • quality control testing, monitoring of use by dates of standards and shelf life of reagents
Resources Implication	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview / Written Test • Observation / Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Physicochemical Laboratory Operation Level IV	
Unit Title	**Maintain Laboratory/Field Workplace Safety**
Unit Code	**MIN PCL4 05 0114**
Unit Descriptor	This unit of competency covers the ability to monitor and maintain the Occupational Health and Safety (OHS) and environmental programs within a work area where the person has some supervisory responsibility for others.

Elements	Performance Criteria
1. Perform all work safely	1.1 Established work practices and personal protective equipment are used to ensure personal safety and that of other laboratory personnel. 1.2 Equipment, materials and reagents are cleaned, cared for and stored as required. 1.3 The generation of wastes and environmental impacts is minimized. 1.4 Safe disposal of laboratory/hazardous wastes is ensured.
2. Ensure others in the work group are able to implement safe work practices	2.1 ***Hazard*** controls and personal protective clothing and equipment appropriate to the work requirements are ensured to be available and functional. 2.2 Current information on ***OHS and environmental*** policies, procedures and programs is provided and communicated to others. 2.3 Hazards and control measures relating to work responsibilities are known by those in the work area. 2.4 Support to those in the work area is provided to implement procedures to support safety. 2.5 Training needs are identified and addressed within level of responsibility.
3. Monitor observance of safe work practices in the work area	3.1 Ensure enterprise procedures are clearly defined, documented and followed. 3.2 Any deviation from identified procedures is identified, reported and addressed within level of responsibility. 3.3 Personal behavior is ensured to be consistent with enterprise policies and procedures. 3.4 Others are encouraged and followed up to identify and report hazards in the work area. 3.5 Conditions and follow up are monitored to ensure housekeeping standards in the work area are maintained.
4. Participate in risk management	4.1 Any identified hazards and inadequacies in existing risk

processes	controls are reported and addressed within level of responsibility and according to enterprise procedures. 4.2 Risk assessments are made participatory to identify and analyze risks. 4.3 The implementation of procedures is supported to control risk (based on the hierarchy of control). 4.4 Records of incidents in the work area and other required documentation are accurately completed and maintained according to enterprise procedures and legislative requirements.
5. Support the implementation of participative arrangements	5.1 Work group is informed and consulted on OHS and environmental issues relevant to the work role. 5.2 Outcomes of consultation on OHS and environmental issues back to the work group are promptly reported. 5.3 Matters raised relating OHS and the environment are resolved, or promptly referred to appropriate personnel.
6. Support the implementation of emergency procedures	6.1 Enterprise procedures are ensured for dealing with ***incidents and emergencies*** available and known by work group. 6.2 Processes are implemented to ensure that others in the work area are able to respond appropriately to incidents and emergencies. 6.3 Investigations of hazardous incidents are made participatory as required to identify their cause.

Variable	**Range**
Hazards	May include: • electric shock • solar radiation, dust, noise • chemicals, such as acids, heavy metals, pesticides, hydrocarbons • aerosols from broken centrifuge tubes, pupating • radiation, such as alpha, beta, gamma, X-ray, neutron • sharps, broken glassware and hand tools • flammable liquids and gases • cryogenics, such as dry ice and liquid nitrogen • fluids under pressure, such as steam, hydrogen in gas liquid chromatography, acetylene • in atomic absorption spectrometry • sources of ignition • high temperature ashing processes • disturbance or interruption of services • occupational overuse syndrome, slips, trips and falls

	• manual handling, working at heights and in confined spaces • crushing, entanglement, cuts associated with moving machinery or falling objects • pedestrian and vehicular traffic • vehicle and boat handling.
OHS and environmental issues	May include: • identification of hazards • assessment of risk and decisions on measures to control risk • risk reduction measures • implementation of controls • investigation of injury and incidents • hazards not otherwise addressed • problems in implementing risk controls • incidents • Clarification of policies or procedures.
Incidents and emergencies	May include: • workplace injury and accidents • biological and chemical spills • leakage of radioactivity • fire • bomb threat • Security threat.
Addressing hazards	May include: • hazard and incident reporting and investigation procedures • elimination • substitution, such as review of nature of substances or processes used • isolation, such as: ➢ use of appropriate equipment, such as , laminar flow cabinets ➢ engineering • administrative procedures, such as: ➢ ensuring access to service shut-off points ➢ recognizing and observing hazard warnings and safety signs ➢ labeling of samples, reagents, liquated samples and hazardous materials ➢ handling and storing hazardous materials and equipment in accordance with labeling, ➢ materials safety data sheets and manufacturer's instructions ➢ identifying and reporting operating problems or equipment malfunctions ➢ cleaning and decontaminating equipment and work areas regularly using enterprise ➢ procedures ➢ applying containment procedures

	➢ following established manual handling procedures for tasks involving manual handling ➢ using appropriate equipment and procedures to avoid personal contamination and ➢ contamination of others ➢ following risk control measures to minimize environmental hazards ➢ using practices which minimize waste ➢ reporting to appropriate personnel of abnormal emissions, discharges and airborne ➢ contaminants, such as noise, light, solids, liquids, water/waste water, gases, smoke, ➢ vapor, fumes, odour and particulates ➢ minimizing exposure to radiation, such as lasers, electromagnetic and ultraviolet ➢ using Material Safety Data Sheets (MSDS) ➢ using signage, barriers and service isolation tags ➢ using personal protective equipment, such as hard hats, hearing protection, sunscreen ➢ lotion, gloves, safety glasses, goggles, face guards, coveralls, gown, body suits, respirators and safety boots.

Evidence Guide	
Critical aspects of Competence	Must demonstrate knowledge and skills competence to: • works safely at all times • ensures others in the workgroup work safely and follow OHS and environmental policies • and procedures for hazard identification and risk control • communicates health and safety and environmental issues with designated personnel • ensures that enterprise procedures for dealing with incidents and emergencies are available and known by work group • communicates effectively with personnel at all levels within the enterprise and OHS specialists • can prepare brief reports for a range of target groups, including OHS committee, OHS representatives, managers and supervisors.
Underpinning Knowledge and Attitudes	Demonstrate knowledge of: • hazards commonly found in the work area and standard risk controls • signage, symbols and signals relating to OHS • location and purpose of personal protective equipment and emergency/hazard control • equipment in the work area, including first aid facilities and personnel • use, care and storage requirements for personal protective clothing and equipment used in work areas

	• roles and responsibilities under OHS legislation of employers and employees, including supervisors and contractors • requirements for record keeping that address OHS, privacy and other relevant legislation • principles and practices of effective OHS management, including hazard identification, risk assessment and risk control • the hierarchy of control • enterprise procedures for OHS and environmental management • key personnel within enterprise management structure and the OHS management system • sources of OHS information, including specialist advisors.
Underpinning Skills	Demonstrate skills to: • Perform all work safely • Ensure others in the work group are able to implement safe work practices • Monitor observance of safe work practices in the work area • Participate in risk management processes • Support the implementation of participative arrangements • Support the implementation of emergency procedures
Resources Implication	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview / Written Test • Observation / Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Physicochemical Laboratory Operation Level IV	
Unit Title	**Prepare Practical Science Classes and Demonstrations**
Unit Code	**MIN PCL4 06 0114**
Unit Descriptor	This unit of competency covers the ability to manage the day-to-day running of science teaching laboratories and the preparation of practical experiments, demonstrations and field trips.

Elements	Performance Criteria
1. Ensure safe work practices	1.1 Risk assessments are organized and performed to identify ***hazards*** and analyze risks associated with planned practical activities. 1.2 Appropriate controls are selected and implemented for identified risks and their effectiveness is monitored. 1.3 Preparation and conduct of practical activities are performed in accordance with relevant regulations, codes, guidelines and enterprise procedures. 1.4 Personal protective clothing and equipment are selected, fitted and used by students and teachers. 1.5 Materials and equipment are handled, prepared, stored and disposed of safely. 1.6 ***Incidents and emergencies*** are addressed as they arise.
2. Plan work schedule	2.1 Schedule of classes and demonstrations is planned in consultation with teaching staff to ensure timely delivery. 2.2 Communication is done effectively with staff and students using appropriate negotiation and conflict resolution skills. 2.3 Work activities are prioritized and time is managed to meet deadlines. 2.4 Work plan is modified to deal with ***contingencies*** as they arise.
3. Organize experiments and demonstrations	3.1 ***Materials*** and ***equipment*** are collected from appropriate sources. 3.2 Pre-use checks are performed; material and equipment prepared and organized to be ready for use. 3.3 Practical skills, techniques and use of materials and equipment are demonstrated, as required. 3.4 Clean up operations and recycling or disposal of wastes are organized. 3.5 Experiments and demonstrations and recommend variations or alternatives are trialed.

4. Manage resources	4.1 Practical activities are operated within approved budgets. 4.2 Stocks of materials and equipment are maintained and controlled. 4.3 Storerooms, preparation areas and laboratories are maintained to fit for purpose. 4.4 Materials and equipment are evaluated and selected and recommendations made for purchase. 4.5 Materials and equipment are ordered, received and stored using enterprise procedures. 4.6 Quotes and bookings are organized for transport and accommodation for field trips, as necessary. 4.7 Laboratory equipment is serviced and/or repaired where feasible. 4.8 The servicing or repair of equipment is arranged by appropriate personnel or accredited service agents.

Variable	Range
Hazards	May include: • electric shock • solar radiation, dust, noise • exposure to extreme weather conditions • snake, insect and animal bites • chemicals, such as acids, heavy metals, pesticides, hydrocarbons • aerosols from broken centrifuge tubes, pipetting • radiation, such as alpha, beta, gamma, X-ray • sharps, broken glassware and hand tools • flammable liquids • cryogenics, such as dry ice and liquid nitrogen • fluids under pressure, such as steam, acetylene • in atomic absorption spectrometry • sources of ignition • high temperature ashing processes • disturbance or interruption of services • occupational overuse syndrome, slips, trips and falls • manual handling, working at heights and in confined spaces • crushing, entanglement, cuts associated with moving machinery or falling objects • vehicle and boat handling.
Incidents and emergencies	May include: • workplace injury and accidents • biological and chemical spills • leakage of radioactivity

	• fire • bomb • security threats.
Contingencies	May include: • new information • urgent requests • modified activities • changed situations • late instructions from appropriate personnel • substitution of reagents.
Typical materials	May include: • live flora and fauna, such as plant specimens • animals, such as rats, bacteria, algae, insects, fungi • blood and blood products, human or animal tissue and fluids • teaching aids, such as textbooks, videos • distilled water, reagents, chemicals, disinfectants, detergents, agar media and plates • consumable items, such as syringes, pipette tips, weigh boats • oils/lubricants, fuels, industrial gases, cryogenics, such as dry ice and liquid nitrogen • equipment spares, such as fuses, bulbs, batteries • paper, stationery • Reference samples and standards.
Typical equipment	May include: • Analytical instruments, such as UV/VIS and AAS spectrometers, • dishwashers, refrigerators, freezers, ovens, microwave ovens, incubators, water baths • fume hoods, biohazard containers, biological safety cabinets • gas cylinders • glassware (burettes, pipettes); plastic ware; glass, plastic, quartz cuvettes • hotplates, mantles, burners, muffle furnaces • light and fluorescence microscopes • microtomes, tissue processors • teaching aids, such as VCR and DVD players, computers • thermometers, pH meters and ion selective electrodes • ultrasonic cleaners • Analytical instruments, such as UV/VIS and AAS spectrometers
Hazard control measures	May include: • ensuring access to service shut-off points • recognizing and observing hazard warnings and safety signs • use of Material Safety Data Sheets (MSDS) • labeling of samples, reagents, aliquated samples and

	hazardous materials• handling and storing hazardous materials and equipment in accordance with labeling, • materials safety data sheets and manufacturer's instructions • identifying and reporting operating problems or equipment malfunctions • cleaning and decontaminating equipment and work areas regularly using enterprise procedures • using personal protective clothing and equipment, such as hats, hearing protection, gloves, • safety glasses, coveralls, gown, body suits, respirators and safety boots • applying containment procedures through the use of appropriate equipment • following established manual handling procedures for tasks involving manual handling • reporting abnormal emissions, discharges and airborne contaminants, such as noise, light, • Solids, liquids, water/waste water, gases, smoke, vapour, fumes, odour and particulates to appropriate personnel.

Evidence Guide	
Critical aspects of Competence	Must demonstrate knowledge and skills competence to: • clarifies/designs practical activities and assesses resource needs • works with teaching staff and students to assess risks, develop and implement controls and • monitors their effectiveness • prepares laboratory experiments and demonstrations on time with the correct materials • and equipment • works with teaching staff and students to ensure all practical activities are performed • safely (through demonstrations and monitoring of practical activities) • manages contingencies and resources within level of responsibility • maintains the laboratory fit for purpose • liaises with suppliers to obtain stocks of materials and equipment using enterprise procedures • works effectively with students and staff who may have diverse work styles, cultures and perspectives.
Underpinning Knowledge and Attitudes	Demonstrate knowledge of: • scientific terminology used in common practical activities • relevant legislation, regulations, codes governing practical activities • technical details of sampling, testing, equipment and instrumentation used in common practical activities

	• enterprise procedures for the purchase, handling and storage of materials and equipment • principles of budgeting, operational planning and efficient resource use • principles of risk assessment and risk management, hierarchy of control • problem solving techniques and contingency planning • relevant enterprise health, safety and environment requirements.
Underpinning Skills	Demonstrate skills to: • Ensure safe work practices • Plan work schedule • Organize experiments and demonstrations • Manage resources
Resources Implication	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview / Written Test • Observation / Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Physicochemical Laboratory Operation Level IV	
Unit Title	**Obtain Representative Samples in Accordance with Sampling Plan**
Unit Code	**MIN PCL4 07 0114**
Unit Descriptor	This unit of competency covers the ability to obtain a range of samples that are representative of the source material (raw ingredients, product in process, final product) and to prepare the samples for testing.

Elements	Performance Criteria
1. Prepare for sampling	1.1 The sampling location(s), number and type of samples, and timing and frequency of sampling are confirmed from enterprise or client's sampling plan. 1.2 Liaise is done with relevant personnel to arrange site access and (if appropriate) all necessary clearances and/or permits. 1.3 Sampling equipment and conditions are selected to achieve representative samples and sample integrity is preserved during collection, storage and transit. 1.4 All procedures are checked in accordance with client or enterprise requirements, relevant standards and codes. 1.5 Site and sampling ***hazards*** are identified and enterprise safety procedures reviewed. 1.6 All sampling equipment, materials, containers and safety equipment are assembled and checked. 1.7 Suitable transport to, from and around site is arranged as required.
2. Conduct sampling and log samples	2.1 Sampling sites and (if required) services are located at the ***laboratories or processing site.*** 2.2 Representative sampling is conducted in accordance with sampling plan and defined procedures. 2.3 All information and label samples are recorded in accordance with traceability requirements. 2.4 Environment or production conditions and any atypical observations made during sampling that may impact on sample representativeness or integrity are recorded. 2.5 All samples are transported back to base according to Standard Operating Procedures (SOPs) and relevant codes.
3. Prepare samples for testing	3.1 Sub-samples, back-up sub-samples that are representative of the source are prepared. 3.2 All sub-samples are labeled to ensure traceability and store in accordance with SOPs.

	3.3 Defined preparation and safety procedures are followed to limit hazard or contamination to samples, self, work area and environment. 3.4 Sub-samples are distributed to defined work stations maintaining sample integrity and traceability requirements.
4. Address client issues	4.1 Approved information is entered into Laboratory Information Management System (LIMS). 4.2 All relevant aspects of the sampling and preparation phases are reported in accordance with enterprise procedures. 4.3 Ensure that information provided to client is made accurate, relevant and authorized for release. 4.4 Security and confidentiality of all client/enterprise data and information are maintained.
5. Maintain a safe work environment	5.1 All equipment, containers, work area and vehicles are cleaned according to enterprise procedures. 5.2 Serviceability of all equipment is checked before storage. 5.3 Defined safe work practices and personal protective equipment are used to ensure personal safety and that of other laboratory personnel. 5.4 The generation of wastes and environment impacts is minimized. 5.5 The safe collection of all hazardous wastes is ensured for appropriate disposal.

Variable	Range
Hazards	May include: • solar radiation, dust and noise • wildlife, such as snakes, spiders, domestic animals • biohazards, such as micro-organisms and agents associated with soil, air, water, blood and • blood products, human or animal tissue and fluids • chemicals, such as acids and hydrocarbons • aerosols • sharps, broken glassware • manual handling of heavy sample bags and containers • crushing, entanglement, cuts associated with moving machinery and hand tools • vehicular and pedestrian traffic.
Laboratories or processing sites	May include: • a range of sampling plans, samples and sampling procedures, which apply to the • enterprise site, plant laboratory or field sites

	• enterprise products/materials, hazardous materials • a range of sampling points and/locations • Methods and procedures which may be written to meet enterprise, client and/or regulatory/certifying body requirements.
Samplers	May include: • enterprise and/or client sampling schemes and sampling plans • industry methods, such as Ethiopian Association of Chemists (EAC) Preparation of samples • enterprise and/or client procedures • Material Safety Data Sheets (MSDSs)) • National Code of Practice for the labeling of workplace substances • site plans, maps and specifications • Enterprise recording and reporting procedures.
Materials sampled	May include: • gas or air samples • liquid samples, such as water, groundwater, wastewater, storm water, sledges, sewage • solid samples, such as soil, sediments, rocks, concrete, quarry and mining material • solid wastes • raw materials, start-, middle-, end-of production run samples, final products, materials • used in production processes, such as flocculant
Types of samples	May include: • grab samples • composite samples • quality control samples • research or one-off samples • environmental or survey samples.
Sampling tools and equipment	May include: • shovels, augers, chain saws • sampling frames, sampling tubes, dip tubes, spears, flexible bladders, syringes • front-end loader, backhoe, excavator, drill rig • sample bottles or containers, plastic containers and disposable buckets • access valves • sample thief • auto samplers • pumps, stainless steel bailers • traps and cages • sterile containers, pipettes, inoculating loops, disposable spoons.

Maintenance of integrity of samples could include	May include: • use of compatible container, such as glass, plastic, amber, opaque bottles • use of appropriate preservatives, such as sodium azide, toluene • decontamination of sampling tools between collection of consecutive samples • wrapping container in foil • purging of sample lines and boxes • handling and transport to avoid disturbance or damage • temperature control which may involve insulation of sample without direct contact with • the coolant • wrapping in wet newspaper, cloth, sand or sawdust • transfer of sterile sample into sterile container • monitoring of storage conditions.
Safety procedures may include	May include: • use of Material Safety Data Sheets (MSDSs) • use of personal protective equipment, such as hard hats, hearing protection, gloves, safety • glasses, goggles, face guards, coveralls, gown, body suits, respirators, safety boots • use of biohazard containers and laminar flow cabinets • correct labeling of reagents and hazardous materials • handling, and storing hazardous materials and equipment in accordance with labels, • MSDS, manufacturer's instructions, enterprise procedures and regulations • regular cleaning and/or decontaminating equipment and work areas • machinery guards • signage, barriers, service isolation tags, traffic control, flashing lights • lockout and tag out procedures.

Evidence Guide	
Critical aspects of Competence	The assessors should look to see that the candidate: • collects the specified quantity of sample to enable all processing and testing to occur and backup samples to be stored • obtains a sample that is representative of the bulk material • preserves the integrity of samples by closely adhering to procedures • labels samples and subsamples to satisfy enterprise/legal traceability requirements • identifies atypical materials and samples and takes appropriate

	action • maintains sampling equipment in appropriate condition • completes sampling records using enterprise procedures • follows safety regulations and enterprise OHS procedures during sampling, transport and storage • follows relevant legislative requirements for the disposal of waste and the preservation of the environment.
Underpinning Knowledge and Attitudes	Competency includes the ability to apply and explain: • the links between correct OHS procedures and personal and environmental safety particularly at high risk sites • the basic principles of sampling, including: ➢ representative samples ➢ preservation of integrity of samples ➢ maintaining identification of samples relative to their source, enterprise and legal traceability ➢ cost effectiveness of sampling ➢ consistency of sampling procedures ➢ sampling principles, including random, systematic, stratified sampling • characteristics of product/material to be sampled and likely contaminants • links between quality control, quality assurance and quality management systems • and sampling procedures • enterprise procedures dealing with legislative requirements for the handling, labeling • and transport of hazardous goods • enterprise and/or legal traceability requirements • Relevant health, safety and environment requirements.
Underpinning Skills	Demonstrate skills to: • Prepare for sampling • Conduct sampling and log samples • Prepare samples for testing • Address client issues • Maintain a safe work environment
Resources Implication	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview / Written Test • Observation / Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Physicochemical Laboratory Operation Level IV	
Unit Title	**Prepare Mineral Samples for Analysis**
Unit Code	**MIN PCL4 08 0114**
Unit Descriptor	The unit of competency covers the ability to reduce given mineral samples to representative client samples and analytical portions that meet client requirements for analysis.

