AFRICA CENTRE OF EXCELLENCE FOR SUSTAINABLE POWER

AND ENERGY DEVELOPMENT (ACESPED)

UNIVERSITY OF NIGERIA, NSUKKA

Developed modules for training Laboratory personnel

April, 2023

Administrative Responsibility office:	ACE-SPED testing facility
Date which manual was developed:	October, 2022
Effective Date of manual:	April, 2023
Policy developed by:	ACE-SPED testing facility Committee
Authorized by:	ACE-SPED BOARD
Version:	001
Web link to document	

1.0 Background

In order to accomplish the purpose of the innovation-oriented collaboration of research infrastructures with the commercial sector via advisory services, the ACE-SPED will guarantee training and re-training of the staff, providing them exceptional competency. Information on internal rules and processes to be followed for consumer product testing, staff training, report writing, safety, research, evaluating data from private labs, and other laboratory activities is supplied.

2.0 Objective

i. In addition to formulae and other technical data, laboratory manuals contain standard laboratory procedures, current methodologies, and safety measures.
ii. Laboratory staff members need to know how to operate systems, environmental controls, laboratory chemical hoods, and other related exhaust devices, as well as their capabilities and limits.
iii. The experimental activity should be considered in the context of the whole laboratory and its facilities to guarantee efficiency and safety.

3.0 Modules of Safety Training manual

According to the ACE-SPED laboratory policy, even the finest precautions to protect laboratory workers might be compromised by mistakes made by people or by bad protocol. Thus, the key to preventing occurrences and accidents related to laboratory acquired injuries is having a staff that is concerned about safety as well as a student/partners that is knowledgeable about identifying and managing laboratory dangers. It is crucial that ACE-SPED provide ongoing in-service training on safety measures because of this. The foundation of any successful safety program is a

laboratory manager, who should see to it that all staff members and students get basic training that includes integration of safe laboratory practices and procedures.

3.1 **Training in Instructional Laboratories**

The safety officer or ACE-SPED course teacher is required to provide laboratory safety training in instructional labs. Lab teachers need to have had pre-documented training. A discussion of the risks related to the substances used and the procedures to be followed, appropriate methods for handling and discarding hazardous materials, safety measures to be taken to prevent exposure or release into the environment, and emergency and spill procedures are all included in the training, which will be made sure of by ACE-SPED. In addition to offering extra laboratory safety training in instructional courses upon request, the ACE-SPED Safety Officer is ready to assist course instructors in creating this training. In close collaboration with the University Laboratory Safety Committee, the handbook will support the creation and distribution of instructional materials and records. The following highly hazardous procedures—which are frequently performed by all laboratory personnel and involve the risk of inhalation—will be covered in staff and student training:

i. Inhalation risks (i.e., aerosol production) when using loops, streaking agar plates, pipetting, making smears, opening cultures, taking blood/serum samples, centrifuging, etc.

ii. Dangers of ingestion while working with cultures, smears, and specimens

3.2 Information and training manual provided the following:

i. The location and availability of the written Laboratory Safety Manual

ii. The health hazards, signs, and symptoms associated with exposure(s) and infection(s) with the biohazardous agent(s) used in the work area

iii. The measures employees can take to protect themselves from these hazards include specific procedures the university or department has implemented, such as appropriate work practices, emergency procedures, and personal protective equipment.

iv. The location and availability of reference material on the hazards, safe handling, storage, and disposal of biohazardous agents

3.3 **Module on Laboratory instrumentation manual**

The use of instruments in a laboratory is for observation, measurement, or control. It entails using or working with equipment, particularly using one or more while doing laboratory procedures. The creation or use of measuring instruments for observation, monitoring, or control is referred to as instrumentation. A group of test equipment is referred to as laboratory instrumentation. A set of these tools might be used to automate testing procedures. The design, manufacture, and supply of instruments for measurement, control, etc.; the condition of having such instruments all at once or being controlled by them

3.4 Laboratory Instrument

Any device, tool, or utensil used in a laboratory is referred to as a laboratory instrument. A tool that measures a physical property, such as flow, concentration, temperature, level, distance, angle, or pressure, is known as an instrument. Instruments may range in complexity from multi-variable process analyzers to simple direct-reading hand-held thermometers. A medical instrument is a tool used to identify and treat illnesses. A tool or device used for a certain task;

particularly, a tool or piece of equipment designed to do meticulous and precise work. a tool for measuring anything.

3.5 Laboratory equipment

The measuring instruments used in a scientific laboratory are often electronic in design. The many instruments and tools that scientists use when working in a laboratory are referred to as laboratory equipment. Typically, laboratory equipment is used to conduct an experiment, take measurements, and collect data. A scientific instrument is often a larger or more advanced piece of equipment. More and more, open hardware ideas are being used in the design and sharing of scientific instruments and lab equipment. In addition to specialised tools like operant conditioning chambers, spectrophotometers, and calorimeters, the traditional equipment comprises instruments like Bunsen burners, microscopes, and spectrophotometers.

3.6 Laboratory techniques

Laboratory techniques are the procedures used in both pure and applied sciences to conduct experiments, all of which adhere to the scientific method. Some of these procedures call for the use of sophisticated laboratory apparatus, such as electrical devices and laboratory glassware, while other procedures call for specialised or expensive supplies.

3.8 Laboratory apparatus

A collection of instruments, tools, or a machine used in a laboratory is known as a laboratory apparatus. The equipment used in laboratories, whether it be a single instrument, a whole set, or both, is used to undertake projects and experiments. the most typical tools and equipment

required for hands-on activity in laboratories. The sort of laboratory you are in and the experiment you will do will determine what equipment you need.

Laboratory tool

Any physical object that may be utilised in a laboratory as long as it is not consumed while being used is considered a laboratory tool. Different names for tools used in certain areas or occupations include "instrument," "utensil," "implement," "machine," "device," and "apparatus." Equipment" is the collection of tools required to do a task. Technology is the understanding of creating, getting, and employing tools.

4.0 Module on Calibration of Equipment

The ACE-SPED laboratory policy believes that human error and poor procedure can affect the best results from the testing laboratory. As a result, the ACE-SPED laboratory policy makes training on the calibration of equipment necessary.

4.1 What is calibration of an instrument?

Calibration is the act of determining whether or not a piece of measuring equipment is performing safely and effectively by comparing it to an established standard in order to test or restore its accuracy. After calibration is complete, the equipment's values at each point of reference are calibrated, and the standard calibration equipment must match the results or fall within the tolerance/accuracy range permitted before the equipment may be certified as safe. However, if there is a deviation, the instrumentation engineer makes the necessary adjustments, corrections, resets, or repairs to the equipment to return it to the anticipated or usual standard.

Instrument calibration basically makes sure that businesses (food processing, environmental, oil and gas, etc.) are able to stop incorrect readings in their operations, making sure that the instruments continue to match their makers' requirements and designated purpose.

4.2 What makes calibration necessary?

As a result of the aforementioned explanation, we now know the importance of trustworthy calibration services for quality. In light of this, we thought it would be excellent to provide some