Elements	Performance Criteria
1. Interpret and schedule client requirements	1.1 ***Client request*** is reviewed to identify sample/analysis requirements, preparation methods and equipment involved. 1.2 Sample(s) is/are inspected, compared with specifications; any discrepancies are recorded and reported. 1.3 Liaise is done with client when samples and/or request forms do not comply with enterprise procedures. 1.4 ***Hazards*** and enterprise ***controls*** associated with the ***sample, preparation methods***, reagents and equipment are identified. 1.5 Parallel work sequences are planned to optimize throughput of multiple sets of samples. 1.6 All required ***equipment*** materials, reagents assembled and checked to fit for purpose.
2. Prepare client sample(s) for analysis	2.1 Safe times are estimated for the preparation of required sample proportions. 2.2 Sample(s) is/are torn to obtain representative sub-samples as required. 2.3 Combination equipment is safely operated. 2.4 Texture of the sample(s) is monitored as an indicator of particle size and milling times are adjusted accordingly. 2.5 Sample compaction is monitored and residues on equipment are built up and rectified as necessary. 2.6 Preparation difficulties that may impact on quality or cause additional client costs are recorded. 2.7 Any departure from preparation methods or client specifications is reported. 2.8 Client samples are labeled and chain-of-custody information is recorded. 2.9 All client samples are stored in accordance with enterprise procedures.
3. Use (non) destructive methods to	3.1 The recommended preparation method is examined to identify critical steps that will affect the quality of analytical results.

prepare laboratory portions for analysis	3.2 Each ***preparation step*** is closely followed with particular attention to safety, precision and minimization of cross-contamination of samples. 3.3 Parameters that indicate completion or failure of each preparation step are monitored. 3.4 Invalid preparation steps are analyzed and recorded and corrective action is taken before repeating the procedures. 3.5 Laboratory portions are presented for analysis in appropriate containers with all required chain-of custody documentation.
4. Maintain a safe work environment	4.1 Established safe work practices and use ***safe equipment*** are applied to ensure personal safety and that of other laboratory personnel. 4.2 The generation of waste and environmental impacts is minimized. 4.3 The safe disposal of all hazardous waste and spent/surplus samples is ensured. 4.4 Equipment and reagents are cleaned, cared for and stored as required.

Variable	**Range**
Client requests	May include: • client profile, sample identification and sample receipt • preparation methods, storage and analyses required • service charges.
Hazards	May include: • asbestiform minerals, dust, silica, fibrous samples • chemicals, such as hydrofluoric acid, bromine, perchloric acid, aquaregia, cyanide, • lead-based compounds, free-mercury, nickel compounds • noise, vibration • crushing, entanglement, cuts associated with moving machinery • manual handling of heavy loads, such as sample bags • heat, exhaustion, stress, fatigue.
Control measures	May include: • ensuring assess to service shut-off points • recognising and observing hazard warnings and safety signs • labeling of samples, reagents and hazardous materials • direct extraction, fume hoods • guards for moving machinery parts • noise insulation • using personal protective equipment, such as mask, gloves, boots, goggles, coats, • ear muffs, safety boots • following established manual handling procedures

	• regular cleaning of equipment and work areas using enterprise procedures • antidotes for specific hazards, such as hydrofluoric acid, cyanide • reporting of abnormal emissions, discharges and airborne contaminants, such as noise, • light, solids, liquids, water/waste water, gasses, smoke, vapour, fumes, odour and • particulars to appropriate personnel.
Samples	May include: • solids, such as rocks, minerals, soils, sands, stream sediments • core and other drill samples, such as RAB, RC, air core • slurries, powder concentrates, metallurgical solutions • dump samples, grab samples.
Preparation methods	May include: • sorting, boxing and drying • sieving • primary crushing (for example, 10mm, 2mm) • fine pulverising (for example, 100 micron, 75 micron) • partial digestion requiring separation (for example, aqua regia) • complete digestion (for example, multi-acid digest) • non destructive (for example, LIF, Li2B4O7 disks) • solvent extraction (for example, di isobutyl ketone dibK).
Preparation equipment	May include: • splitters (for example, riffles, rotary dividers) • mills (for example, ball, ring, rod) • bowls (for example, chrome-steel, tungsten-carbide, zirconia) and tumblers • crushers (for example, cone, jaw, roll), grinders, disc pulverisers • sieves • ovens, muffle furnaces, hot plates, microwave ovens • ultrasonic baths • centrifuges, vacuum and pressure filtration • volumetric glassware/plastic ware, dispensers • analytical balances • auto samplers • sample containers, labels.
Critical preparation steps	May include: • monitoring drying (incipient, total) • mixing to ensure homogeneity before sub sampling • suitability of reagents for purpose (for example, dryness) • accurate operation of dispensers and balances • critical/non critical volumes, critical reagent quantities • temperature control during digests • loss of solution prior to/after mixing • type and acid strength in final solutions • mechanical loss of digest (sputtering, residues on glassware/plastic

	ware, filtering).

Evidence Guide	
Critical aspects of Competence	The assessors should look to see that the candidate: • recognizes hazards and works safely at all times • interprets and closely follows preparation methods • prepares a range of samples that consistently meet client requirements (that is, representative, free of contamination, specified quantity and particle size, ready for analysis) • recognizes problems, atypical preparation stages and implements corrective actions • achieves required sample throughput • recognises limitations and seeks timely advice • minimizes rework, waste and environmental impact • disposes of all waste, surplus and spent samples responsibly.
Underpinning Knowledge and Attitudes	Demonstrate knowledge of: • geological properties of common samples, such as sulphides, oxides, silicates • terminology, such as homogeneous, heterogeneous, integrity, segregation distribution of common analytes in a matrix • chemical reactions associated with common preparation methods, effects of reagents • on the element of interest • reaction and recovery rates, solubility, equilibrium • tracking analytes of interest during changes of state • safety information (for example, MSDSs) • function of key equipment components and principles of operation • calculation steps in preparation methods (for example, serial dilution) • non SI units (ppm, ppb) and SI units, conversions • enterprise and/or legal traceability requirements • relevant health, safety and environmental requirements.
Underpinning Skills	Demonstrate skills to: • Interpret and schedule client requirements • Prepare client sample(s) for analysis • Use (non) destructive methods to prepare laboratory portions for analysis • Maintain a safe work environment
Resources Implication	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview / Written Test • Observation / Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Physicochemical Laboratory Operation Level IV	
Unit Title	**Prepare, Standardize and Use Solutions**
Unit Code	**MIN PCL4 09 0114**
Unit Descriptor	This unit of competency covers the ability to prepare, standardize and use solutions to monitor the quality of prepared solutions.

Elements	Performance Criteria
1. Prepare solutions	1.1 Appropriate procedure is selected for ***solution*** preparation. 1.2 Equipment, materials and solvent of specified purity are selected. 1.3 Appropriate quantities of ***reagents*** for standard solution preparation are measured and data is recorded. 1.4 Specified laboratory equipment and appropriate grade of glassware are selected and assembled. 1.5 Specified dilutions are performed. 1.6 Solutions are prepared to achieve homogeneous mix of the specified concentration. 1.7 Solutions are labeled and stored to maintain identity and stability.
2. Standardize and use volumetric solutions	2.1 Appropriate laboratory equipment is assembled. 2.2 Serial dilutions are performed as required. 2.3 The solution to the required specified range and precision is standardized. 2.4 Solutions are labeled and stored to maintain identity and stability. 2.5 Standard volumetric solutions are used to determine concentration of unknown solutions.
3. Calculate and record data	3.1 Specified concentrations are calculated. 3.2 Authorized procedure is used if data is to be modified. 3.3 All relevant details are recorded as per laboratory procedures and results reported. 3.4 Concentration is reported with appropriate units.
4. Monitor the quality of laboratory solutions	4.1 ***Suitability of solutions*** is checked for visual deterioration and expiry date. 4.2 Dated or deteriorated solutions are standardized or disposed . 4.3 Details and label solutions are recorded as per laboratory procedures.

5. Maintain a safe work environment	5.1 Established ***safe work practices*** and personal protective equipment are used to ensure personal safety and that of other laboratory personnel. 5.2 Spills are cleaned up using appropriate techniques to protect personnel, work area and environment. 5.3 Generation of waste and environmental impacts is minimized. 5.4 The safe collection of laboratory and hazardous waste is ensured for subsequent disposal. 5.5 Equipment and reagents are stored as required.

Variable	**Range**
Solutions	May include: • solutions of strong/weak acids and bases • oxidising/reducing agents • solutions used for complex metric or precipitation titrations
Standard preparation	May include: • ISO 9000 series Quality management and quality assurance standards • Relevant Ethiopia standard for Safety in laboratories • Relevant Ethiopia standard Good laboratory practice • Relevant Ethiopia standard Codes of Practice • Material Safety Data Sheets (MSDSs)) • National Measurement Act • Standard Operating Procedures (SOPs) • quality manuals, equipment and procedure manuals • enterprise and reporting procedures • production and laboratory schedules • material, production, product and solution specifications • waste minimization and safe disposal procedures.
Apparatus and reagents	May include: • balances • pipettes, burettes, volumetric glassware, weighing bottles • dessicators, filtering media • ovens, muffle furnaces • solutions, indicators, primary and secondary standards • auto titrators, pH meters and other related meters and electrodes for determining • equivalence points, top pan and analytical balances • magnetic stirrers and heaters, water baths
Checking use ability of solutions	May include: • examining stained samples for correct staining reactions • performing pH checks • confirming enzyme activity

Safe work practices	May include: • use of Material Safety Data Sheets (MSDSs)) • use of personal protective equipment, such as gloves, safety glasses, goggles, faceguards, • coveralls, gown • use of biohazard containers, laminar flow cabinets, fume hoods • correct labeling of reagents and hazardous materials • handling and storing hazardous materials and equipment in accordance with labels, • MSDS, manufacturer's instructions, enterprise procedures and regulations • regular cleaning and/or decontaminating of equipment and work areas.
Hazards	May include: • chemicals, such as strong acids and bases • sharps, broken glassware • burners, hot plates, ovens, furnaces.

Evidence Guide	
Critical aspects of Competence	The assessor should look to see that the candidate can: • use balances and volumetric glassware appropriately • select and use primary and secondary standards appropriately • select and use indicators appropriately • select and care for electrodes appropriately • perform QA checks for solution performance • perform titrations using laboratory procedures with required accuracy and precision and within required timelines • calculate the concentration of the solution given the chemical reaction for the titration • recognise control results that are not within acceptable range • record results to enterprise standards • label and store solutions in accordance with enterprise procedures • interpret and follow enterprise Standard Operating Procedures (SOPs) • interpret and use safety information, such as that provided by material safety data sheets • (MSDSs) and follow relevant safety procedures.
Underpinning Knowledge and Attitudes	Demonstrate knowledge of: • solution terminology, chemistry of acids, bases, buffers, redox reactions and • complex metric reactions • grades of glassware, reagents and their use

	• reactions used for standardisation and desirable characteristics • determination of equivalence points using indicators and graphical methods • calculation methods, including appropriate units, uncertainties and balancing equations • enterprise communication and reporting procedures • OHS procedures, including those for using corrosive materials • relevant health, safety and environment requirements.
Underpinning Skills	Demonstrate skills to: • Prepare solutions • Standardize and use volumetric solutions • Calculate and record data • Monitor the quality of laboratory solutions • Maintain a safe work environment
Resources Implication	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview / Written Test • Observation / Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Physicochemical Laboratory Operation Level IV	
Unit Title	**Perform Chemical Tests and Procedures**
Unit Code	**MIN PCL4 10 0114**
Unit Descriptor	This unit of competency covers the ability to interpret chemical test requirements, prepare samples, conduct pre-use and calibration checks on equipment and perform routine chemical tests/procedures.

Elements	Performance Criteria
1. Interpret and schedule test requirements	1.1 Test request is reviewed to identify samples to be tested, test method and equipment/instruments involved. 1.2 ***Hazards*** and enterprise control measures associated with the sample, preparation/test methods, reagents and/or equipment are identified. 1.3 Work sequences are planned to optimize throughput of multiple samples (if appropriate).
2. Receive and prepare samples	2.1 Samples are logged on using standard operating procedures. 2.2 Sample description is ***recorded***, compared with specification and discrepancies are noted and reported. 2.3 Samples and standards are prepared in accordance with chemical testing requirements. 2.4 Traceability of samples is ensured from receipt to report results.
3. Check equipment before use	3.1 Equipment/instruments is/are set up in accordance with test method requirements. 3.2 Pre-use and safety checks are performed in accordance with relevant enterprise and operating procedures. 3.3 Faulty or unsafe components and equipment are identified and reported to appropriate personnel. 3.4 Equipment calibration is checked using specified standards and procedures (if applicable). 3.5 Out-of-calibration equipment/instruments is/are quarantined. 3.6 Reagents required for the test are ensured available and meet quality requirements.
4. Test samples to determine chemical species or properties	4.1 Equipment/instruments is/are operated in accordance with test method requirements. 4.2 Tests/procedures on all samples and standards (if appropriate) are performed in accordance with specified methods. 4.3 Equipment/instruments are shut down in accordance with

	operating procedures.
5. Process and interpret data	5.1 Test data noting atypical observations is recorded. 5.2 Calibration graphs (if appropriate) are constructed and results computed for all samples from these graphs. 5.3 Calculated values are ensured to be consistent with expectations. 5.4 Results are recorded and reported in accordance with enterprise procedures. 5.5 Trends in data and/or results are interpreted and 'out of specification' or atypical results are reported promptly to appropriate personnel. 5.6 Determine if obvious procedure or equipment problems have led to atypical data or results.
6. Maintain a safe work environment	6.1 Established safe work practices and personal protective equipment are used to ensure personal safety and that of other laboratory personnel. 6.2 The generation of wastes and environmental impacts is minimized. 6.3 The safe collection of laboratory and hazardous waste is ensured for subsequent disposal. 6.4 Equipment and reagents is/are cared for and stored as required.
7. Maintain laboratory records	7.1 Approved data is entered into laboratory information management system. 7.2 Confidentiality and security of enterprise information and laboratory data are maintained. 7.3 Equipment and calibration logs are maintained in accordance with enterprise procedures.

Variable	**Range**
Hazards	May include: • chemicals, such as: ➢ acids, for example, sulphuric, perchloric, hydrofluoric ➢ heavy metals, pesticides ➢ anions, for example, fluoride ➢ hydrocarbons, for example, mono-aromatics • aerosols from broken centrifuge tubes, pipetting • sharps, broken glassware • flammable liquids and gases • cryogenics, such as dry ice and nitrogen • fluids under pressure, such as argon gas, acetylene in atomic absorption spectrometry

	• sources of ignition • high-temperature ashing processes • disturbance or interruption of services.
Records	May include: • test and calibration results • equipment use, maintenance and servicing history • faulty or unsafe equipment.
Non instrumental test/procedures	May include: • gravimetric analysis, such as: ➢ loss on drying ➢ suspended solids ➢ ashes, such as sulphated and gravimetric assays (for example, sulphates and nitrogen in fertilisers) ➢ Ni by dimethylglyoxime ➢ bitumen content of asphaltic concrete • titrimetric analysis, such as: ➢ acid/base determinations ➢ complexiometric, such as water hardness, Fe by dichromate, binder content analysis ➢ redox, such as precipitation of chlorides in water ➢ Dissolved Oxygen (DO), Chemical Oxygen Demand (COD), Biochemical Oxygen Demand (BOD) • filtration, separation, solvent extraction techniques • corrosion testing, cement content, accelerated weathering.
Types of instrumentation and instrumental techniques	May include: • colorimetric, such as chlorine in water, specific cations and anions • infrared, ultraviolet and visible spectrophotometry • other spectrometric techniques, such as: ➢ fluorimetric analysis, flame atomic emission, flame atomic absorption spectrometry ➢ fourier transform infrared • electrochemical techniques, such as: pH, eH, conductivity, ion selective electrodes • soil testing, such as: ➢ moisture content ➢ organic matter content ➢ specific anions and cations • autoanalysers for determination of total P, total Kjeldahl N, orthophosphate, nitrite/nitrate, ammonia.
Hazard control measures	May include: • ensuring access to service shut-off points • recognising and observing hazard warnings and safety signs • labeling of samples, reagents, aliquoted samples and hazardous materials • handling and storage of hazardous materials and equipment in accordance with labeling,

	• materials safety data sheets and manufacturer's instructions • identifying and reporting operating problems or equipment malfunctions • cleaning and decontaminating equipment and work areas regularly using enterprise • procedures • using personal protective clothing and equipment, such as gloves, safety glasses, coveralls • using containment facilities • containment equipment • reporting abnormal emissions, discharges and airborne contaminants, such as noise, light, solids, liquids, water/waste water, gases, smoke, vapour, fumes, odour and particulates to appropriate personnel.

Evidence Guide	
Critical aspects of Competence	The assessors should look to see that the candidate: • interprets test methods/procedures accurately • prepares and tests samples using procedures appropriate to the nature of sample • performs calibration checks (if required) • safely operates test equipment/instruments to enterprise standards and/or manufacturer's • specification • prepares calibration graphs and calculates results using appropriate units and precision • applies basic theoretical knowledge to interpret gross features of data and makes relevant conclusions • identifies atypical results as out of normal range or an artifact • traces and sources obvious causes of an artefact • communicates problem(s) to a supervisor or outside service technician • records and communicates results in accordance with enterprise procedures • maintains security, integrity, traceability of samples, sub-samples, test data and results and documentation.
Underpinning Knowledge and Attitudes	Demonstrate knowledge of: • chemical principles and concepts underpinning test/procedure, such as: ➢ ions, atoms, molecules, bonding and links to chemical properties ➢ chemical reactions involving acid/base, redox, complex ion formation, solubility and equilibrium ➢ energy levels, absorption/emission spectra • use of instruments for qualitative and/or quantitative analysis • purpose of the test(s) • metrology and/or separation techniques underpinning

	test/procedure • principles and concepts related to equipment/instrument operation and testing • function of key components of the equipment/instrument and/or reagents • effects of modifying equipment/instrument variables • sample preparation procedures • reagent maintenance and evaluation procedures • basic equipment/method troubleshooting procedures • use of calibration procedures • calculation steps to give results in appropriate units and precision • enterprise and/or legal traceability requirements • relevant health, safety and environment requirements.
Underpinning Skills	Demonstrate skills to: • Interpret and schedule test requirements • Receive and prepare samples • Check equipment before use • Test samples to determine chemical species or properties • Process and interpret data • Maintain a safe work environment • Maintain laboratory records
Resources Implication	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview / Written Test • Observation / Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Physicochemical Laboratory Operation Level IV	
Unit Title	**Capture and Manage Scientific Image**
Unit Code	**MIN PCL4 11 0114**
Unit Descriptor	This unit of competency covers the ability to capture accurate and reproducible images of scientific (environmental, medical and technical) subjects using a scientific approach and enterprise procedures/protocols to ensure the integrity of the image.

Elements	Performance Criteria
1. Establish requirements for image capture	1.1 Requirements and ***purpose of the work*** are defined and a brief is created. 1.2 ***Scientific imaging*** technique that maintains the integrity and veracity of the subject is chosen and the ***work requirements*** are fulfilled. 1.3 The work using technical knowledge is planned to ensure an effective and efficient result.
2. Plan and set up the shoot	2.1 The required equipment is selected and assembled. 2.2 Ethical and legal work practices are followed at all times. 2.3 Risks or ***hazards*** are assessed and safety procedures implemented. 2.4 The subject is prepared to achieve the brief.
3. Capture and reproduce the required image	3.1 Media or film is exposed and accurately documented the work in progress. 3.2 The image is reviewed against the work requirements and repeat if necessary. 3.3 The image is reproduced to specification.
4. Keep records and deliver images	4.1 The request, technical specifications and images are accurately and retrievably recorded so that they are retrievable. 4.2 Records are stored safely and securely to archival standards. 4.3 Copyright and crediting policies and procedures are followed. 4.4 The images available to the client are made, discussed the results and ensured that requirements have been met.

Variable	Range
Purposes of the image	May include: • publication as a thesis, presentation or on the web • temporal serial recording of changes over time • display as a poster, diorama, print or projection

	• preview, snapshot or proof of an image for production at a later stage • records of data for inclusion in databases • Planning of the job may include: ➢ choice of type of image, media, site and conditions ➢ preparation of the subject, such as: make-up, choice of whole or part magnification ➢ back up method and equipment for image capture ➢ specification of final product, size, delivery, number, cost position of subject. • Equipment may include: ➢ lighting ➢ backdrops ➢ camera systems and accessories.
Scientific images	include photographic, digital, X-ray and video images, and prints or transparencies of subjects, such as: • building sites, environmental survey and monitoring sites • accident or incident sites, injuries • Other imaging techniques may include: • autoradiations • micrographs • other non visible light sources, such as ultraviolet light, fluorescence and phosphorescence • electron micrographs.
Work requirements	May include: • description and specification of work, including constraints, due date • purpose of the image • specifications, such as size, purpose, audience, medium and style • interviewing and collecting information from the client • keeping records, request forms, notes.
Hazards	May include: • microbiological organisms and agents associated with soil, air, water, blood and blood • products, human or animal tissue and fluids • solar radiation, dust, noise • chemicals and radioisotopes • X rays and other sources of electromagnetic radiation (laser, UV) • manual handling of heavy objects • slips, trips and falls, falling objects, moving machinery (for example, on building sites) • pedestrian and vehicular traffic.
Safety procedures	May include: • recognising and observing hazard warnings and safety signs

	• use of personal protective equipment, such as hard hats, hearing protection, gloves, safety • glasses, goggles, face guards, coveralls, gown, body suits, respirators and safety boots • following required containment procedures through the use of appropriate equipment, • use of Material Safety Data Sheets (MSDS) • handling and storage of all hazardous materials and equipment in accordance with • labeling, materials safety data sheets and manufacturer's instructions • following established manual handling procedures. • Ethical and legal work practices include consideration of: • industry Codes of Practice, contracts, permits, intellectual property, crediting, plagiarism and copyright • moral rights, model release, etiquette, decorum and sensitivity towards the subject, use of a chaperone and confidentiality. • Production of images may include sending images for processing, processing the images or use of commercial software. • Storage of records may include the brief, technical specifications and images. It may include file management (backups, data retrieval, storage) and can be paper based, electronic or digital.

Evidence Guide	
Critical aspects of Competence	The assessors should look to see that the candidate: • can create and interpret a brief • can apply an imaging technique that best meets the specifications and purpose of the job, • consistent with enterprise procedures • provides a backup system of image capture when shooting images • produces consistent high quality, cost effective outcomes for clients • keeps accurate records that allow future replication of images • works safely and in an ethical manner consistent with legislation, regulations and Codes of Practice.
Underpinning Knowledge and Attitudes	Demonstrate knowledge of: • repercussions of manipulation of images and differences between adjustment and • manipulation • scientific approach and protocols to ensure integrity of images • veracity of different types of storage media

	• relevant copyright, moral rights and intellectual property issues and legislation • relevant health, safety and environment requirements • enterprise policies and procedures for capturing and managing scientific images.
Underpinning Skills	Demonstrate skills to: • Establish requirements for image capture • Plan and set up the shoot • Capture and reproduce the required image • Keep records and deliver images
Resources Implication	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview / Written Test • Observation / Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Physicochemical Laboratory Operation Level IV	
Unit Title	**Perform Mechanical Tests**
Unit Code	**MIN PCL4 12 0114**
Unit Descriptor	This unit of competency covers the ability to interpret mechanical test requirements, prepare samples, conduct pre-use and calibration checks on equipment and perform routine mechanical tests.

Elements	Performance Criteria
1. Interpret and schedule test requirements	1.1 ***Test*** request is review to identify samples to be tested, test method and equipment/instruments involved. 1.2 ***Hazards*** and enterprise control measures associated with the sample, preparation/test methods and/or equipment are identified. 1.3 Work sequences are planned to optimize throughput of multiple samples (if appropriate).
2. Receive samples and prepare test-pieces	2.1 Samples are logged on using standard operating procedures. 2.2 Sample description is recorded, compared with specification and discrepancies are noted and reported 2.3 Test-pieces (and standards if appropriate) are prepared in accordance with ***mechanical testing*** requirements. 2.4 Traceability of samples is ensured from receipt to reporting of results.
3. Check equipment before use	3.1 Equipment/instruments is/are set up in accordance with test method requirements. 3.2 Pre-use and safety checks are performed in accordance with relevant enterprise and operating procedures. 3.3 Faulty or unsafe components and equipment are identified and reported to appropriate personnel. 3.4 Equipment calibration is checked using specified procedures (if applicable). 3.5 Out-of-calibration equipment/instruments is/are quarantined.
4. Test samples to determine mechanical properties	4.1 Equipment/instruments are operated in accordance with test method requirements. 4.2 Tests/procedures on all test-pieces and standards (if appropriate) are performed in accordance with specified methods. 4.3 Equipment/instruments is/are shut down in accordance with operating procedures.
5. Process and	5.1 Test data noting atypical observations is ***recorded***.

interpret data	5.2 Calculated values are ensured to be consistent with expectations. 5.3 Results are recorded and reported in accordance with enterprise procedures. 5.4 Trends in data and/or results are interpreted and 'out of-specification' or atypical results is/are reported promptly to appropriate personnel. 5.5 Obvious procedure or equipment problems have led to atypical data or results.
6. Maintain a safe work environment	6.1 Established work practices and personal protective equipment are used to ensure personal safety and that of other laboratory personnel. 6.2 The generation of wastes and environmental impacts is minimized. 6.3 The safe collection of laboratory and hazardous waste is ensured for subsequent disposal. 6.4 Equipment, used test-pieces and back-up samples are cared for and stored as required.
7. Maintain laboratory records	7.1 Approved data is entered into laboratory information management system. 7.2 Confidentiality and security of enterprise information and laboratory data are maintained. 7.3 Equipment and calibration logs are maintained in accordance with enterprise procedures.

Variable	Range
Tests	May include: • control of starting materials, in-process materials and finished products • investigation of sources of construction materials • basic troubleshooting of enterprise processes.
Hazards	May include: • microbiological organisms and agents associated with soil • chemicals, such as acids and solvents • sharps and hand tools • flammable liquids and gases • cryogenics, such as dry ice and nitrogen • fluids under pressure, such as steam and industrial gases • sources of ignition • disturbance or interruption of services • crushing, entanglement, cuts associated with moving machinery or falling objects.

Mechanical tests	May include: • adhesive strength • elastic properties and strength of materials • slip resistance, friction • viscosity, torque • creep, endurance • abrasion, hardness, impact, indent, penetration resistance • pressure and/or vacuum testing using manometers, load cells.
Records	May include: • test and calibration results • equipment use, maintenance and servicing history • faulty or unsafe equipment.
Relevant standards, appropriate procedures and/or enterprise requirements	May include: • ISO/IEC 17025 General requirements for the competence of testing and calibration laboratories • Safety in Laboratories — Mechanical aspects • Relevant Ethiopian Standard Methods of testing concrete • Relevant Ethiopian Standard Methods of testing soils for engineering purposes • Preparation of laboratory sheets for physical testing • ISO 9000 series Quality management and quality assurance standards • Codes of Practice • National Measurement Act • Material Safety Data Sheets (MSDSs)) • Standard Operating Procedures (SOPs) • quality manuals, equipment and procedures manuals • equipment startup, operation and shutdown procedures • calibration and maintenance schedules • data quality procedures • enterprise recording and reporting procedures • production and laboratory schedules • material, production and product specifications.
Hazard control measures	May include: • ensuring access to service shut-off points • recognising and observing hazard warnings and safety signs • labeling of samples and hazardous materials • handling and storage for hazardous materials and equipment in accordance with labeling, • materials safety data sheets and manufacturer's instructions • identifying and reporting operating problems or equipment malfunctions • cleaning equipment and work areas regularly using

	enterprise procedures • using personal protective clothing and equipment, such as hard hats, hearing protection, • gloves, safety glasses, coveralls and safety boots • following established manual handling procedures • reporting abnormal emissions, discharges and airborne contaminants, such as noise, light, • solids, liquids, water/waste water, gases, smoke, vapour, fumes, odour and particulates to • appropriate personnel.

Evidence Guide	
Critical aspects of Competence	Must demonstrate knowledge and skills competence to: • interprets test methods/procedures accurately • prepares and tests samples/test-pieces in accordance with specified methods • performs calibration checks (if required) • safely operates test equipment/instruments to enterprise standards and/or manufacturer's specifications • applies basic knowledge of mechanical properties of materials to interpret gross features of data and make relevant conclusions • identifies atypical results, such as 'out of normal' range or an artefact • traces and sources obvious causes of an artefact • communicates problem(s) to a supervisor or outside service technician • records and communicates results in accordance with enterprise procedures • maintains security, integrity and traceability of samples, test-pieces, test data/results and documentation.
Underpinning Knowledge and Attitudes	Demonstrate knowledge of: • mechanical principles and concepts underpinning the test/procedure, such as: ➢ matter, interatomic and intermolecular forces, states of matter ➢ mass, weight, forces, pressure, energy ➢ cohesive/adhesive forces, friction, slip resistance ➢ elasticity, hardness, ductility, malleability, strength of materials, elastic limit, elastic • moduli, ultimate stress ➢ electrical concepts, including electric field, voltage, current, resistance, AC/DC) • use of instruments for qualitative and/or quantitative analysis • purpose of test(s) • metrology techniques underpinning test/procedure

	• principles and concepts related to equipment/instrument operation and testing • function of key components of the equipment/instrument • effects on test of modifying equipment/instrument variables • sample preparation procedures • basic equipment/method troubleshooting procedures • use of calibration procedures • calculation steps to give results in appropriate units and precision • enterprise and/or legal traceability requirements • relevant health, safety and environment requirements.
Underpinning Skills	Demonstrate skills to: • Interpret and schedule test requirements • Receive samples and prepare test-pieces • Check equipment before use • Test samples to determine mechanical properties • Process and interpret data • Maintain a safe work environment • Maintain laboratory records
Resources Implication	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview / Written Test • Observation / Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Physicochemical Laboratory Operation Level IV	
Unit Title	**Plan and Organize Work**
Unit Code	**MIN PCL4 13 0114**
Unit Descriptor	This unit covers the knowledge, skills and attitude required in planning and organizing work activities in a production application. It may be applied to a small independent operation or to a section of a large organization.

Elements	Performance Criteria
1. Set objectives	1.1 ***Objectives*** are planned consistent with and linked to work activities in accordance with organizational aims. 1.2 Objectives are stated as measurable targets with clear time frames. 1.3 Support and commitment of team members are reflected in the objectives. 1.4 Realistic and attainable objectives are identified.
2. Plan and schedule work activities	2.1 Tasks/work activities to be completed are identified and prioritized as directed. 2.2 Tasks/work activities are broken down into steps in accordance with set time frames and achievable components. 2.3 Task/work activities are assigned to appropriate team or individuals in accordance with agreed functions. 2.4 ***Resources*** are allocated as per requirements of the activity. 2.5 ***Schedule of work activities*** is coordinated with personnel concerned.
3. Implement work plans	3.1 ***Work methods and practices*** are identified in consultation with personnel concerned. 3.2 ***Work plans*** are implemented in accordance with set time frames, resources and ***standards.***
4. Monitor work activities	4.1 Work activities are monitored and compared with set objectives. 4.2 Work performance is monitored. 4.3 Deviations from work activities are reported and recommendations are coordinated with appropriate personnel and in accordance with set standards. 4.4 Reporting requirements are complied with in accordance with recommended format. 4.5 Timeliness of report is observed. 4.6 Files are established and maintained in accordance with standard operating procedures.

5. Review and evaluate work plans and activities	5.1 Work plans, strategies and implementation are reviewed based on accurate, relevant and current information. 5.2 Review is done based on comprehensive consultation with appropriate personnel on outcomes of work plans and reliable feedback. 5.3 Results of review are provided to concerned parties and formed as the basis for adjustments/simplifications to be made to policies, processes and activities. 5.4 Performance appraisal is conducted in accordance with organization rules and regulations. 5.5 Performance appraisal report is prepared and documented regularly as per organization requirements. 5.6 Recommendations are prepared and presented to ***appropriate personnel/authorities***. 5.7 ***Feedback mechanisms*** are implemented in line with organization policies.

Variable	**Range**
Objectives	May include but not limited to: • Specific • General
Resources	May include but not limited to: • Personnel • Equipment and technology • Services • Supplies and materials • Sources for accessing specialist advice • Budget
Schedule of work activities	May include but not limited to: • Daily • Work-based • Contractual Regular
Work methods and practices	May include but not limited to: • Legislated regulations and codes of practice • Industry regulations and codes of practice • Occupational health and safety practices
Work plans	May include but not limited to: • Daily work plans • Project plans • Program plans • Resource plans • Skills development plans • Management strategies and objectives

Standards	May include but not limited to: • Performance targets • Performance management and evaluation systems • Occupational standards • Employment contracts • Client contracts • Discipline procedures • Workplace assessment guidelines • Internal quality assurance • Internal and external accountability and auditing requirements • Training Regulation Standards • Safety Standards
Appropriate personnel/ authorities	May include but not limited to: • Appropriate personnel include: • Management • Line Staff
Feedback mechanisms	May include but not limited to: • Verbal feedback • Informal feedback • Formal feedback • Questionnaire • Survey • Group discussion

Evidence Guide	
Critical Aspects of Competence	Demonstrates skills and knowledge in: • set objectives • plan/schedule and monitor work activities • implement work plans • review and evaluate work plans and activities
Underpinning Knowledge and Attitudes	Demonstrates knowledge of: • organization's strategic plan, policies rules and regulations, laws and objectives for work unit activities and priorities • organizational guidelines related to the role of the work unit • team work and consultation strategies
Underpinning Skills	Demonstrates skill to: • plan, lead, organize, coordinate, communicate inter-and intra-person/motivation skills and present
Resource Implications	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview / Written Test • Observation / Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Physicochemical Laboratory Operation Level IV	
Unit Title	**Migrate to New Technology**
Unit Code	**MIN PCL4 14 0114**
Unit Descriptor	This unit defines the competence required to apply skills and knowledge in using new or upgraded technology. The rationale behind this unit emphasizes the importance of constantly reviewing work processes, skills and techniques in order to ensure that the quality of the entire business process is maintained at the highest level possible through the appropriate application of new technology. To this end, the person is typically engaged in on-going review and research in order to discover and apply new technology or techniques to improve aspects of the organization's activities.

Elements	Performance Criteria
1. Apply existing knowledge and techniques to technology and transfer	1.1 Situations are identified where existing knowledge can be used as the basis for developing new skills. 1.2 New or upgraded technology skills are acquired and used to enhance learning. 1.3 New or upgraded equipment are identified, classified and used where appropriate, for the benefit of the organization.
2. Apply functions of technology to assist in solving organizational problems	2.1 Testing of new or upgraded equipment is conducted according to the specification manual. 2.2 Features of new or upgraded equipment are applied within the organization 2.3 Features and functions of new or upgraded equipment are used for solving organizational problems 2.4 Sources of information relating to new or upgraded equipment are accessed and used
3. Evaluate new or upgraded technology performance	3.1 New or upgraded equipment is evaluated for performance, usability and against OHS standards**.** 3.2 ***Environmental considerations*** are determined from new or upgraded equipment. 3.3 ***Feedback*** is sought from users where appropriate.

Variables	Range
Environmental Considerations	May include but is not limited to: • recycling, safe disposal of packaging (e.g. cardboard, polystyrene, paper, plastic) and correct disposal of waste materials by an authorized body

Feedback	May include but is not limited to: • surveys, • questionnaires, • interviews and meetings

Evidence Guide	
Critical Aspects of Competence	Competence must confirm the ability to transfer the application of existing skills and knowledge to new technology
Underpinning Knowledge and Attitudes	Demonstrate knowledge of: • Broad awareness of current technology trends and directions in the industry (e.g. systems/procedures, services, new developments, new protocols) • Knowledge of vendor product directions • Ability to locate appropriate sources of information regarding metal manufacturing and new technologies • Current industry products/services, procedures and techniques with knowledge of general features • Information gathering techniques
Underpinning Skills	Demonstrate skills of: • Research skills for identifying broad features of new technologies • Ability to assist in the decision making process • Literacy skills in regard to interpretation of technical manuals • Ability to solve known problems in a variety of situations and locations • Evaluate and apply new technology to assist in solving organizational problems • General analytical skills in relation to known problems
Resources Implication	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview / Written Test • Observation / Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Physicochemical Laboratory Operation Level IV	
Unit Title	**Establish Quality Standards**
Unit Code	**MIN PCL4 15 0114**
Unit Descriptor	This unit covers the knowledge, skills and attitudes required to establish quality specifications for work outcomes and work performance. It includes monitoring and participation in maintaining and improving quality, identifying critical control points in the production of quality output and assisting in planning and implementing of quality assurance procedures.

Elements	Performance Criteria
1. Establish quality specifications for product	1.1 Market specifications are ***sourced*** and ***legislated requirements*** identified. 1.2 Quality specifications are developed and agreed upon 1.3 Quality specifications are documented and introduced to organization staff / personnel in accordance with the organization policy 1.4 Quality specifications are updated when necessary
2. Identify hazards and critical control points	2.1. Critical control points impacting on quality are identified. 2.2. Degree of risk for each hazard is determined. 2.3. Necessary documentation is accomplished in accordance with organization quality procedures
3. Assist in planning of quality assurance procedures	3.1 Procedures for each identified control point are developed to ensure optimum quality. 3.2 Hazards and risks are minimized through application of appropriate controls. 3.3 Processes are developed to monitor the effectiveness of quality assurance procedures.
4. Implement quality assurance procedures	4.1 Responsibilities for carrying out procedures are allocated to staff and contractors. 4.2 Instructions are prepared in accordance with the enterprise's quality assurance program. 4.3 Staff and contractors are given induction training on the quality assurance policy. 4.4 Staff and contractors are given in-service training relevant to their allocated ***safety procedures***.
5. Monitor quality of work outcome	5.1 Quality requirements are identified 5.2 Inputs are inspected to confirm capability to meet quality requirements

	5.3 Work is conducted to produce required outcomes 5.4 Work processes are monitored to confirm quality of output and/or service 5.5 Processes are adjusted to maintain outputs within specification.
6. Participate in maintaining and improving quality at work	6.1 Work area, materials, processes and product are routinely monitored to ensure compliance with quality requirements 6.2 Non-conformance in inputs, process, product and/or service is identified and reported according to workplace reporting requirements 6.3 Corrective action is taken within level of responsibility, to maintain quality standards 6.4 Quality issues are raised with designated personnel
7. Report problems that affect quality	7.1 Potential or existing quality problems are recognized. 7.2 Instances of variation in quality are identified from specifications or work instructions. 7.3 Variation and potential problems are reported to supervisor/manager according to enterprise guidelines.

Variable	**Range**
Sourced	May include but is not limited to: • End-users • Customers or stakeholders
Legislated requirements	May include but is not limited to: • Verification of product quality as part of consumer legislation or specific legislation related to product content or composition.
Safety procedures.	May include but is not limited to: • Use of tools and equipment for fabrication/production/ manufacturing works • Workplace environment and handling of material safety, • Following occupational health and safety procedures designated for the task • Respect the policies, regulations, legislations, rule and procedures for manufacturing/production/fabrication works

Evidence Guide	
Critical Aspect of Competence	Demonstrates skills and knowledge to: • Monitor quality of work • Establish quality specifications for product • Participate in maintaining and improving quality at work • Identify hazards and critical control points in the production of quality product • Assist in planning of quality assurance procedures

	• Report problems that affect quality • Implement quality assurance procedures
Underpinning Knowledge	Demonstrates knowledge of: • work and product quality specifications • quality policies and procedures • improving quality at work • hazards and critical points of operation • obtaining and using information • applying federal and regional legislation within day-today work activities • accessing and using management systems to keep and maintain accurate records • requirements for correct preparation and operation • technical writing
Underpinning Skills	Demonstrates skills to: • monitor quality of work • establish quality specifications for product • participate in maintaining and improving quality at work • identify hazards and critical control points in the production of quality product • assist in planning of quality assurance procedures • report problems that affect quality • implement quality assurance procedures
Resource Implications	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview / Written Test • Observation / Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Physicochemical Laboratory Operation Level IV	
Unit Title	**Develop Individuals and Team**
Unit Code	**MIN PCL4 16 0114**
Unit Descriptor	This unit covers the knowledge, skills and attitudes required to determine individual and team development needs and facilitate the development of the workgroup.

Elements	Performance Criteria
1. Provide team leadership	1.1 ***Learning and development needs*** are systematically identified and implemented in line with ***organizational requirements***. 1.2 Learning plan to meet individual and group training and developmental needs is collaboratively developed and implemented. 1.3 Individuals are encouraged to self-evaluate performance and identify areas for improvement. 1.4 ***Feedback on performance*** of team members is collected from relevant sources and compared with established team learning process.
2. Foster individual and organizational growth	2.1 Learning and development program goals and objectives are identified to match the specific knowledge and skills requirements of Competence standards. 2.2 ***Learning delivery methods*** are made appropriate to the learning goals, the learning style of participants and availability of equipment and resources. 2.3 Workplace learning opportunities and coaching/ mentoring assistance are provided to facilitate individual and team achievement of competencies. 2.4 Resources and timelines required for learning activities are identified and approved in accordance with organizational requirements.
3. Monitor and evaluate workplace learning	3.1 Feedback from individuals or teams is used to identify and implement improvements in future learning arrangements. 3.2 Outcomes and performance of individuals/teams are assessed and recorded to determine the effectiveness of development programs and the extent of additional support. 3.3 Modifications to learning plans are negotiated to improve the efficiency and effectiveness of learning. 3.4 Records and reports of competence are maintained within organizational requirement.
4. Develop team	4.1 Open communication processes to obtain and share

commitment and cooperation	information is used by team. 4.2 Decisions are reached by the team in accordance with its agreed roles and responsibilities. 4.3 Mutual concern and camaraderie are developed in the team.
5. Facilitate accomplishment of organizational goals	5.1 Team members are actively participated in team activities and communication processes. 5.2 Individual and joint responsibility is developed by team's members for their actions. 5.3 Collaborative efforts are sustained to attain organizational goals.

Variable	Range
Learning and development needs	May include but is not limited to: • Coaching, monitoring and/or supervision • Formal/informal learning program • Internal/external training provision • Work experience/exchange/opportunities • Personal study • Career planning/development • Performance evaluation • Workplace skills assessment • Recognition of prior learning
Organizational requirements	May include but is not limited to: • Quality assurance and/or procedures manuals • Goals, objectives, plans, systems and processes • Legal and organizational policy/guidelines and requirements • Safety policies, procedures and programs • Confidentiality and security requirements • Business and performance plans • Ethical standards • Quality and continuous improvement processes and standards
Feedback on performance	May include but is not limited to: • Formal/informal performance evaluation • Obtaining feedback from supervisors and colleagues • Obtaining feedback from clients • Personal and reflective behavior strategies • Routine and organizational methods for monitoring service delivery
Learning delivery methods	May include but is not limited to: • On the job coaching or monitoring • Problem solving • Presentation/demonstration • Formal course participation • Work experience and involvement in professional networks

	• Conference and seminar attendance

Evidence Guide	
Critical Aspects of Competence	Demonstrates skills and knowledge to: • identify and implement learning opportunities for others • give and receive feedback constructively • facilitate participation of individuals in the work of the team • negotiate plans to improve the effectiveness of learning • prepare learning plans to match skill needs • access and designate learning opportunities
Underpinning Knowledge and Attitude	Demonstrates knowledge of: • coaching and monitoring principles • understanding how to work effectively with team members who have diverse work styles, aspirations, cultures and perspective • understanding how to facilitate team development and improvement • understanding methods and techniques to obtain and interpreting feedback • understanding methods for identifying and prioritizing personal development opportunities and options • knowledge of career paths and competence standards in the industry
Underpinning Skills	Demonstrates skills to: • read and understand a variety of texts, preparing general information and documents according to target audience; spell with accuracy; use grammar and punctuation effective relationships and conflict management • communicate including receiving feedback and reporting, maintaining effective relationships and conflict management • plan and organize required resources and equipment to meet learning needs • coach and mentor skills to provide support to colleagues • report to organize information; assess information for relevance and accuracy; identify and elaborate on learning outcomes • facilitate and conduct small group training sessions • relate to people from a range of social, cultural, physical and mental backgrounds
Resource Implications	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview / Written Test • Observation / Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Physicochemical Laboratory Operation Level IV	
Unit Title	**Utilize Specialized Communication Skills**
Unit Code	**MIN PCL4 17 0114**
Unit Descriptor	This unit covers the knowledge, skills and attitudes required to use specialized communication skills to meet specific needs of internal and external clients, conduct interviews, facilitate group discussions, and contribute to the development of communication strategies.

Elements	Performance Criteria
1. Meet common and specific communication needs of clients and colleagues	1.1 Specific communication needs of clients and colleagues are identified and met. 1.2 Different approaches are used to meet communication needs of clients and colleagues. 1.3 Conflict is addressed promptly and in a timely way and in a manner which does not compromise the standing of the organization.
2. Contribute to the development of communication strategies	2.1 ***Strategies*** for internal and external dissemination of information are developed, promoted, implemented and reviewed as required. 2.2 Channels of communication are established and reviewed regularly. 2.3 Coaching in effective communication is provided. 2.4 Work related network and relationship are maintained as necessary. 2.5 Negotiation and conflict resolution strategies are used where required. 2.6 Communication with clients and colleagues is appropriate to individual needs and organizational objectives.
3. Represent the organization	3.1 When participating in internal or external fora, presentation is relevant, appropriately researched and presented in a manner to promote the organization. 3.2 Presentation is made clear and sequential and delivered within a predetermined time. 3.3 Appropriate media is utilized to enhance presentation. 3.4 Differences in views are respected. 3.5 Written communication is made consistent with organizational standards. 3.6 Inquiries are responded in a manner consistent with organizational standard.

4. Facilitate group discussion	4.1 Mechanisms which enhance ***effective group interaction*** are defined and implemented. 4.2 Strategies which encourage all group members to participate are used routinely. 4.3 Objectives and agenda are routinely set and followed for meetings and discussions. 4.4 Relevant information is provided to group to facilitate outcomes. 4.5 Evaluation of group communication strategies is undertaken to promote participation of all parties. 4.6 Specific communication needs of individuals are identified and addressed.
5. Conduct interview	5.1 A range of appropriate communication strategies are employed in ***interview situations***. 5.2 Different ***types of interview*** are conducted in accordance with the organizational procedures. 5.3 Records of interviews are made and maintained in accordance with organizational procedures. 5.4 Effective questioning, listening and nonverbal communication techniques are used to ensure that required message is communicated.

Variable	**Range**
Strategies	May include but is not limited to: • Recognizing own limitations • Utilizing techniques and aids • Providing written drafts • Verbal and non verbal communication
Effective group interaction	May include but is not limited to: • Identifying and evaluating what is occurring within an interaction in a non-judgmental way • Using active listening • Making decision about appropriate words, behavior • Putting together response which is culturally appropriate • Expressing an individual perspective • Expressing own philosophy, ideology and background and exploring impact with relevance to communication
Interview situations	May include but is not limited to: • Establish rapport • obtain facts and information • Facilitate resolution of issues • Develop action plans • Diffuse potentially difficult situation

Types of Interview	May include but is not limited to: • Related to staff issues • Routine • Confidential • Evidential • Non-disclosure • Disclosure

Evidence Guide	
Critical Aspects of Competence	Demonstrates skills and knowledge to: • Demonstrate effective communication skills with clients and work colleagues accessing service • Adopt relevant communication techniques and strategies to meet client particular needs and difficulties
Underpinning Knowledge and Values	Demonstrates knowledge of: • communication process • dynamics of groups and different styles of group leadership • communication skills relevant to client groups
Underpinning Skills	Demonstrates skills to: • full range of communication techniques including: ➢ active listening ➢ feedback ➢ interpretation ➢ role boundaries setting ➢ negotiation ➢ establishing empathy ➢ communication strategies • communicate to fulfill job roles as specified by the organization
Resource Implications	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview / Written Test • Observation / Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Physicochemical Laboratory Operation Level IV	
Unit Title	**Manage and Maintain Small/Medium Business Operations**
Unit Code	**MIN PCL4 18 0114**
Unit Descriptor	This unit covers the operation of day-to-day business activities in a micro or small business. The strategies involve developing, monitoring and managing work activities and financial information, developing effective work habits, and adjusting work schedules as needed.

Elements	Performance Criteria
1. Identify daily work requirements	1.1 Work requirements are identified for a given time period by taking into consideration ***resources*** and constraints. 1.2 Work activities are prioritized based on business needs, requirements and deadlines. 1.3 If appropriate, work is allocated to relevant staff or contractors to optimize efficiency.
2. Monitor and manage work	2.1 People, resources and/or equipment are coordinated to provide optimum results. 2.2 Staff, clients and/or contractors are communicated within a clear and regular manner, to monitor work in relation to ***business goals*** or timelines. 2.3 ***Problem solving techniques*** are applied to work situations to overcome difficulties and achieve positive outcomes.
3. Develop effective work habits	3.1 Work and personal priorities are identified and a balance is achieved between competing priorities using appropriate ***time management strategies***. 3.2 Input from ***internal and external sources*** is sought and used to develop and refine new ideas and approaches. 3.3 Business or inquiries is/are responded to promptly and effectively. 3.4 Information is presented in a format appropriate to the industry and audience.
4. Interpret financial information	4.1 Relevant documents and reports are identified. 4.2 Documents and reports are read and understood and any implications discussed with appropriate persons. 4.3 Data and numerical calculations are analyzed, checked, evaluated, organized and reconciled. 4.4 Daily financial records and cash flow are maintained correctly and in accordance with legal and accounting requirements. 4.5 Invoices and payments are prepared and distributed in a timely

	manner and in accordance with legal requirements. 4.6 Outstanding accounts are collected or followed-up on.
5. Evaluate work performance	5.1 Opportunities for improvements are monitored according to business demands. 5.2 Work schedules are adjusted to incorporate necessary modifications to existing work and routines or changing needs and requirements. 5.3 Proposed changes are clearly communicated and recorded to aid in future planning and evaluation. 5.4 Relevant codes of practice are used to guide an ethical approach to workplace practices and decisions.

Variable	Range
Resources	May include but is not limited to: • Staff, money, time, equipment and space
Business goals	May include but is not limited to: • sales targets • budgetary targets • team and individual goals • production targets • reporting deadlines
Problem solving techniques	May include but is not limited to: • gaining additional research and information to make better informed decisions • looking for patterns • considering related problems or those from the past and how they were handled • eliminating possibilities • identifying and attempting sub-tasks • collaborating and asking for advice or help from additional sources
Time management strategies	May include but is not limited to: • prioritizing and anticipating • short term and long term planning and scheduling • creating a positive and organized work environment • clear timelines and goal setting that is regularly reviewed and adjusted as necessary • breaking large tasks into smaller tasks • getting additional support if identified and necessary
Internal and external sources	May include but is not limited to: • staff and colleagues • management, supervisors, advisors or head office • relevant professionals such as lawyers, accountants, management consultants • professional associations

Evidence Guide	
Critical Aspects of Competence	A person must be able to: • identify daily work requirements and allocate work appropriately • interpret financial documents in accordance with legal requirements
Underpinning Knowledge and Attitudes	Demonstrate knowledge of: • Federal and Local Government legislative requirements affecting business operations, especially in regard to Occupational Health and Safety (OHS), equal employment opportunity, industrial relations and anti-discrimination • technical or specialist skills relevant to the business operation • relevant industry code of practice • planning techniques to establish realistic timelines and priorities • identification of relevant performance measures • quality assurance principles and methods • relevant marketing, management, sales and financial concepts • methods for monitoring performance and implementing improvements • structured approaches to problem solving, idea management and time management
Underpinning Skills	Demonstrate skills to: • interpret legal requirements, company policies and procedures and immediate, day-to-day demands • communicate using questioning, clarifying, reporting, and giving and receiving constructive feedback • numeracy skills for performance information, setting targets and interpreting financial documents and reports • technical and analytical skills to interpret business document, reports and financial statements and projections • relate to people from a range of social, cultural and ethnic backgrounds and physical and mental abilities • solve problem and develop contingency plans • using computers and software packages to record and manage data and to produce reports • evaluate using assessment work and outcomes • observe for identifying appropriate people, resources and to monitor work
Resource Implications	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview / Written Test • Observation / Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Physicochemical Laboratory Operation Level IV	
Unit Title	**Apply Problem Solving Techniques and Tools**
Unit Code	**MIN PCL4 19 0114**
Unit Descriptor	This unit of competency covers the knowledge, skills and attitude required to apply scientific problem solving techniques and tools to enhance quality, productivity and other kaizen elements on continual basis.

Elements	Performance criteria
1. Identify and select theme/problem.	1.1 ***Safety requirements*** are followed in accordance with safety plans and procedures. 1.2 All possible problems related to the process /Kaizen elements are listed using ***statistical tools and techniques***. 1.3 All possible problems related to kaizen elements are identified and listed on Visual Management Board/Kaizen Board. 1.4 Problems are classified based on obviousness of cause and action. 1.5 Critical factors like the number of customers affected, Potentials for bottlenecks, and number of complaints etc… is selected. 1.6 Problems related to priorities of ***Kaizen Elements*** are given due emphasis and selected.
2. Grasp current status and set goal.	2.1 The extent of the problem is defined. 2.2 Appropriate and achievable goal is set.
3. Establish activity plan.	3.1 The problem is confirmed. 3.2 High priority problem is selected. 3.3 The extent of the problem is defined. 3.4 Activity plan is established as per ***5W1H***.
4. Analyze causes of a problem.	4.1 All possible causes of a problem are listed. 4.2 Cause relationships are analyzed using ***4M1E***. 4.3 Causes of the problems are identified. 4.4 Root causes are selected. 4.5 The root cause which is most directly related to the problem is selected. 4.6 All possible ways are listed using ***creative idea generation*** to eliminate the most critical root cause. 4.7 The suggested solutions are carefully tested and evaluated for potential complications.

	4.8 Detailed summaries of the action plan are prepared to implement the suggested solution.
5. Examine countermeasures and their implementation.	5.1 Action plan is implemented by ***medium KPT*** members. 5.2 Implementation is monitored according to the agreed procedure and activities are checked with preset plan.
6. Assess effectiveness of the solution.	6.1 ***Tangible and intangible results*** are identified. 6.2 The results are verified over time. 6.3 Tangible results are compared with targets using ***various types of diagram***.
7. Standardize and sustain operation.	7.1 If the goal is achieved, the new procedures are standardized and made part of daily activities. 7.2 All employees are trained on the new ***Standard Operating Procedures (SOPs)***. 7.3 SOP is verified and followed by all employees. 7.4 The next problem is selected to be tackled by the team.

Variables	**Range**
Safety requirements	may include but not limited to: • OHS requirements include legislation, material safety, managements system, hazardous substances and dangerous goods code and local safe operating procedures • Work is carried out in accordance with legislative obligations, environmental legislations, relevant health regulation, manual handling procedure and organization insurance requirements
Statistical tools and techniques	may include but not limited to: • 7 QC tools may include: ➢ Stratification ➢ Pareto Diagram ➢ Cause and Effect Diagram ➢ Check Sheet ➢ Control Chart/Graph ➢ Histogram ➢ Scatter Diagram • QC techniques may include: ➢ Brain storming ➢ Why analysis ➢ What if analysis ➢ 5W1H
Kaizen Elements	may include but not limited to: • Quality • Cost • Productivity • Delivery

	• Safety • Moral • Environment • Gender equality
5W1H	may include but not limited to: • Who: person in charge • Why: objective • What: item to be implemented • Where: location • When: time frame • How: method
4M1E	may include but not limited to: • Man • Machine • Method • Material and • Environment
Creative idea generation	may include but not limited to: • Brainstorming • Exploring and examining ideas in varied ways • Elaborating and extrapolating • Conceptualizing
Medium KPT	may include but not limited to: • 5S • 4M (machine, method, material and man) • 4P (Policy, procedures, People and Plant) • PDCA cycle • Basics of IE tools and techniques
Tangible and intangible results	may include but not limited to: • Tangible result may include: ➢ Quantifiable data • Intangible result may include: ➢ Qualitative data
Various types of diagram	may include but not limited to: • Line graph • Bar graph • Pie-chart • Scatter diagram • Affinity diagram
Standard Operating Procedures (SOPs)	may include but not limited to: • The customer demand • The most efficient work routine (steps) • The cycle times required to complete work elements • All process quality checks required to minimize defects/errors • The exact amount of work in process required

Evidence Guide	
Critical Aspects of Assessment	Demonstrates skills and knowledge competencies to: • Apply all relevant procedures and regulatory requirements to ensure quality and productivity of an organization. • Detect non-conforming products/services in the work area • Apply effective problem solving approaches/strategies. • Implement and monitor improved practices and procedures • Apply statistical quality control tools and techniques.
Underpinning Knowledge and Attitude	Demonstrates knowledge of: • QC story/PDCA cycle/ • QC story/ Problem solving steps • QCC techniques • 7 QC tools • Basic IE tools and techniques. • SOP • Quality requirements associated with the individual's job function and/or work area • Workplace procedures associated with the candidate's regular technical duties • Relevant health, safety and environment requirements • organizational structure of the enterprise • Lines of communication • Methods of making/recommending improvements. • Reporting procedures
Underpinning Skills	Demonstrates skills to: • Apply problem solving techniques and tools • Apply statistical analysis tools • Apply Visual Management Board/Kaizen Board. • Detect non-conforming products or services in the work area • Document and report information about quality, productivity and other kaizen elements. • Contribute effectively within a team to recognize and recommend improvements in quality, productivity and other kaizen elements. • Implement and monitor improved practices and procedures. • Organize and prioritize activities and items. • Read and interpret documents describing procedures • Record activities and results against templates and other prescribed formats.
Resources Implication	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview / Written Test • Observation / Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

NTQF Level V

Occupational Standard: Physicochemical Laboratory Operation Level V	
Unit Title	**Perform Non-standard Calibrations**
Unit Code	**MIN PCL5 01 0114**
Unit Descriptor	This unit of competency covers the ability to recognize non-conforming calibration work, to research and select the most appropriate test method or calibration procedure for a given measurement request and then conduct the calibration. It also covers the ability to modify and revise existing procedures or substitute alternative instruments and measurement standards.

Elements	Performance Criteria
1. Select the appropriate calibration procedure	1.1 ***Non-conforming calibration*** tasks and requests are identified and their significance is analyzed. 1.2 The authorized ***procedure*** is reviewed and established whether it is appropriate for the test, if required. 1.3 An alternative is researched or an existing procedure adapted to satisfy the test specification requirements, if required. 1.4 Available resources are confirmed to meet all the requirements of the calibration procedures. 1.5 Authorization is obtained prior to substituting equipment, changing or deviating from the specified procedures. 1.6 Any authorized changes or deviations are documented and validated in accordance with enterprise procedures.
2. Prepare items for calibration	2.1 ***Hazards*** are identified and the appropriate personal protective equipment, safety equipment and ***safety procedures*** used. 2.2 Reference standards and associated equipment are assembled and set up prior to testing. 2.3 Performance of reference standards and measuring equipment is verified prior to use and adjust or calibrate as necessary. 2.4 Potential sources of measurement error are identified and minimized.
3. Perform calibration	3.1 Individual tests and document each step in the calibration procedure is performed to ensure repeatability of measurement. 3.2 Readings are critically analyzed to confirm they are the result of a valid measurement and record data as required (as-found or before adjustment). 3.3 Device is adjusted under test to bring readings within tolerance and results (as-left or after adjustment) are recorded if required. 3.4 Resulting test data is analyzed to detect trends or inconsistencies that would significantly affect the accuracy or validity of test results.

	3.5 Appropriate advice is sought when result interpretation is outside authorized scope of approval.
4. Document results	4.1 Compliance/non compliance are documented with requirements of test and or specifications. 4.2 Uncertainty of measurement is estimated and documented in accordance with enterprise procedures, if required. 4.3 The results of each test/calibration are recorded accurately, unambiguously and objectively. 4.4 Confidentiality of enterprise information is ensured.
5. Finalise calibration	5.1 A final report is prepared and issued for the job/item detailing testing, statement of compliance and all other required information carried out. 5.2 Any non compliance is reported and next course of action verified with supervisor. 5.3 Calibration labels, equipment stickers, quality control tags and tamper resistant seals are attached as required in enterprise procedures. 5.4 All changes and deviations that may have a significant influence on the test are reported. 5.5 Test equipment/measurement standards and results are stored in accordance with enterprise procedures.

Variable	Range
Non-conforming calibrations	involve detecting and dealing with non-conforming work associated with the testing and/or calibrating of equipment, such as: • common test equipment, such as balances, calipers ,barometers • environmental chambers, hygrometers, manometers, masses, micrometers, pressure equipment, spectrophotometers, tape measures, rules, temperature (digital) indicating • systems, thermometers, thermocouples, timing devices, vibration analysis equipment, • weighing instruments • electrical reference standards, such as air-lines, analogue meters, attenuators, bridges manual • balance, capacitors, DC voltage references, digital instruments (calibrators, • DMMs, electronic transfer standards), inductors, instrument and ratio transformers, • instrument transformer test sets, potentiometers, resistors, RF power meters, RF • thermistor mounts and thermal converters, shunts, time interval and frequency standards, • transfer standards AC-DC, voltage dividers, volt ratio boxes, watt-

	hour references • working standards, instruments and testing equipment, such as EMC test equipment, field • strength meters, flammability test equipment, gauges/test fingers/test pins, • impact hammers, impulse testers, instrument calibrators, network analysers, signal • generators, spectrum and harmonic analysers.
Procedures	These procedures include or may have been prepared from: • Relevant Ethiopian and international standards, such as: ➢ ISO/IEC 17025 General requirements for the competence of testing and calibration laboratories ➢ ISO 5725–11, 6 Accuracy (trueness and precision) of measurement methods and results ➢ ISO 9000–1 Quality management and quality assurance standards Part ➢ selection and use ➢ ISO 9004–1 Quality management and quality system elements ➢ ISO 9004–4 Quality management and quality system elements ➢ quality improvement ➢ ISO 10012 Quality assurance requirements for measurement equipment ➢ Guide to the expression of uncertainty in measurement, issued by Relevant Ethiopian − industry/sector specific guides, such as Uncertainty in Analytical Measurement' • Material Safety Data Sheets (MSDSs)) • enterprise recording and reporting procedures, Standard Operating Procedures (SOPs) • quality manuals, equipment and operating/technical manuals • test methods and calibration procedures (validated and authorized) ➢ test methods and calibration procedures published by: international, national or regional ➢ standards, reputable technical organizations, scientific texts or journals, equipment ➢ manufacturers incident and accident/injury reports ➢ schematics, workflows, laboratory layouts, production and laboratory schedules.
Hazards	may include: • electric shock • disturbance or interruption of services • manual handling of heavy equipment boxes • sources of electromagnetic radiation (lasers, RF generators/transmitters) • fluids under pressure

	• heat sources, such as ovens.
Safety procedures	may include: • use of personal protective equipment, such as hearing protection, gloves, safety glasses, coveralls • ensuring access to service shut off points • handling and storing hazardous materials and equipment in accordance with labels, MSDS, manufacturer's instructions, enterprise procedures and regulations • regular cleaning of equipment and work areas. • This unit of competency may involve communication with: • supervisors and managers (laboratory, quality and customer service) • peers and other laboratory or relevant technical personnel • clients and end users of equipment • external auditors, or accreditation agency (for example, NATA) • equipment manufacturers and suppliers of spare parts.
Working environment	will have a controlled environment but could be a: • purpose built designed facility • mobile facility in the field.

Evidence Guide	
Critical aspects of Competence	Must demonstrate knowledge and skills competence to: • Select the appropriate calibration procedure • Prepare items for calibration • Perform calibration and document results • Finalize calibration
Underpinning Knowledge and Attitudes	Demonstrate knowledge of: • requirements for the competence of testing and calibration laboratories (for example, • AS ISO/IEC 17025) as they affect job role and responsibilities • limits of authority and procedures for changing or deviating from standard calibration • methods and procedures • structure and terminology used in standard calibration methods, procedures, requests • and instructions • current calibration methods, procedures and technology applications used in the laboratory • implications of changing or deviating from standard calibration procedures • equipment specifications and limitations and the implications of equipment substitution • hierarchy and appropriate selection of reference materials • handling, transport, storage and operation of reference and working standards

	• laboratory environmental control requirements • calculation procedures to give results in appropriate accuracy, precision and units • equipment and testing method troubleshooting procedures • methods for statistical analysis (means, ranges, standard deviations) and estimation • of uncertainty of measurement (may include the use of soft ware) • reporting procedures and legislative requirements • enterprise and/or legal traceability requirements • relevant health, safety and environmental requirements. • layout of the enterprise, divisions and laboratory • organizational structure of the enterprise • lines of communication • Role of laboratory services to the enterprise and customers.
Underpinning Skills	Demonstrate skills to: • identifies non-conforming calibration tasks and requests and assesses their significance • researches current, alternative calibration methods and equipment for a given request • quantifies the potential or actual impact of a wide range of test/environmental/equipment influences on data quality • explains complex calibration procedures to clients, clarifies requirements and deviations • maintains very close attention to procedures, accuracy and precision of measurement to ensure integrity of test/calibration results • critically examines each calibration step to ensure repeatability and validity of data • prepares test/calibration documentation that is accurate and complies with requirements • operates a wide range of equipment correctly and safely • applies all relevant enterprise procedures to ensure the quality and integrity of the services or data they provide • recognizes opportunities for improvements to procedures.
Resources Implication	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview / Written Test • Observation / Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Physicochemical Laboratory Operation Level V	
Unit Title	**Create or Modify Calibration Procedures**
Unit Code	**MIN PCL5 02 0114**
Unit Descriptor	This unit of competency covers the ability to create or modify calibration procedures in response to the introduction of alternative/new equipment, changing test circumstances, activities involved in research and development trials or to meet client needs. The unit covers research of current calibration procedures and technology, development or modification of a procedure, its subsequent trialing and confirmation that it is fit for purpose.

Elements	Performance Criteria
1. Assess the suitability of available calibration procedures	1.1 The authorized calibration ***procedure*** is confirmed not to be appropriate for intended use or requires modification. 1.2 Suitable alternative established calibration procedures are researched, if available. 1.3 Establish whether an available procedure can be customized or if a new procedure is needed. 1.4 Internal approval is obtained to develop or modify a calibration procedure, as necessary. 1.5 Available resources are confirmed to meet all the requirements of the alternative or new procedures. 1.6 Authorisation is gained for any deviation from requirements previously agreed with client. 1.7 ***Communication*** is done with superiors, managers and other technical staff when any laboratory procedure is changed.
2. Develop procedure	2.1 All relevant calibration data to be collected, including parameters and ranges to be tested is identified and documented. 2.2 All new instructions or modifications to methods are described to ensure repeatability of test. 2.3 All ***hazards*** and safety measures to be observed are documented. 2.4 Specify data to be recorded and produce a results template, if required. 2.5 The requirements are listed for calibration approval and rejection. 2.6 All calibration requirements can be fulfilled by using the procedures.

3. Prepare equipment for testing	3.1 The appropriate personal protective equipment, safety equipment and ***safety procedures*** are used. 3.2 Reference standards and associated equipment are assembled and set up prior to ***testing***. 3.3 Performance of reference standards and measuring equipment is verified prior to use and adjust or calibrate as necessary. 3.4 Potential sources of measurement error are identified and minimized.
4. Trial modified / new calibration procedure	4.1 Individual steps are performed and confirmed they are adequately documented to ensure repeatability of measurement. 4.2 Readings are critically analyzed to confirm they are the result of a valid measurement and data is recorded as required. 4.3 Device is adjusted under test to bring readings within tolerance and results are recorded. 4.4 The resulting test data is analyzed to detect trends or inconsistencies that that may significantly affect the accuracy or validity of test results.
5. Confirm the modification or new procedure is fit for purpose	5.1 Results achieved are compared with those from other calibration procedures. 5.2 All measurement and ***environmenta***l factors that may influence the result are systematically analyzed and corrective action is taken, if necessary. 5.3 Internal peer checking of calibration procedure, data and results are arranged and feedback is incorporated. 5.4 The uncertainties of results obtained by analyzing equipment specifications and test methodology are quantified. 5.5 Results are compared with those obtained by other laboratories, if applicable. 5.6 Confirm that the modified/new procedure is fit for purpose and relevant to the client's needs and document as necessary.
6. Document and review modified/new calibration procedure	6.1 Ensure that the procedure is written in accordance with enterprise procedures or statutory and regulatory requirements. 6.2 Ensure that the procedure has been reviewed in accordance with enterprise procedures. 6.3 The procedure is reported and presented to appropriate personnel for validation before use.

Variable	**Range**
Procedures	These procedures include or may have been prepared from: • Relevant Ethiopian and international standards, such as:

	➢ ISO/IEC 17025 General requirements for the competence of testing and calibration laboratories ➢ ISO 5725–1, 6 Accuracy (trueness and precision) of measurement methods and results ➢ ISO 9000–1 Quality management and quality assurance standards ➢ selection and use ➢ ISO 9004–1 Quality management and quality system elements ➢ quality improvement ➢ ISO 10012 Quality assurance requirements for measurement equipment ➢ Guide to the expression of uncertainty in measurement, issued by relevant Ethiopia standard ➢ industry/sector specific guides • Uncertainty in Analytical Measurement' • Material Safety Data Sheets (MSDSs)) • enterprise recording and reporting procedures, Standard Operating Procedures (SOPs) • quality manuals, equipment and operating/technical manuals • test methods and calibration procedures (validated and authorized) • test methods and calibration procedures published by: international, national or regional • standards, reputable technical organizations, scientific texts or journals, equipment manufacturers • incident and accident/injury reports • schematics, workflows, laboratory layouts, production and laboratory schedules.
Communication	May involve: • supervisors and managers (laboratory, quality and customer service) • peers and other laboratory or relevant technical personnel • clients and end users of equipment • external auditors, or accreditation agency (for example, NATA) • Equipment manufacturers and suppliers of spare parts.
Hazards	may include: • electric shock • disturbance or interruption of services • manual handling of heavy equipment boxes • sources of electromagnetic radiation (lasers, RF generators/transmitters) • fluids under pressure • heat sources, such as ovens.
Safety procedures	may include: • use of personal protective equipment, such as hearing protection, gloves, • safety glasses, coveralls

	• ensuring access to service shut off points • handling and storing hazardous materials and equipment in accordance with • labels, MSDS, manufacturer's instructions, enterprise procedures and regulations • regular cleaning of equipment and work areas.
Test methods	may involve using, testing and or calibrating the following: • common test equipment, such as: balances, barometers, callipers, • environmental chambers, hygrometers, manometers, masses, micrometers, pressure • equipment, spectrophotometers, tape measures, rules, temperature (digital) indicating • systems, thermometers, thermocouples, timing devices, vibration analysis equipment, weighing instruments • electrical reference standards, such as: air-lines, analogue meters, attenuators, bridgesmanual • balance, capacitors, DC voltage references, digital instruments (calibrators, • DMMs, electronic transfer standards), inductors, instrument and ratio transformers, • instrument transformer test sets, potentiometers, resistors, RF power meters, RF • thermistor mounts and thermal converters, shunts, time interval and frequency standards, • transfer standards AC-DC, voltage dividers, volt ratio boxes, watt-hour references • working standards, instruments and testing equipment, such as: EMC test equipment, • field strength meters, flammability test equipment, gauges/test fingers/test pins, hipot • testers, impact hammers, impulse testers, instrument calibrators, network analysers, • signal generators, spectrum and harmonic analysers.
Working Environment	will have a controlled environment but could be a: • purpose built designed facility • mobile facility in the field.

Evidence Guide	
Critical aspects of Competence	Must demonstrate knowledge and skills competence to: • Assess the suitability of available calibration procedures • Develop procedure • Prepare equipment for testing • Trial modified / new calibration procedure • Confirm the modification or new procedure is fit for purpose • Document and review modified/new calibration procedure
Underpinning	Demonstrate knowledge of:

Knowledge and Attitudes	• requirements for the competence of testing and calibration laboratories (for example, AS ISO/IEC 17025) as they affect job role and responsibilities • limits of authority and procedures for creating or modifying calibration procedures • structure and terminology used in standard calibration methods, procedures, requests • and instructions • current calibration methods, procedures and technology applications used in laboratory • implications of modifying standard calibration procedures • equipment specifications and limitations and the implications of equipment substitution • hierarchy and appropriate selection of reference materials • handling, transport, storage and operation of reference and working standards • laboratory environmental control requirements • calculation procedures to give results in appropriate accuracy, precision and units • methods for statistical analysis (means, ranges, standard deviations) and estimation • of uncertainty of measurement (may include the use of soft ware) • equipment and testing method troubleshooting procedures • enterprise procedures and legislative requirements for documenting calibration procedures • enterprise and/or legal traceability requirements • relevant health, safety and environmental requirements. • layout of the enterprise, divisions and laboratory • organizational structure of the enterprise • lines of communication • role of laboratory services for the enterprise and customers.
Underpinning Skills	Demonstrate skills to: • researches current, alternative calibration methods and equipment for a given request • applies specialized technical knowledge to critically analyze and resolve complex • problems associated with measurement non-conformances where solutions are not obvious or readily available • develops or adapts methods to suit technical and/or client requirements • conducts reliable calibration/testing trials to ensure a high degree of reproducibility • explains complex calibration procedures to clients, clarifies requirements and deviations • liaises with peers and technical staff from other laboratories to clarify and validate test methods

	• estimates measurement uncertainty and applies statistical techniques for analyzing test and/or calibration data • writes calibration procedures using an unambiguous, logical sequence of instructions that meet statutory and regulatory requirements • prepares all test documentation accurately, concisely and in accordance with requirements • recognizes opportunities for improvements to procedures.
Resources Implication	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview / Written Test • Observation / Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Physicochemical Laboratory Operation Level V	
Unit Title	**Create or Modify Automated Calibration Procedures**
Unit Code	**MIN PCL5 03 0114**
Unit Descriptor	This unit of competency covers the ability to create, edit, test and document computer controlled calibration procedures for test and measurement instruments.

Elements	Performance Criteria
1. Assess the suitability of available automated procedures	1.1 The technical and quality deficiencies of the current automated calibration ***standard procedure*** are determined. 1.2 Alternative established procedures are researched, if available. 1.3 Available procedure can be customized or if a new procedure is needed by making ***communication*** with supervisors, managers and other technical staff. 1.4 Internal approval is obtained to develop an automation plan and strategy. 1.5 The resources required for automation are identified and verified to meet necessary quality, laboratory and technical requirements. 1.6 The automated procedure is confirmed to meet the needs of the client, if applicable.
2. Create or edit automated procedure	2.1 All relevant calibration data to be collected, including parameters and ranges to be tested are identified and documented. 2.2 Check that instructions are adequately documented to ensure repeatability of test. 2.3 ***Hazards*** and safety measures to be observed are documented. 2.4 The requirements are listed for calibration approval and rejection. 2.5 Data to be recorded is specified and a results template produced, if required 2.6 The procedure is edited or compiled using appropriate software. 2.7 Confirm that all calibration requirements can be fulfilled by using the procedures. 2.8 The program is tested; errors and debug are checked as necessary.
3. Configure instruments / equipment	3.1 The appropriate personal protective equipment, safety equipment and ***safety procedures*** are used. 3.2 Workstation, reference standards, instruments and equipment

	are configured. 3.3 Performance of reference standards, instruments and equipment is verified prior to use and adjust or calibrate as necessary. 3.4 Potential sources of measurement error are identified and minimized.
4. Refine the automated procedures	4.1 Automated procedure is run to confirm functionality of all steps. 4.2 Non-conforming results or data are recognized and the program or troubleshoot procedure/equipment amended as necessary. 4.3 All data have verified the result of a valid measurement and all calculations are made correct. 4.4 The integrity of procedure is confirmed at each step to ensure repeatability of measurement.
5. Verify automated procedure is fit for purpose	5.1 A calibration report is generated and results achieved are compared with other methods. 5.2 All measurement and environmental factors that may influence results are systematically analyzed and corrective action is taken. 5.3 The uncertainties of results are quantified by analyzing equipment specifications and methodology is tested. 5.4 Arrange for internal peer checking of procedure, data and results and incorporate feedback. 5.5 Feedback from other laboratories is reviewed to assess acceptance of procedure, if applicable. 5.6 Confirm the procedure is fit for purpose and relevant to the client's needs and document as required.
6. Document and review automated procedure	6.1 Ensure that the procedure is written in accordance with enterprise procedures or statutory and regulatory requirements. 6.2 Ensure that the procedure has been reviewed in accordance with enterprise procedures. 6.3 The procedure is reported and presented to appropriate personnel for validation before use.

Variable	Range
Procedures & Standards	May include: • Relevant Ethiopian and international standards, such as: ➢ ISO/IEC 17025 General requirements for the competence of testing and calibration laboratories ➢ ISO 5725–11, 6 Accuracy (trueness and precision) of measurement methods and results

	➢ ISO 9000–1 Quality management and quality assurance standards ➢ ISO 9004–1 Quality management and quality system elements ➢ ISO 9004–4 Quality management and quality system elements ➢ ISO 10012 Quality assurance requirements for measurement equipment ➢ Guide to the expression of uncertainty in measurement, issued by Relevant Ethiopian Standard ➢ industry/sector specific guides, such as Relevant Ethiopian Standard Guide on 'Quantifying Uncertainty in Analytical Measurement' • laboratory calibration software and programs, manufacturer's proprietary software • Material Safety Data Sheets (MSDSs)) • enterprise recording and reporting procedures, Standard Operating Procedures (SOPs) • quality manuals, equipment and operating/technical manuals • test methods and calibration procedures (validated and authorized) • test methods and calibration procedures published by: international, national or regional standards, reputable technical organizations, scientific texts or journals, equipment manufacturers • incident and accident/injury reports • Schematics, workflows, laboratory layouts, production and laboratory schedules.
Communication	May involve: • supervisors and managers (laboratory, quality and customer service) • peers and other laboratory or relevant technical personnel • clients and end users of equipment • external auditors, or accreditation agency (for example, NATA) • equipment manufacturers and suppliers of spare parts.
Hazards	may include: • electric shock • disturbance or interruption of services • manual handling of heavy equipment boxes • sources of electromagnetic radiation (lasers, RF generators/transmitters) • fluids under pressure • heat sources, such as ovens.
Safety procedures	may include: • use of personal protective equipment, such as hearing protection, gloves, safety • glasses, coveralls

	• ensuring access to service shut off points • handling and storing hazardous materials and equipment in accordance with labels, • MSDS, manufacturer's instructions, enterprise procedures and regulations • regular cleaning of equipment and work areas.
Editing or creating automated procedures	may involve using, testing and or calibrating the following: • common test equipment, such as: anemometers, balances, barometers, calipers, environmental chambers, hygrometers, manometers, masses, micrometers, pressure equipment, spectrophotometers, tape measures, rules, temperature (digital) indicating • systems, thermometers, thermocouples, timing devices, vibration analysis equipment, • weighing instruments • electrical reference standards, such as: air-lines, analogue meters, attenuators, bridges manual • balance, capacitors, DC voltage references, digital instruments (calibrators, • DMMs, electronic transfer standards), inductors, instrument and ratio transformers, • instrument transformer test sets, potentiometers, resistors, RF power meters, RF thermistor mounts and thermal converters, shunts, time interval and frequency standards, • transfer standards AC-DC, voltage dividers, volt ratio boxes, watt-hour references working standards, instruments and testing equipment, such as: • EMC test equipment, • field strength meters, flammability test equipment, gauges/test fingers/test pins testers, impact hammers, impulse testers, instrument calibrators, network analyzers, signal generators, spectrum and harmonic analyzers.
Working environment	will have a controlled environment but could be a: • purpose-built designed facility • mobile facility in the field.

Evidence Guide	
Critical aspects of Competence	Must demonstrate knowledge and skills competence to: • Assess the suitability of available automated procedures • Create or edit automated procedure • Configure instruments /equipment • Refine the automated procedure • Verify automated procedure is fit for purpose • Document and review automated procedure
Underpinning Knowledge and Attitudes	Demonstrate knowledge of: • requirements for the competence of testing and calibration laboratories (for example, • ISO/IEC 17025) as they affect job role and responsibilities

	• limits of authority and procedures for creating or modifying automated calibration Procedures • structure and terminology used in standard calibration methods, procedures, requests and instructions • current automated calibration methods, procedures and technology applications used in laboratory • computer operation/automation using graphical user interfaces • equipment specifications and limitations and the implications of equipment substitution • equipment and testing method troubleshooting procedures • the hierarchy and appropriate selection of reference materials • handling, transport, storage and operation of reference and working standards • laboratory environmental control requirements • calculation procedures to give results in appropriate accuracy, precision and units • methods for statistical analysis (means, ranges, standard deviations) and estimation • of uncertainty of measurement (may include the use of soft ware) • enterprise procedures and legislative requirements for documenting calibration procedures • enterprise and/or legal traceability requirements • relevant health, safety and environmental requirements. • layout of the enterprise, divisions and laboratory • organizational structure of the enterprise • lines of communication • role of laboratory services for the enterprise and customers
Underpinning Skills	Demonstrate skills to: • assesses the suitability of software controlled calibration procedures • researches current, alternative calibration methods and equipment for a given request • develops or modifies calibration procedures to automate as many processes as possible • writes efficient calibration procedures using an unambiguous, logical sequence of • instructions that meet statutory and regulatory requirements • writes/edits efficient software programs for a range of calibration applications and • assesses their integrity under test • applies specialized technical knowledge to critically analyze and resolve complex • problems associated with measurement non-conformances where solutions are not • obvious or readily available

	• explains automated calibration procedures to clients and clarifies their requirements • conducts reliable calibration/testing trials to ensure a high degree of reproducibility • liaises with peers and technical staff from other laboratories to clarify and validate • automated procedures • estimates measurement uncertainty and applies statistical techniques for analyzing test and/or calibration data • critically examines each calibration step to ensure repeatability and validity of data • prepares all test documentation accurately, concisely and in accordance with requirements • recognizes opportunities for improvements to procedures.
Resources Implication	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview / Written Test • Observation / Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Physicochemical Laboratory Operation Level V	
Unit Title	**Provide Information to Customers**
Unit Code	**MIN PCL5 04 0114**
Unit Descriptor	This unit of competency covers the ability to respond to both internal and external inquiries of a specialized technical nature.

Elements	Performance Criteria
1. Assess the request for information and/or advice	1.1 The ***information source***, nature and priority of the request are clarified and confirmed. 1.2 The request is redirected to the relevant section, department or person if appropriate. 1.3 The receipt of the request is recorded in accordance with enterprise procedures.
2. Prepare response	2.1 Required information is located and obtained if available. 2.2 If not available, decide whether to obtain or generate the required information given the priority and costs involved. 2.3 Required approval/authority is sought to release information before proceeding.
3. Provide information and/or advice	3.1 Ensure that information is made accurate, relevant and complied with enterprise/statutory requirements. 3.2 The customer informed of progress is kept when it is not possible to answer immediately. 3.3 Other relevant personnel of request and response are notified in accordance with enterprise procedures. 3.4 Most appropriate communication method is used with the given priority, cost and customer facilities. 3.5 Information is provided in a format suitable to customer. 3.6 The response is checked to meet the customer's needs and appropriate actions are taken if required. 3.7 Customers are dealt with politely, efficiently and appropriately, and in accordance with enterprise procedures.
4. Record details of the request and response	4.1 All information details are recorded accurately in accordance with enterprise procedures. 4.2 Ensure that all written information is made accurate and/or legible. 4.3 All records are filed in the designated place and in accordance with enterprise procedures.

Variable	Range
Information sources	Involve the following: • information directories (organizational structure, telephone),

	online database and CD ROMS • personnel, such as: scientists; technical experts; quality managers; laboratory and production personnel and customer service • workplace documents, such as: ➢ equipment manuals ➢ laboratory record ➢ certified laboratory reports ➢ analysis report sheets (past and present) ➢ organizational charts ➢ Standard Operating Procedures (SOPs) • enterprise procedures governing, for example: ➢ receipt of requests ➢ release of information and results, confidentiality needs of clients and customers ➢ sample collection protocols and techniques for preserving sample integrity ➢ filing systems, databases, laboratory records. • Information may be provided to: ➢ internal and external customers ➢ members of the public ➢ authorities, including regulatory authorities ➢ other enterprises, municipalities ➢ Engineers, scientists, other specialist staff. • It may be necessary to provide appropriate information regarding: ➢ a local situation ➢ a person with a disability ➢ a person from a particular cultural group ➢ material classification and characteristics ➢ technical and/or manufacturing knowledge of procedures ➢ analysis and/or test results and their interpretation where authority permits ➢ risk assessment, monitoring and minimization ➢ cost, quantity, time estimation ➢ contractual variations and claims ➢ site assessment and problems ➢ data analysis, statistical interpretation.

Evidence Guide	
Critical aspects of Competence	Must demonstrate knowledge and skills competence to: • correctly prioritizes requests for information • locates and synthesizes the required information using appropriate sources • locates and synthesizes the required information using appropriate sources • provides authorized information that is accurate, relevant, and in the required format • uses technical terminology appropriate to customer and

	avoids jargon • communicates in an efficient and polite manner, taking into account cultural diversity and disabilities • maintains security and confidentiality of information as required by enterprise procedures • records and files records of the request and information provided as required by enterprise procedures.
Underpinning Knowledge and Attitudes	Demonstrate knowledge of: • an awareness of the laboratory's business goals and key performance indicators is required as a basis for dealing with customers.
Underpinning Skills	Demonstrate skills to: • enterprise procedures relating to: ➢ customer service for internal and internal customers with cognizance of cultural and social contexts ➢ communication protocols ➢ OHS and environmental regulations • customer information about enterprise products and services • technical details of methods, data and sample collection and the key features of laboratory results. • relevant health, safety and environment requirements.
Resources Implication	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview / Written Test • Observation / Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Physicochemical Laboratory Operation Level V	
Unit Title	**Analyse Data and Report Results**
Unit Code	**MIN PCL5 05 0114**
Unit Descriptor	This unit of competency covers the ability to perform scientific calculations, analyses trends and uncertainty in data and report results within the required timeframe.

Elements	Performance Criteria
1. Perform scientific calculations	1.1 Raw ***data*** are ensured to be consistent with expectations and reasonable ranges. 1.2 Scientific quantities involving algebraic, logarithmic, exponential, and power functions are calculated. 1.3 Calculated quantities are ensured to be consistent with estimations. 1.4 Results are presented using the appropriate units, uncertainties and number of significant figures.
2. Analyze trends and relationships in data	2.1 Linear and non-linear relationships between sets of data are determined. 2.2 Control charts are prepared and analyzed to determine if a process is in control. 2.3 Possible causes are identified for out-of-control condition. 2.4 Enterprise procedures are followed to return process to in control operation.
3. Determine variation and/or uncertainty in data distributions	3.1 Raw data is organized into appropriate frequency distributions. 3.2 Means, medians, modes, ranges and standard deviations are ***calculated*** for ungrouped and grouped data. 3.3 Frequency distributions are interpreted to determine the characteristics of the sample or population. 3.4 Standard deviations and confidence limits are calculated for means and replicates. 3.5 The uncertainty in measurements is determined using ***statistical analysis***. 3.6 Data acceptability is determined using statistical tests and enterprise procedures.
4. Check for aberrant results	4.1 Results that cannot be reconciled with sample, sample documentation, testing procedures and/or expected outcomes are identified. 4.2 Appropriate actions are determined in consultation with supervisor as required.

5. Report results	5.1 Charts, tables and ***graphs*** are used to present results in the required format. 5.2 Entry of data and results is verified to be correct. 5.3 Reports are prepared in a format and style consistent with their intended use and enterprise guidelines. 5.4 Results are communicated within the specified time and in accordance with enterprise confidentiality and security guidelines.

Variable	**Range**
Data	includes the results of: • tests, • measurements, • analyses and surveys.
Calculations	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, Ka, pKa, Kb, pKb, Kw • solubility constants Ks, pKs • 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 • 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, Stewart 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 • Relevant Ethiopian Standards, NATA technical notes and National Measurement Act.

Evidence Guide	
Critical aspects of Competence	Must demonstrate knowledge and skills competence to: • Perform scientific calculations • Analyze trends and relationships in data • Determine variation and/or uncertainty in data distributions • Check for aberrant results • Report results
Underpinning Knowledge and Attitudes	Demonstrate knowledge of: • 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. • 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.
Underpinning Skills	Demonstrate skills to: • store, retrieve and manipulate data following document traceability procedures • calculate scientific quantities relevant to their work and present accurate results in • the required format • analyses 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.
Resources Implication	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview / Written Test • Observation / Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Physicochemical Laboratory Operation Level V	
Unit Title	**Use Laboratory Application Software**
Unit Code	**MIN PCL5 06 0114**
Unit Descriptor	This unit of competency covers the ability to use and apply computer application software in the laboratory, field and production plants for analysis and reporting.

Elements	Performance Criteria
1. Access application software	1.1 Software required for the task is identified. 1.2 Software is opened from a personal computer or network. 1.3 Terminal is used to get ***information source***.
2. Use software for specified purposes	2.1 A range of scientific data is input into a computing system. 2.2 Searches are conducted for the retrieval of required data. 2.3 Application features are used for efficient computation. 2.4 Data sets and databases are constructed for numerical and graphical analyses.
3. Produce reports of retrieved data and/or processed data	3.1 Data is analyzed using features of the ***software package***. 3.2 Options are selected for constructing data reports. 3.3 The results of data analyses are printed using features of the software package. 3.4 Data is integrated from diverse application software units in a report. 3.5 Reports of the rationale and history of a computerized database search are prepared where appropriate. 3.6 Computerised data sources are referenced according to the style requirements of the enterprise.
4. Perform simple record housekeeping	4.1 Backup of worked data is maintained. 4.2 Archive data is maintained according to enterprise standard procedures. 4.3 Hard copy data is maintained according to standard enterprise operating procedures. 4.4 Approved antivirus software and general standard quarantine procedures are applied.

Variable	Range
Information sources	could include: • manuals of enterprise standard instructions • hardware manuals • software manuals • training materials to orient software to enterprise needs

	• on screen instructions embedded in the software.
Software packages	could include: • Word processing, • spreadsheets, • databases, • graphical and statistical analysis and • Laboratory information systems.

Evidence Guide	
Critical aspects of Competence	Must demonstrate knowledge and skills competence to: • Access application software • Use software for specified purposes • Produce reports of retrieved data and/or processed data • Perform simple record housekeeping
Underpinning Knowledge and Attitudes	Demonstrate knowledge of: • the applications of the software package • the terminology associated with the software packages • the relationship between the package instructions and the data manipulation performed • types of database models that are available • the relationship between the protocol for data input and file storage of the data • general file and record maintenance • relevant health, safety and environment requirements.
Underpinning Skills	Demonstrate skills to: • selects the most appropriate software package for the task from the suite of software • applications available • uses routine instruction sets of the software package to complete the task • uses software to analyze data, such as quality control and instrument performance • characteristics • backs up electronic storage • uses scanning software to protect in house software and data.
Resources Implication	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview / Written Test • Observation / Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Physicochemical Laboratory Operation Level V	
Unit Title	**Assist in the Maintenance of Reference Materials**
Unit Code	**MIN PCL5 07 0114**
Unit Descriptor	This unit of competency covers the ability to assist in the maintenance of reference materials that can be used in the identification of new specimens and allow for the quality control of laboratory procedures.

Elements	Performance Criteria
1. Acquire reference materials	2.1 Required transit conditions are confirmed were maintained. 2.2 Quarantine or isolation arrangements are applied as necessary. 2.3 Data of accessioned ***reference material*** is recorded in the collection data base. 2.4 Material is labeled to ensure that its identity is maintained during storage and issue.
2. Maintain reference materials	2.1 Storage conditions are monitored to ensure that they comply with suppliers' warranty specifications. 2.2 Storage conditions are monitored to ensure materials remain true to specification. 2.3 Material is tested during storage, where relevant and appropriate, to report on reference characteristics and specificity. 2.4 Findings that suggest reference specimens may be deteriorating are reported.
3. Dispense reference materials to clients	3.1 Requests are verified with supervisor before requests for reference materials used as ***information source*** processed. 3.2 Reference material is supplied without contamination of stock material. 3.3 Records of materials issued are kept in accordance with enterprise procedures.
4. Maintain a safe work environment	4.1 Established safe work practices and persona protective ***equipment*** are used to ensure personal safety and that of other laboratory personnel. 4.2 Safety protocols are followed when handling and processing reference materials. 4.3 The generation of wastes and environmental impacts is minimized. 4.4 The safe collection of redundant/outdated stocks is ensured for subsequent disposal.

Variable	Range
Reference materials	could include: • Standard solutions • aggregates, grains and powders • materials used for checking equipment calibrations.
Information sources	could include: • enterprise procedures, Standard Operating Procedures (SOPs) and operating manuals • test procedures (validated and authorized) • sampling procedures (labeling, preparation, storage, transport and disposal) • safety requirements for equipment, materials or products • cleaning, hygiene and personal hygiene requirements • quality system and continued improvement processes • incident and accident/injury reports • schematics, work flows and laboratory layouts • instructions to comply with new legislation, standards, guidelines and codes • waste minimization and disposal procedures.
Equipment, materials and systems	could include: • centrifuges, water baths, incubators • lyophilizes and humidifiers • equipment and material for transport (such as dry ice or ice packs) • equipment and material for storage (such as liquid nitrogen) • storage boxes • storage and display cabinets • computer information systems, databases, record and filing systems • laboratory glassware and measuring equipment
Communication	may include with: • supervisors and managers (laboratory, quality and customer service) • other laboratory or clinical personnel • outside suppliers, internal and external customers.
Hazards	may include: • chemicals, reagents • micro-organisms associated with soil, air, water, blood and blood products, human or animal tissue and fluids • sharps, such as broken glassware • disturbance or interruption of services • manual handling of heavy boxes.
Safety procedures	may include: • use of personal protective equipment, such as hearing protection, gloves, safety glasses, coveralls • ensuring access to service shut off points • handling and storing hazardous materials and equipment in

	accordance with labels, • MSDS, manufacturer's instructions, enterprise procedures and regulations • regular cleaning of equipment and work areas.

Evidence Guide	
Critical aspects of Competence	Must demonstrate knowledge and skills competence to: • Acquire reference materials • Maintain reference materials • Dispense reference materials to clients • Maintain a safe work environment
Underpinning Knowledge and Attitudes	Demonstrate knowledge of: • certified reference materials — what they are, when and why they should be used • the storage requirements of biological and non-biological materials • quarantine or isolation procedures • the labile nature of chemical and biological materials • the rationale for testing reference characteristics before issuing reference materials • reasons for testing before accession of reference materials • relevant health, safety and environment requirements.
Underpinning Skills	Demonstrate skills to: • maintains material identity during storage • performs all manipulations safely • tests stored material for reference characteristics before release • reconstitutes completely lyophilized materials (if required) • prepares materials for freeze-drying (if required) • communicates appropriately with all customers.
Resources Implication	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview / Written Test • Observation / Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Physicochemical Laboratory Operation Level V	
Unit Title	**Maintain Instruments and Equipment**
Unit Code	**MIN PCL5 08 0114**
Unit Descriptor	This unit of competency covers the ability to check the serviceability and calibration of laboratory/field instruments and equipment and perform routine maintenance, such as cleaning and replacement of consumables and minor components. Personnel are also required to perform basic troubleshooting and repairs consistent with warranty and service agreements.

Elements	Performance Criteria
1. Perform serviceability checks	1.1 Pre/after use checks are performed in accordance with appropriate enterprise and manufacturer's ***standard procedures***. 1.2 Faulty or unsafe components and equipment are identified. 1.3 Basic faults are troubleshot or the need for major maintenance and/or repairs is reported. 1.4 Instrument/equipment logbooks are completed to enterprise requirements.
2. Conduct routine maintenance safely	2.1 Maintenance procedures, records and safety requirements are identified. 2.2 Maintenance schedules are planed/adjusted in accordance with operational requirements. 2.3 Damaged/worn/spent components or items are identified and replaced or repaired. 2.4 Equipment and instruments are cleaned using recommended cleaning agents and techniques. 2.5 ***Equipment and instruments*** are stored in accordance with enterprise/manufacturer's requirements. 2.6 Maintenance records are updated in accordance with enterprise procedures. 2.7 Arrange for reordering of consumable stocks and equipment components as necessary.
3. Perform calibration/qualification checks	3.1 Equipment/instrument is operated in accordance with enterprise/manufacturer's procedures. 3.2 ***Calibration/qualification*** is checked using specified standards and/or procedures. 3.3 All calibration/qualification data are recorded accurately and legibly. 3.4 Calibration status and report out-of calibration equipment/instruments are documented. 3.5 Out-of-calibration items are quarantined.

4. Arrange instrument servicing where appropriate	4.1 Instrument repair status are assessed, and determined if local repair/maintenance is possible and economical. 4.2 ***Basic repair***/maintenance of equipment is contacted and arranged from accredited service agent or other appropriate personnel in accordance with enterprise procedures.
5. Maintain a safe work environment	5.1 Established safe work practices and personal protective equipment are used to ensure personal safety and that of other laboratory personnel. 5.2 The generation of wastes and environmental has minimized impacts and ***hazards***. 5.3 Unwanted components or laboratory waste are disposed of using enterprise procedures.

Variable	**Range**
Standards and procedures	include or have been prepared from: • relevant Ethiopian and international standards ➢ ISO/IEC 17025 General requirements for the competence of testing and calibration laboratories ➢ relevant Ethiopian standard Safety in laboratories Chemical aspects ➢ relevant Ethiopian Safety in laboratories — Mechanical aspects ➢ relevant Ethiopian Safety in laboratories — Storage of chemicals ➢ relevant Ethiopian Good laboratory practice • Codes of Practice • material safety data sheets • standard operating procedures • equipment manuals • equipment startup, operation and shutdown procedures • calibration and maintenance schedules • quality manuals • enterprise recording and reporting procedures • production and laboratory schedules • material, production and product specifications. • use of personal protective equipment, such as hearing protection, gloves, safety glasses, • coveralls, safety boots • ensuring access to service shut off points • handling and storing hazardous materials and equipment in accordance with labels, • MSDS, manufacturer's instructions, enterprise procedures and regulations • following appropriate manual handling procedures • regular cleaning of equipment and work areas • machinery guards

Equipment and instruments	may include, but are not limited to: • balances • density bottles, pipettes, burettes and volumetric glassware • thermometers, melting point apparatus, water baths, incubators • optical microscopes, refractometers, polarimeters • conductivity meters, pH meters • ion selective electrodes • autoclaves • mixing and separating equipment, such as centrifuges, rifflers and splitters, mixers • noise meters and blast meters • pressure gauges, torque testers, load cells, strain guages, tensiometers • disintegration apparatus, penetrometers, hardness testing equipment, viscometers, soil • compaction and classification equipment • colorimeters, spectrometers • electrochemical equipment • cell analysers and cell counters • motors, pumps, generators.
Calibration status/qualification checks	might include, but are not limited to: • matching cells (for dual beam instruments) • checks for mono chromator wavelength and photometric accuracy • checks for baseline flatness, stray light • checks on electrode performance • checking sensitivity • injection/use of standard mixtures • comparison with manufacturer's specifications/chromatogram • use of standard masses and solutions • use of calibrated thermometers and glassware to assess instrument/component performance.
Basic repairs	may include: • replacement of fuses and reagents, consumables • cleaning and/or replacement of cells, torches, burners • connecting gas supplies • maintaining syringes/injection equipment • cleaning detectors • appropriate storage of columns and other equipment not currently in use • changing detectors (for photometers) • optimising nebulisers • replacement of lamps • realignment of components • replacement of hoses, belts • replacement or top up of oils, lubricants or coolants

	• basic electrical checks involving simple digital multimeters.
Hazards	may include: • electric shock • chemicals, such as acids, cleaning agents • fluids under pressure, such as steam, industrial gases • sharps, such as broken glassware • sources of heat, such as burners, ovens and furnaces • manual handling of heavy equipment • crushing, entanglement and cuts associated with moving machinery.

Evidence Guide	
Critical aspects of Competence	Must demonstrate knowledge and skills competence to: • Perform serviceability checks • Conduct routine maintenance safely • Perform calibration/qualification checks • Arrange instrument servicing where appropriate • Maintain a safe work environment
Underpinning Knowledge and Attitudes	Demonstrate knowledge of: • operating principles for equipment/instruments used in routine work • common sources of equipment/instrument faults and their repair • common errors associated with equipment use • role and importance of regular calibration checks • equipment maintenance schedules and procedures • OHS hazards and control measures • enterprise communication and reporting procedures.
Underpinning Skills	Demonstrate skills to: • perform routine maintenance safely • determine whether an item of equipment/instrument is in correct working order • locate and rectify basic faults • recognise the need for specialist servicing and/or repairs • conduct calibration status/qualification checks • obtain instrument/equipment readings with the required accuracy and precision • follow all relevant OHS requirements • follow enterprise recording and reporting procedures.
Resources Implication	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview / Written Test • Observation / Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Physicochemical Laboratory Operation Level V	
Unit Title	**Schedule Laboratory Work for a Small Team**
Unit Code	**MIN PCL5 09 0114**
Unit Descriptor	This unit of competency covers the ability to schedule laboratory work for a small team to meet operational requirements. It covers the ability to identify resource requirements and then document, monitor and adjust schedules in response to operational variations and in consultation with relevant personnel.

Elements	Performance Criteria
1. Determine work requirements and laboratory resources	1.1 Demand for ***laboratory services*** in work area is determined and prioritized for the planning period. 1.2 Information on orders/service requests, stocks and delivery is accessed and verified. 1.3 The personnel, material and equipment required to deliver services are determined.
2. Develop schedules in consultation with relevant personnel	2.1 Schedules which meet the demand for services are prepared and the best use of available resources balanced with skill development opportunities. 2.2 Work schedules are distributed to team or appropriate personnel and confirm contents with them.
3. Monitor schedules	2.1 Workflow and outputs are monitored against schedules and any variation(s) or potential disruptions recognized. 2.2 Possible causes are identified for the variation(s) and possible adjustments discussed with senior personnel.
4. Adjust schedules in consultation with senior personnel	4.1 ***Schedules for small team*** are adjusted in response to operational variation. 4.2 Outputs are maintained or renegotiated in accordance with work requirements. 4.3 Documented schedules are updated and distributed to appropriate personnel.

Variable	Range
Laboratory work	could include: • setup, pre-use and calibration checks of equipment • preparation and standardization of solutions • maintenance of laboratory facilities, equipment and stocks • collection, preparation, storage/dispatch of samples • testing and analysis of raw materials, products and specimens • preparation of products (for example, sterile media) and

	product batches • trial and modification of methods.
Scheduling for a small team	could include: • identification of resources to maintain work flow including: ➢ interpreting production data ➢ analyzing job tasks ➢ prioritizing tasks within a work schedule ➢ determining appropriate human resources in terms of skills and numbers ➢ determining material and equipment requirements ➢ monitoring information regarding orders, stocks and deliveries • monitoring of work outputs • adjustment of work schedules as agreed with senior personnel to accommodate • unexpected events, such as: ➢ processing abnormal and urgent results ➢ delays in arrival of samples ➢ seasonal variations, bad weather ➢ analyzing and solving operational problems resulting in unacceptable test results ➢ unexpected events, such as equipment failure and sudden personnel absences • communication with senior personnel including: ➢ determining and organizing work priorities and schedules ➢ analyzing and solving problems affecting work schedules ➢ adjusting work schedules as necessary ➢ identifying possible problems for following shift • appropriate communication with team members in relation to: ➢ explaining work schedules, priorities and sequences ➢ distributing work schedules ➢ maintaining required output • documentation of outputs and resource usage ➢ quality and quantity of outputs ➢ supplies of stock materials ➢ maintenance and servicing of equipment.

Evidence Guide	
Critical aspects of Competence	Must demonstrate knowledge and skills competence to: • Determine work requirements and laboratory resources • Develop schedules in consultation with relevant personnel • Monitor schedules • Adjust schedules in consultation with senior personnel
Underpinning Knowledge and Attitudes	Demonstrate knowledge of: • basic planning strategies • accurate scientific and technical terminology • scientific and technical details underpinning the processes or techniques involved

	• enterprise Standard Operating Procedures (SOPs) for the processes or techniques involved • production schedules, analysis times for product range • operational factors that may affect the type of tasks scheduled • resource requirements of the work to be scheduled • hazards of operations, equipment and materials involved • enterprise procedures relating to OHS, access and equity, relevant sections of industrial • awards and enterprise agreements • quality requirements for the tasks scheduled • relevant health, safety and environment requirements.
Underpinning Skills	Demonstrate skills to: • determines required resources accurately • plans schedules that are efficient and satisfy operational requirements without • compromising safety, quality, accuracy and ethics • adheres to timelines whenever possible • recognizes non-standard behavior in samples and equipment • recognizes potential disruptions to planned timetable • compensates for a variety of work environments (for example, outdoors or night work) • adjusts schedules and resource requirements efficiently in response to variations • communicates and documents schedule variations in accordance with procedures • recognizes and uses capabilities of team members • communicates effectively with team members and appropriate to cultural and social contexts.
Resources Implication	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview / Written Test • Observation / Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Physicochemical Laboratory Operation Level V	
Unit Title	**Monitor the Quality of Test Results and Data**
Unit Code	**MIN PCL5 10 0114**
Unit Descriptor	This unit of competency covers the ability to analyse a series of test results and data to detect potential or actual non-conformances, assess their significance and recommend preventative or corrective actions.

Elements	Performance Criteria
1. Verify accuracy of data and technical records	1.1 All relevant data files and technical records for the specified time interval, tests or product range or project are retrieved and collated. 1.2 Data records are inspected to check the integrity of data entry, alterations, transfers and calculations. 1.3 Technical records are confirmed to contain sufficient information that provides an audit trail for the tests involved.
2. Assess the quality of data/results	2.1 ***Charts and tables*** are used to determine whether data/results are within specified limits. 2.2 Data trends and results for blanks, duplicates are analyzed and/or samples checked to detect systematic uncertainties. 2.3 Statistical tests and enterprise ***standard procedures*** are used to check data acceptability. 2.4 Estimations of uncertainties are checked to be reasonable and consistent with test method, client or product specification requirements. 2.5 Results that cannot be reconciled with ***technical records*** and/or expected outcomes are identified.
3. Identify potential causes for unacceptable results	3.1 User checks and ***calibration performance*** records are reviewed to confirm that equipment/ instrument meets test specifications. 3.2 Obvious ***sources of interferences*** that may have occurred during measurements are checked. 3.3 Technical records are reviewed to identify ***human or environmental facto***rs that could affect reliability of results. 3.4 Records of sample collection and preparation are reviewed to confirm chain of custody requirements and adherence to sampling procedures. 3.5 Any documented deviations are checked from sampling procedures and/or methods tested technically justified and authorized. 3.6 The condition of sampling equipment and/or stored samples is checked if available/appropriate.

4. Report findings to relevant personnel	4.1 The quality of test results and data is summarized. 4.2 Potential sources or instances of nonconforming work are documented and their significance is assessed. 4.3 Appropriate ***preventative/corrective actions*** are recommended to improve sampling, testing and/or calibration activities. 4.4 Reports are prepared in a format and style consistent with their intended use and enterprise guidelines.

Variable	Range
Charts, tables and statistical tests	could include: • run charts, control charts • 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.
Standards and procedures	include or may have been prepared from: • Relevant Ethiopia and international standards, such as: ➢ ISO/IEC 17025 General requirements for the competence of testing and calibration laboratories ➢ ISO 5725–11, 6 Accuracy (trueness and precision) of measurement methods and results ➢ ISO 9000–1 Quality management and quality assurance standards ➢ ISO 9004–1 Quality management and quality system elements ➢ ISO 9004–4 Quality management and quality system elements or quality improvement ➢ ISO 10012 Quality assurance requirements measurement equipment ➢ guide to the expression of uncertainty in measurement, issued by • Codes of Practice • Material Safety Data Sheets (MSDSs)) • Standard Operating Procedures (SOPs) and published preparation methods • quality manuals, equipment and procedures manuals • equipment startup, operation and shutdown • enterprise recording and reporting procedures • Production and laboratory schedules.
Technical records	may include: • request forms, service agreements, contracts • worksheets, work books, check sheets, work notes

	• original observations, derived data, calculations • control graphs • external, internal test reports and calibration certificates • clients notes, papers and feedback • listing of data and the personnel responsible for sampling, performance of each test/calibration, checking of results.
Instrument calibration/performance records	may include: • checks that equipment/instrument complies with specifications • dates, results and copies of reports and certificates of calibrations, adjustments, acceptance • criteria and due date of next calibration • maintenance plan, maintenance carried out to date • damage, malfunction, modification or repairs.
Sources of interferences	could include: • spectral interference (for example, in ICP) • physical interference (for example, in AAS) • matrix effects • presence of contaminants • masking of analytes.
Human and environmental factors	could include: • lack of operator competence and/or training • inadequate attention to detail, fatigue, stress • inadequate hygiene, sterility • unacceptable dust, humidity, temperature, illumination levels • electromagnetic disturbances • variations to gas, electricity and water supply • unacceptable sound and vibration levels.
Preventative/corrective actions	could include: • regular use of certified reference materials • internal quality controls using secondary reference materials • participation in interlaboratory comparison or proficiency testing programs • replicate tests or calibrations using the same or different methods • retesting or recalibration of retained items • correlation of results for different characteristics of an item • additional audits, management reviews • regular quality checks on consumables • enhanced staff observation, supervision and/or training • more detailed sample specifications, test methods and procedures • feedback from clients on improving quality system, testing and calibration activities.
Sample preparation problems	could result from: • incomplete preparation • segregation • sample disturbance

	• incorrect sample containers • incorrect sample handling (filtered/non filtered, temperature control, preservation) • incorrect particle size • incorrect matrix • incomplete digest.

Evidence Guide	
Critical aspects of Competence	Must demonstrate knowledge and skills competence to: • Verify accuracy of data and technical records • Assess the quality of data/results • Identify potential causes for unacceptable results • Report findings to relevant personnel
Underpinning Knowledge and Attitudes	Demonstrate knowledge of: • characteristic properties of the materials in question • specifications for samples, tests and/or calibration activities under investigation • scientific and technical knowledge of the procedures, equipment, materials and • instrumentation used to generate the test results and data • methods for statistical analysis of data (means, ranges, standard deviations, confidence • limits, data acceptability) and sampling procedures • problem solving techniques, cause analysis • enterprise and/or legal traceability requirements • relevant health, safety and environment requirements.
Underpinning Skills	Demonstrate skills to: • verifies the accuracy and completeness of data, results and technical records • recognises significant trends in data and/or aberrant results • uses statistical tests to estimate uncertainties and determine data acceptability • analyses sampling, sample preparation testing and/or calibration activities to identify potential causes of unacceptable data/results • applies effective problem solving strategies • recommends appropriate preventative/corrective actions to control potential/actual on conforming work • follows enterprise procedures for documenting and reporting information about quality.
Resources Implication	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview / Written Test • Observation / Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Physicochemical Laboratory Operation Level V	
Unit Title	**Supervise Earthworks Inspection, Sampling and Testing Operations**
Unit Code	**MIN PCL5 11 0114**
Unit Descriptor	This unit of competence covers the ability to supervise and direct earthworks operations based on observation and testing. This competency is typically performed by experienced technicians or para-professionals, which often supervise or direct less experienced technical personnel.

Elements	Performance Criteria
1. Prepare for on-laboratory operations	1.1 The job is identified, consulted with the client and relevant information, including the level of supervision required, ***procedure*** and specifications are obtained. 1.2 Equipment and materials required for the job are selected. 1.3 ***Site hazards*** and the personal protective equipment and safety procedures specified for job are identified. 1.4 Site induction is organized for support personnel as required. 1.5 Description of the job to be undertaken is recorded, compared with specification and any variations are resolved. 1.6 Suitable transport is selected for site access. 1.7 Support personnel are briefed on job-specific requirements.
2. Establish on-site operations	2.1 Consultation is done with the site superintendent to determine methods of communication, roles, responsibilities and expectations of each party, including identification of potential problems and conflicts. 2.2 Facilities are set up for supervision, testing and sample storage. 2.3 The site is inspected to determine the characteristics of the project, including survey control points. 2.4 Inspection, sampling and testing program is designed in accordance with specifications as per the ***safety procedure***.
3. Supervise earthworks operations	3.1 Inspection, sampling and testing are conducted in accordance with project requirements. 3.2 The site superintendent is directed and advised based on test results and observations. 3.3 Test data and observations are recorded in accordance with enterprise practices. 3.4 Samples are remitted to the base laboratory for testing as required.

	3.5 Cleaning of equipment is ensured not to cause environmental damage. 3.6 The removal of equipment and materials is supervised from site.
4. Analyze project data and report to client	4.1 Project data is analyzed and reported to client. 4.2 Test results are reported to site superintendent at specified frequency.
5. Maintain enterprise Records	5.1 Observations, data and results are recorded in accordance with enterprise practices. 5.2 Security and confidentiality of enterprise information are maintained. 5.3 A final project report detailing supervision and testing carried out, statement of compliance and relevant tables and plans is prepared and issued as required.

Variable	Range
Procedures and requirements	include or have been prepared from: • industry Codes of Practice • environmental legislation and regulations • Standard Operating Procedures (SOPs) • equipment manuals • equipment start-up, operation and shutdown procedures • calibration and maintenance schedules • quality manuals • enterprise recording and reporting procedures • production and laboratory schedules • material, production and product specifications.
Site hazards	may include: • solar radiation, dust and noise • manual handling of heavy materials and equipment • working in/on trenches, confined spaces, wet and uneven surfaces, heights, slopes • vehicular and pedestrian traffic.
Safety procedures	may include: • location of site services before investigations commence • use of Material Safety Data Sheets (MSDSs)) • use of personal protective equipment, such as hard hat, hearing protection, sunscreen, • gloves, masks, goggles, coveralls, safety boots, high visibility clothing • handling, and storage of hazardous materials and equipment in accordance with labels, • MSDS, manufacturer's instructions, enterprise procedures and regulations • regular cleaning of equipment and vehicles

	• machinery guards • signage, barriers, flashing lights, traffic control.
Tools and equipment	may include: • hand and power augers • hand tools, including shovels, crowbars, scoops, spanners, wrenches, tape measure • consumables, including sample bags, labels • documentation, including maps, plans, contract documents, worksheets • field test equipment, including sand replacement apparatus, nuclear soil moisture/density • gauge, dynamic cone penetrometer • still/video camera • two-way radio, mobile telephone • leveling equipment (dumpy, automatic levels).
Typical skills	may include: • working safely with equipment and around earthmoving plant • driving safely on- and off-road • working safely in field conditions • setting up and maintaining tools and equipment • using tools and equipment to perform sampling and in-situ testing • cleaning equipment before leaving site in compliance with environmental authority requirements • reading site plans, specifications and codes to determine sampling locations and frequencies • measuring and estimating elevations, lengths, areas and volumes • identifying of soil and rock materials • observing and recording project information • handling and storing samples appropriately • comparing test results with specifications • resolving problems without creating confrontational environments • using computer software to create/maintain databases and produce detailed reports.
Typical problems	include: • uncooperative site personnel • non-conformances leading to confrontation with other personnel • delays in obtaining test results • damage to services, materials and site conditions • displaced, missing and inaccurate survey markers • misidentification of samples and sampling locations • equipment breakdown and breakage • environmental problems and issues, including site access, inclement weather, traffic, wildlife, vegetation, construction

	activities.

Evidence Guide	
Critical aspects of Competence	Must demonstrate knowledge and skills competence to: • Prepare for on-site operations • Establish on-site operations • Supervise earthworks operations • Analyze project data and report to client • Maintain enterprise Records
Underpinning Knowledge and Attitudes	Demonstrate knowledge of: • engineering properties of soil and rock materials • techniques used in civil construction • plant and equipment used in earthworks • in-situ and laboratory test methods and their application to various materials • roles and responsibilities for different levels of supervision • relevant health, safety and environment requirements.
Underpinning Skills	Demonstrate skills to: • reads and interprets maps, drawings, specifications and Codes of Practice • identifies and locates sampling and testing sites • measures and estimates elevations, lengths, areas and volumes • determines sampling and testing frequencies • takes representative samples • identifies and describes materials • records project details in writing, by sketching and photography • handles and transports samples correctly • records sampling and testing information • compares test results with specifications and draws valid conclusions on compliance • uses tools and equipment effectively and efficiently • observes, interprets and reports atypical situations • communicates problems to appropriate personnel • records and communicates work results • works safely • resolves problems constructively.
Resources Implication	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview / Written Test • Observation / Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Physicochemical Laboratory Operation Level V	
Unit Title	**Perform Fire Assay Techniques**
Unit Code	**MIN PCL5 12 0114**
Unit Descriptor	This unit of competency covers the ability to safely extract a range of precious metals from their host matrices in readiness for analysis.

Elements	Performance Criteria
1. Classify ore samples and select fluxing method	1.1 ***Client request*** is reviewed to identify ***sample***/analysis requirements, preparation methods and ***assay equipment*** involved. 1.2 Sample(s) is/are inspected, compared with specifications; any discrepancies are recorded and reported. 1.3 Visual and simple chemical tests are conducted to identify the type of sample and sulphide concentrations as per the ***standard procedure***. 1.4 Client sample/analysis history is reviewed and possible chemical interferences are identified. 1.5 Whether non-standard fluxing is decided as required. 1.6 Sample weight and flux are selected to optimize precious metal recovery and purity.
2. Prepare for precious metal recovery	2.1 ***Hazards*** and enterprise controls associated with the sample, preparation methods, reagents and equipment are identified. 2.2 The recommended preparation method is examined to identify the critical steps that will affect the quality of analytical results. 2.3 Parallel work sequences are planned to optimize the throughput of multiple sets of samples. 2.4 All required equipments, materials and reagents are assembled and checked to fit for purpose.
3. Recover precious metal(s) from ore sample	3.1 Required amounts of sample and ***flux*** components are weighed to achieve an acceptable button and fluid slag. 3.2 The type and size of ***pot*** are selected to suit sample method and client requirements. 3.3 Charge is mixed to ensure homogeneity and optimal collection of precious metal. 3.4 Furnace temperature/time is set and monitored to ensure complete fusion. 3.5 Slag and ***button*** are separated with minimal loss of ***collector***. 3.6 Sequencing is maintained in order to track samples, buttons

	and prills throughout the recovery process. 3.7 ***Collector is separated*** from the required precious metal and checked for ***contamination***, losses and evidence of other precious metals. 3.8 Personal exposure to hazards and the release of collectors is minimized to the work environment. 3.9 Laboratory ***documentation*** and the prepared sample are collated and presented for analysis.
4. Troubleshoot and correct failed recovery	4.1 All stages of recovery are monitored for indicators of potential loss. 4.2 Undesirable recovery conditions are recognized and decided whether the process requires correction. 4.3 An appropriate corrective action is chosen and the process restarted. 4.4 Any adjustments made to standard methods and re-sequencing of samples are documented. 4.5 Advice is sought when problems are beyond scope of responsibility or knowledge.
5. Perform daily maintenance of assay equipment	5.1 ***Wastes*** are segregated and disposed of in accordance with enterprise requirements. 5.2 Pots are graded and inspected using established criteria prior to storage for re-use. 5.3 Furnaces are inspected for cracks, unserviceable components and slag is removed. 5.4 Extractive systems are inspected and cleaned. 5.5 Defective equipment and consumable requirements are reported to appropriate personnel.

Variable	**Range**
Client requests/documentation	may include: • client profile, sample identification, sample receipt, storage, analyses • required preparation method/and service charges.
Samples	may include: • solids, such as rocks, minerals, soils, sands, stream sediments • core and other drill samples (RAB, RC, air core) • slurries, powder concentrates, metallurgical solutions • dump samples, grab samples.
Assay equipment	could include: • ovens, furnaces, temperature sensors • compressed air service, extraction systems, fuel supply lines • pots, cupelles

	• pouring equipment, trolleys, moulds, tongs, hammers.
Standards and procedures	include or have been prepared from: • Relevant Ethiopian Standard and international standards, such as: ➢ Methods for the analysis of copper, lead, zinc, gold and silver ores ➢ Determination of gold (Fire Assay — Flame AAS method) • Material Safety Data Sheets (MSDSs)) • Standard Operating Procedures (SOPs) and published preparation methods • quality manuals, equipment and procedures manuals • enterprise recording and reporting procedures • production and laboratory schedules.
Hazards	may include: • dust, silica, slag, glass shards, molten flux • chemicals, such as hydrofluoric acid, bromine, perchloric acid, aquaregia, cyanide, • lead-based compounds, free-mercury, nickel compounds • noise, vibration • crushing, entanglement, cuts associated with moving machinery • manual handling of heavy loads, such as pots, racks, trolleys • heat, exhaustion, stress, fatigue.
Fluxes	may include: • bulk fluxes containing PbO, borax, soda ash, silica, silver nitrate, flour • non-standard flux additives, such as: ➢ flour (oxidising samples) ➢ nitre (reducing samples, sulphides) ➢ silica (basic ores) ➢ PbO (siliceous ores) • exotic additives, such as CaF2 (refractory ores) • NiS (NiCO3, sulphur, borax, soda ash).
Pots	may be: • ceramic, acidic/basic, alumina, zirconia, graphite.
Criteria for an ‘acceptable’ button	could include: • one piece, mass >20g • malleable • separates cleanly from slag • free of undecomposed ore, matte and speiss.
Collectors	may include: • Pb, NiS, Bi, Sn.
Separation of collectors	may involve: • cupellation • digestion • parting and annealing.

Contamination	could be caused by: • base metals — Cu, Ni • arsenic, sulphur, antimony, selenium, tellurium.
Documentation	could include: • pour sheets — date, time, client, pour number, preparation method • number of pots, positions of sample, blank, check in rack • analytical method • assay data.
Wastes	Include: • rejected pots, cupels, slag, disposable personal protective equipment.
Safety equipment and hazard control measures	may include: • ensuring assess to service shut off points • recognising and observing hazard warnings and safety signs • labeling of samples, reagents and hazardous materials • direct extraction, fume hoods • guards for moving machinery parts • noise insulation • using personal protective equipment, such as mask, heat resistant mittens, boots, goggles, • coats, ear muffs, safety boots, heat reflective clothing • following established manual handling procedures • regular cleaning of equipment and work areas using enterprise procedures • antidotes for specific hazards, such as hydrofluoric acid, cyanide • reporting of abnormal emissions, discharges and airborne contaminants, such as noise, • light, solids, liquids, water/waste water, gasses, smoke, vapour, fumes, odour and • particulars to appropriate personnel.
Sequencing of pots in a rack	could involve: • addition of coloured salts (for example, Cu) • position of reagent blanks, standards, check samples.
Indicators of potential loss and the corrective action	Include: • viscous slag — check furnace temperature, adjust flux • lead shotting — adjust flux to compensate for high oxides/sulphides, add Cr, adjust • fusion time • matte, speiss — adjust sample weight and/or flux • incomplete fusion — adjust fusion time, adjust sample weight and/or flux, roasting • unacceptable button — adjust sample weight and/or flux, scorification, roasting • contaminants — scorification, roasting • inquart — add Ag to prill and recupel.

Assay equipment	Includes: • the door, floor and vents of ovens; cupel furnaces, muffle liners, • mixing equipment, balances, hotplates and dispensers.

Evidence Guide	
Critical aspects of Competence	Must demonstrate knowledge and skills competence to: • Classify ore samples and select fluxing method • Prepare for precious metal recovery • Recover precious metal(s) from ore sample • Troubleshoot and correct failed recovery • Perform daily maintenance of assay equipment
Underpinning Knowledge and Attitudes	Demonstrate knowledge of: • chemical and physical principles relating to: ➢ fusion of mineral ores ➢ cupellation ➢ parting and digestion processes • expected physical and chemical properties of materials at each recovery stage • standard methods for the fire assay of a range of precious metal ores • hazards and effects of absorption of chemical reagents • control measures and operation of safety equipment • function and operation of assay/equipment. • enterprise and/or legal traceability requirements • relevant health, safety and environment requirements.
Underpinning Skills	Demonstrate skills to: • recognizes hazards and works safely at all times • interprets and follows standard recovery methods • maintains close attention to technical and safety requirements in a physically • demanding/hazardous environment • maintains sequential control of samples through all recovery stages • optimizes work flow to ensure efficiency of recovery for multiple client samples • identifies indicators of poor recovery • selects logical corrective actions to improve recovery rates • minimizes rework, waste and environmental impacts • disposes of all waste responsibly.
Resources Implication	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview / Written Test • Observation / Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Physicochemical Laboratory Operation Level V	
Unit Title	**Provide Input to Production Trials**
Unit Code	**MIN PCL5 13 0114**
Unit Descriptor	This unit of competency covers the ability to work closely with production personnel to conduct a routine trial to adjust formulations or develop products and processes following preliminary laboratory work.

Elements	Performance Criteria
1. Prepare for the trial	1.1 Trial objectives, ***specifications***, documentation and reporting requirements are clarified as per the ***standard and regulation***. 1.2 The environmental, health, safety, and /or food safety hazards associated with the trial and the recommended control procedures are identified. 1.3 The availability of ***resources*** and the need for any clearances, special safety and storage requirements are determined. 1.4 The recommended trial schedule is reviewed to identify potential barriers/constraints and alternatives are developed as necessary. 1.5 All laboratory requirements are communicated and confirmed with plant operators and personnel in related work areas and functions.
2. Participate in the trial	2.1 Trial details are reconfirmed with all relevant personnel. 2.2 Any last minute changes are identified and appropriate adjustments are delayed and made. 2.3 Liaise is done closely with production personnel to conduct the trial safely and efficiently. 2.4 Required product samples are collected for laboratory analysis and/or reference. 2.5 Critical process parameters are monitored and required data recorded. 2.6 Data is monitored to identify problems, significant process variations and/or unacceptable product. 2.7 Changes are recommended to production processes as required. 2.8 Plant in condition suitable for routine production is left to recommence.
3. Assess and report trial outcomes	3.1 Testing of product samples is arranged for, or conducted to check specifications. 3.2 Test results are analyzed and properties of product samples

	related to formulation details and processing methods. 3.3 'Out of specification' or unacceptable outcomes is/are identified and investigated, as required. 3.4 Possible modifications and/or opportunities are recommended for improvements within limits of role and responsibility. 3.5 Trial outcomes are documented and reported in accordance with enterprise procedures that of other personnel. 3.6 The generation of wastes and environmental impacts is minimized. 3.7 The safe collection of laboratory and hazardous waste is ensured for subsequent disposal. 3.8 Equipment and reagents are cared for and stored as required.
4. Maintain a safe work environment	4.1 Established safe work practices and personal protective equipment are used to ensure personal safety and that of other personnel. 4.2 The generation of wastes and environmental impacts is minimized. 4.3 The safe collection of laboratory and hazardous waste for subsequent disposal is ensured. 4.4 Equipment and reagents are cared for and stored as required.

Variable	Range
Trial specifications	may include: • product specifications • recipe/formulations • processing parameters • trial size, production target and timeline • trial schedule, resources required • required product samples and tests • analysis of relevant OHS, food safety and environmental hazards and controls • storage requirements. • Hazards could include: • electric shock • microbiological organisms and agents associated with soil, air, water • solar radiation, dust, noise • chemicals, such as acids, heavy metals, pesticides, hydrocarbons • aerosols from broken centrifuge tubes, pipetting • radiation, such as gamma, X-ray • sharps, broken glassware and hand tools • flammable liquids and gases • cryogenics, such as dry ice and liquid nitrogen

	• fluids under pressure, such as steam and industrial gases • sources of ignition • disturbance or interruption of services • manual handling, working at heights and in confined spaces • crushing, entanglement, cuts associated with moving machinery or falling objects • Pedestrian and vehicular traffic. • Safety procedures and hazard control measures may include: • ensuring access to service shut off points • recognizing and observing hazard warnings and safety signs • labeling of samples, reagents, aliquot samples and hazardous materials • handling and storage of hazardous materials and equipment in accordance with labeling, • materials safety data sheets and manufacturer's instructions • identifying and reporting operating problems or equipment malfunctions • cleaning and decontaminating equipment and work areas regularly using enterprise • procedures • using personal protective clothing and equipment, such as hard hats, hearing protection, • gloves, safety glasses, coveralls, gown, body suits, respirators and safety boots • machinery guards • signage, barriers, flashing lights, traffic control • reporting abnormal emissions, discharges and airborne contaminants, such as noise, light, • solids, liquids, water/waste water, gases, smoke, vapor, fumes, odour and particulates to appropriate personnel.
Standards and regulations,	such as: • ISO/IEC 17025 General requirements for the competence of testing and calibration laboratories ➢ ISO9000 series Quality management and quality assurance standards ➢ Relevant Ethiopian Standard of Good Laboratory Practice • Codes of Practice • Material Safety Data Sheets (MSDSs)) • Standard Operating Procedures (SOPs) • quality, equipment and procedures manuals • equipment startup, operation and shutdown procedures • calibration and maintenance schedules • enterprise recording and reporting procedures • production and laboratory schedules • material, production and product specifications.
Resources	may include: • operators and personnel from affected work areas and

	functions • production, testing and sampling equipment • enterprise procedures and standard methods for sampling, testing • raw materials/ingredients, packaging components and consumables • trial documentation, such as technical specifications, plant or production line layout, • MSDSs, trial request and result forms.

Evidence Guide	
Critical aspects of Competence	Must demonstrate knowledge and skills competence to: • Prepare for the trial • Participate in the trial • Assess and report trial outcomes • Maintain a safe work environment
Underpinning Knowledge and Attitudes	Demonstrate knowledge of: • trial objectives, laboratory trial requirements, documentation and reporting requirements • recipes/formulations, technical specifications and quality parameters for trial products • effect on product properties of variations in recipes/formulations • general function of product properties, process stages and unit operations involved in he trial, such as: ➢ classification of samples — screening, sieving ➢ milling ➢ mixing ➢ separation — distillation, sieves, filtration, solvent extraction, ➢ drying ➢ concentrating ➢ diluting ➢ depositing — injecting, forming, extrusion ➢ retorting ➢ cooling, freezing, refrigeration, heat transfer ➢ closure — vacuum sealing ➢ weighing and packaging ➢ materials handling and transport ➢ warehousing • relationship between temperature and viscosity • friction, pumping, fluid flow • expected nature/condition of materials at each process stage • causes and remedies for common processing problems associated with trial products • sampling and test methods for trial products • OHS, food safety and /or environmental management procedures relevant to trial.

Underpinning Skills	Demonstrate skills to: • analyses trial objectives and specifications to accurately determine resource requirements • liaises with relevant personnel to ensure trials are organized and conducted efficiently • follows all safety requirements on the production floor • works within production constraints, priorities and pressures • communicates effectively with personnel from diverse cultural backgrounds • collects accurate trial data and samples in the time available • recognizes, interprets and reports problems, atypical situations or unacceptable products • recommends product modifications and improvements within scope of responsibility • reports trial outcomes in accordance with enterprise procedures.
Resources Implication	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview / Written Test • Observation / Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Physicochemical Laboratory Operation Level V	
Unit Title	**Manage Project Quality**
Unit Code	**MIN PCL5 14 0114**
Unit Descriptor	This unit specifies the outcomes required to manage quality within projects. It covers determining quality requirements, implementing quality assurance processes, and using review and evaluation to make quality improvements in current and future projects.

Elements	Performance Criteria
1. Determine quality requirements	1.1 ***Quality objectives***, standards and levels are determined, with input from stakeholders and guidance of a higher project authority, to establish the basis for quality outcomes and a ***quality management plan.***
	1.2 Established ***quality management methods, techniques and tools*** are selected and used to determine preferred mix of quality, capability, cost and time.
	1.3 Quality criteria are identified, agreed with a higher project authority and communicated to stakeholders to ensure clarity of understanding and achievement of quality and overall project objectives.
	1.4 Agreed quality requirements are included in the project plan and implemented as basis for performance measurement.
2. Implement quality assurance	2.1 Results of project activities and product performance are measured and documented throughout the project life cycle to determine compliance with agreed quality standards.
	2.2 Causes of unsatisfactory results are identified, in consultation with the client, and appropriate actions are recommended to a higher project authority to enable continuous improvement in quality outcomes.
	2.3 Inspections of quality processes and ***quality control*** results are conducted to determine compliance of quality standards to overall quality objectives.
	2.4 A quality management system is maintained to enable effective recording and communication of quality issues and outcomes to a higher project authority and stakeholders.
3. Implement project quality improvements	3.1 Processes are reviewed and agreed changes implemented continually throughout the project life cycle to ensure continuous improvement to quality.
	3.2 Project outcomes are reviewed against performance criteria to determine the effectiveness of quality management processes and procedures.
	3.3 Lessons learned and recommended ***improvements*** are identified, documented and passed on to a higher project authority for application in future projects.

Variable	Range
Quality objectives	May include but not limited to: • requirements from the client and other stakeholders • requirements from a higher project authority • negotiated trade-offs between cost, schedule and performance • those quality aspects which may impact on customer satisfaction
Quality management plan	May include but not limited to: • established processes • authorizations and responsibilities for quality control • quality assurance • continuous improvement
Quality management methods, techniques and tools	May include but not limited to: • brainstorming • benchmarking • charting processes • ranking candidates • defining control • undertaking benefit/cost analysis • processes that limit and/or indicate variation • control charts • flowcharts • histograms • pareto charts • scatter gram • run charts
Quality control	May include but not limited to: • monitoring conformance with specifications • recommending ways to eliminate causes of unsatisfactory • performance of products or processes • monitoring of regular inspections by internal or external agents
Improvements	May include but not limited to: • formal practices, such as total quality management or continuous improvement • improvement by less formal processes which enhance both the product quality and processes of the project, for example client surveys to determine client satisfaction with project team performance

Evidence Guide	
Critical Aspects of Competence	Demonstrates skills and knowledge in: • lists of quality objectives, standards, levels and measurement criteria • records of inspections, recommended rectification actions and quality outcomes • management of quality management system and quality management plans • application of quality control, quality assurance and continuous

	improvement processes • records of quality reviews • lists of lessons learned and recommended improvements • how quality requirements and outcomes were determined for projects • how quality tools were selected for use in projects • how team members were managed throughout projects with respect to quality within the project • how quality was managed throughout projects • how problems and issues with respect to quality and arising during projects were identified and addressed • how projects were reviewed with respect to quality management • how improvements to quality management of projects have been acted upon
Underpinning Knowledge and Attitudes	Demonstrates knowledge of: • the principles of project quality management and their application • acceptance of responsibilities for project quality management • use of quality management systems and standards • the place of quality management in the context of the project life cycle • appropriate project quality management methodologies; and their capabilities, limitations, applicability and contribution to project outcomes • attributes: ➢ analytical ➢ attention to detail ➢ able to maintain an overview ➢ communicative ➢ positive leadership
Underpinning Skills	Demonstrate skills of: • ability to relate to people from a range of social, cultural and ethnic backgrounds, and physical and mental abilities • project management • quality management • planning and organizing • communication and negotiation • problem-solving • leadership and personnel management • monitoring and review skills
Resources Implication	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview / Written Test • Observation / Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Physicochemical Laboratory Operation Level V	
Unit Title	**Facilitate and Capitalize on Change and Innovation**
Unit Code	**MIN PCL5 15 0114**
Unit Descriptor	This unit specifies the outcomes required to plan and manage the introduction and facilitation of change; particular emphasis is on the development of creative and flexible approaches, and on managing emerging opportunities and challenges.

Elements	Performance Criteria
1. Participate in planning the introduction and facilitation of change	1.1 ***Manager*** contributes effectively to the organization's planning processes to introduce and facilitate change. 1.2 Plans are made to introduce change in consultation with ***appropriate stakeholders***. 1.3 Organization's objectives and plans are communicated effectively to introduce change to individuals and teams.
2. Develop creative and flexible approaches and solutions	2.1 Variety of approaches are identified and analyzed to manage workplace issues and problems. 2.2 ***Risks*** are identified and assessed, and action initiated to manage these to achieve a recognized benefit or advantage to the organization. 2.3 Workplace is managed in a way which promotes the development of innovative approaches and outcomes. 2.4 Creative and responsive approaches to resource management improve productivity and services, and/or reduce costs.
3. Manage emerging challenges and opportunities	3.1 Individuals and teams are supported to respond effectively and efficiently to changes in the organization's goals, plans and priorities. 3.2 Coaching and mentoring are made to assist individuals and teams to develop competencies to handle change efficiently and effectively. 3.3 Opportunities are identified and taken as appropriate, to make adjustments and to respond to the changing needs of customers and the organization. 3.4 ***Information needs*** of individuals and teams are anticipated and facilitated as part of change implementation and management. 3.5 Recommendations for improving the methods and techniques to manage change are identified, evaluated and negotiated with appropriate individuals and groups.

Variables	Range
Manager	a person with frontline management roles and

	responsibilities, regardless of the title of their position
Appropriate stakeholders	May include but not limited to: • organization directors and other relevant managers • teams and individual employees who are both directly and indirectly involved in the proposed change • union/employee representatives or groups • OHS committees • other people with specialist responsibilities • external stakeholders where appropriate - such as clients, suppliers, industry associations, regulatory and licensing agencies
Risks	May include but not limited to: • any event, process or action that may result in goals and objectives of the organization not being met • any adverse impact on individuals or the organization • various risks identified in a risk management process
Information needs	May include but not limited to: • new and emerging workplace issues • implications for current work roles and practices including training and development • changes relative to workplace legislation, such as OHS, workplace data such as productivity, inputs/outputs and future projections • planning documents • reports • market trend data • scenario plans • customer/competitor data

Evidence Guide	
Critical Aspects of Competence	Demonstrates skills and knowledge in: • Planning the introduction and facilitation of change • Developing creative and flexible approaches and solutions • Managing emerging challenges and opportunities
Underpinning Knowledge and Attitudes	Demonstrate knowledge of: • Relevant legislation from all levels of government that affects business operation, especially in regard to occupational health and safety and environmental issues, equal opportunity, industrial relations and anti-discrimination • the principles and techniques involved in: • change and innovation management • development of strategies and procedures to implement and facilitate change and innovation • use of risk management strategies: identifying hazards, • assessing risks and implementing risk control measures • problem identification and resolution • leadership and mentoring techniques

	• management of quality customer service delivery • consultation and communication techniques • record keeping and management methods • the sources of change and how they impact • factors which lead/cause resistance to change • approaches to managing workplace issues
Underpinning Skills	Demonstrate skills on: • Communication skills • Planning work • Managing risk
Resources Implication	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview / Written Test • Observation / Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Physicochemical Laboratory Operation Level V	
Unit Title	**Establish and Conduct Business Relationships**
Unit Code	**MIN PCL5 16 0114**
Unit Descriptor	This unit covers the skills, attitudes and knowledge required to manage business relationship with customers.

Elements	Performance Criteria
1. Establish contact with customer	1.1 Welcoming customer environment is maintained. 1.2 Customer is greeted warmly according to enterprise policies and procedures. 1.3 Effective service environment is created through verbal and non-verbal presentation according to enterprise policies and procedures. 1.4 Customer data is maintained to ensure database relevance and currency. 1.5 Information on customers and service history is gathered for analysis. 1.6 ***Opportunities*** to maintain regular contact with customers are identified and taken up.
2. Clarify needs of customer	2.1 Customer needs are determined through questioning and active listening. 2.2 Customer needs are accurately assessed against the products/services of the enterprise. 2.3 Customer details are documented clearly and accurately in required format. 2.4 Negotiations are conducted in a business-like and professional manner. 2.5 Maximize benefits for all parties in the negotiation through use of established ***negotiation techniques*** and in the context of establishing long term relationships. 2.6 The results of negotiations are communicated to appropriate colleagues and stakeholders within appropriate timeframes.
3. Provide information and advice	3.1 Features and benefits of products/services provided by the enterprise are described / recommended to meet customer needs. 3.2 Information is provided to satisfy customer needs. 3.3 Alternative sources of information/advice are discussed with the customer.
4. Foster and maintain business	4.1 Pro-actively seek, review and act upon information needed to maintain sound business relationships.

relationships	4.2 Agreements are honored within the scope of individual responsibility. 4.3 Adjustments to agreements are made in consultation with the customer and share information with appropriate colleagues. 4.4 Nurture relationships through regular contact and use of effective interpersonal and communication styles.

Variables	**Range**
Opportunities to maintain regular contact with customers	May include but not limited to: • informal social occasions • industry functions • association membership • co-operative promotions • program of regular telephone contact
Negotiation techniques	May include but not limited to: • identification of goals, limits • clarification of needs of all parties • identifying points of agreement and points of difference • preparatory research of facts • active listening and questioning • non-verbal communication techniques • appropriate language • bargaining • developing options • confirming agreements • appropriate cultural behavior

Evidence Guide	
Critical Aspects of Competence	Demonstrates skills and knowledge in: • consistently applying enterprise policies and procedures and industry codes of practice in regard to customer service • providing a quality service environment by treating customers in a courteous and professional manner through all stages of the procedure • using effective questioning/active listening and observation skills to identify customer needs • communicating effectively with others involved in or affected by the work • maintaining relevant and current customer databases in accordance with enterprise policies and procedures • ability to build and maintain relationships to achieve successful business outcomes
Underpinning Knowledge and Attitudes	Demonstrate knowledge of: • Operational knowledge of enterprise policies and procedures in regard to: ➢ customer service

	➢ dealing with difficult customers ➢ maintenance of customer databases ➢ allocated duties/responsibilities ➢ General knowledge of the range of enterprise merchandise and services, location of telephone extensions and departments/sections • Basic operational knowledge of legislation and statutory requirements, including consumer law, trade practices and fair trading legislation • Basic operational knowledge of industry/workplace codes of practice in relation to customer service • negotiation and communication techniques appropriate to negotiations that may be of significant commercial value
Underpinning Skills	Demonstrate skills to: • Use workplace technology related to use of customer database • Collect, organize and understand information related to collating and analyzing customer information to identify needs • Communicate ideas and information • Plan and organize activities concerning information for database entries • Use mathematical ideas and techniques to plan database cells and size • Establish diagnostic processes which identify and recommend improvements to customer service
Resources Implication	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview / Written Test • Observation / Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

Occupational Standard: Physicochemical Laboratory Operation Level V	
Unit Title	**Manage Continuous Improvement Process (Kaizen)**
Unit Code	**MIN PCL5 17 0114**
Unit Descriptor	This unit describes the performance, outcomes, knowledge, attitude and skills required to sustain and develop an environment in which continuous improvement, innovation and learning are promoted, rewarded and managed.

Elements	Performance criteria
1. Diagnose the current status.	1.1 ***Parameters*** used for study current situation are obtained. 1.2 Internal and external environment is analyzed. 1.3 Problems related to targeted environment is recognized and identified. 1.4 Problems regarding to current situation are analyzed. 1.5 Alternatives are generated. 1.6 Best alternatives are selected.
2. Design an effective continuous improvement process (kaizen).	2.1 The values, mission and goals of kaizen management system are clarified. 2.2 The ***kaizen management template*** and a visual management logo full of purpose and meaning are developed. 2.3 A clear action strategy (master and detailed plans) is defined. 2.4 The most effective and proven ***kaizen tools*** are chosen and applied. 2.5 A practical way is identified to involve all employees in ***Gemba activities*** (top, middle and bottom).
3. Develop change capability.	3. 1. Kaizen Promotion Team Structure is developed. 3. 2. The Kaizen Training Plan is defined and started. 3. 3. Supervisors' kaizen capability and habits are developed. 3. 4. Key people are developed in terms of ***Individual leadership capability***.
4. Implement improved processes.	4.1 ***Sustainability/continuous improvement*** are promoted as an essential part of doing business. 4.2 Impacts of change and consequences are addressed for people, and transition plans implemented. 4.3 Objectives, time frames, measures and communication plans are ensured in place to manage implementation. 4.4 Contingency plans are implemented in the event of non-performance.

	4.5 Failure is followed-up by prompt investigation and analysis of causes. 4.6 Emerging challenges and opportunities are managed effectively. 4.7 Continuous improvement systems and processes are evaluated regularly. 4.8 Improvements are communicated to all relevant groups and individuals. 4.9 Opportunities are explored for further development of value stream improvement processes.
5. Establish direction and control.	5.1 A ***system audit tool*** is defined and implemented. 5.2 The kaizen management system is deployed across all company levels and functions. 5.3 Results are checked and corrections made. 5.4 ***Standard operating procedures*** are developed and maintained. 5.5 The recruit, training and evaluation systems are improved and ***HR practices*** compensated.

Range	**Variables**
Parameters	May include but not limited to: • Working condition • Resources may include: ➢ Human ➢ Material ➢ Machine • Kaizen elements
Kaizen management template	May include but not limited to: • Visual management board for: ➢ displaying characteristic figures, data and graphics ➢ depicting and controlling processes ➢ identifying and marking sources of risks, setting and standards ➢ displaying company's values and goals of kaizen
Kaizen tools	May include but not limited to: • 5S (a visual workplace management) • 7 QC tools(Cause and Effect Diagram, Check Sheet , Pareto Diagram , Histogram, Scatter Diagram, Control Chart and Flow Chart) • Brainstorming • Basic Industrial Engineering (IE) tools such as time study, motion study, line balancing, work sampling • JIT(JUST IN TIME principles) • MUDA identification and elimination tools

	• Kanban • Poka-yoke • Takt- time
Gemba activities	May include but not limited to: • Value-adding activities to satisfy the customer • Employee autonomous operations (participating in team to identify nonconformity, propose solutions and implement them autonomously)
Individual leadership capability	May include but not limited to: • Personal and interpersonal skills • Courage • Honour and integrity • Energy and drive • Strategic skills • Operating skills • Organizational positioning skills
Sustainability/continuous improvement	May include but not limited to: • Improvements made by following PDCA (Plan, Do, Check and Act) cycle for: ➢ Improvements in one's own work ➢ Saving in energy, material and other resources ➢ Improvements in the working environment ➢ Improvements in machines and processes ➢ Improvements in jigs and tools ➢ Improvement in office work ➢ Improvements in product quality ➢ Ideas for new products ➢ Customers services and customer relations
System audit tool	May include but not limited to: • 5S audit • Patrol system • Kaizen board • 5M check lists • Key Performance Indicators (KPIs)
Standard operating procedure	May include but not limited to: • Administrative standards for: ➢ Managing the business ➢ Administration ➢ Personnel Guidelines ➢ Job Descriptions ➢ Guidelines for preparing cost information • Operation standards for: ➢ Describing the way a job is done. ➢ Help realising Quality, cost, delivery. ➢ Addressing the need to satisfy customers. ➢ Using the process that's the best. ➢ Producing work in the most cost effective manner. ➢ Assuring total quality for the customer.

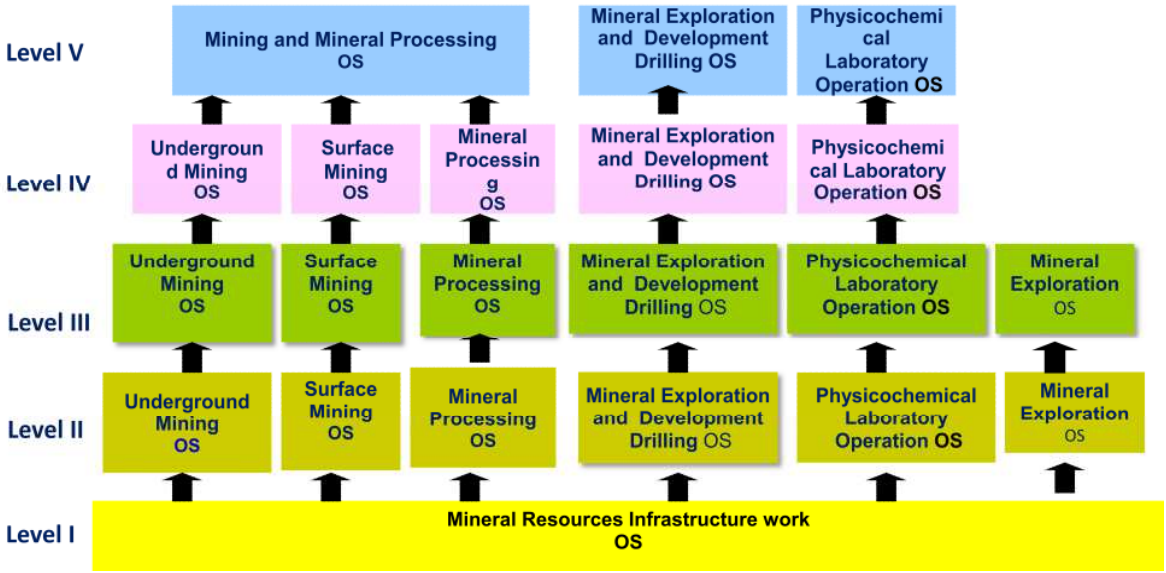
HR practices	May include but not limited to:
	• Resources may include:
	  ➢ Recruit and retain high quality people with innovative skills and a good track, record in innovation
	• HR development is used for:
	  ➢ strategic capability and provide encouragement and facilities for enhancing innovating skills and enhancing the intellectual capital of the organization
	• Reward will:
	  ➢ Provide financial incentives and rewards and recognition for successful innovation

Evidence Guide	
Critical Aspects of Assessment	Demonstrates skills and knowledge competencies to: • Establish policy and cross-functional goals for kaizen • Deploy and implement goals as directed through policy deployment and cross-functional management. • Realize goals through deployment and audits. • Build systems, procedures, and structures conducive to kaizen. • Use kaizen in functional capabilities. • Introduce Kaizen as a corporate strategy • Provide support and direction between allocating resources • Establish, maintain and upgrade standards. • Make employees conscious through training programs. • Assist employees develop skills and tools for problem solving.

Underpinning Knowledge and Attitude	Demonstrates knowledge of:
	• Quality management and continuous improvement theories
	• creativity/innovation theories/concepts
	• competitive systems and practices tools, including:
	  ➢ 5S
	  ➢ JUST IN Time (JIT)
	  ➢ mistake proofing
	  ➢ process mapping
	  ➢ establishing customer pull
	  ➢ setting of KPIs/metrics
	  ➢ SOP
	  ➢ Kaizen elements/targets.
	  ➢ identification and elimination of waste/MUDA
	  ➢ continuous improvement processes including implementation, monitoring and evaluation strategies for a whole organization and its value stream
	  ➢ Difference between breakthrough improvement and continuous improvement
	  ➢ organizational goals, processes and structure
	  ➢ approval processes within organization
	  ➢ methods of determining the impact of a change

	➢ customer perception of value ➢ Define, Measure, Analyze, Improve and Control (DMAIC) to sustain process
Underpinning Skills	Demonstrates Skills to: • Use leadership skills to foster a commitment to quality and openness to improvement. • Analyze training needs and implementing training programs • Prepare and maintain quality and audit documentation • Undertake self-directed problem solving and decision-making on issues of a broad and/or highly specialized nature and in highly varied and/or highly specialized contexts • Communicate at all levels in the organization and to audiences of different levels of literacy and numeracy • Analyze current state/situation of the organization. • Analyze individually and collectively the implementation of competitive systems and practices tools in the organization and determining strategies for improved implementation • Solve highly varied and highly specialized problems related to competitive systems and practices implementation and continuous improvement to root cause • Negotiate with stakeholders, where required, to obtain information required for implementation and refinement of continuous improvements, including management, unions, employees and members of the community. • Review relevant metrics, including all those measures which might be used to determine the performance of the improvement system, including: ➢ Key Performance Indicators (KPIs) for existing processes ➢ Quality statistics ➢ Delivery timing and quantity statistics ➢ Process/equipment reliability (‘uptime’)
Resources Implication	Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.
Methods of Assessment	Competence may be assessed through: • Interview / Written Test • Observation / Demonstration with Oral Questioning
Context of Assessment	Competence may be assessed in the work place or in a simulated work place setting.

MINERAL EXPLORATION, MINING AND MINERAL PROCESSING



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This occupational standard was developed in January 2014 at Addis Ababa, Ethiopia.

COMMENT TEMPLATE

The Federal TVET Agency values your feedback of the document.
If you would like someone to personally contact you, please provide the following information:
Name:
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Please, leave a comment.

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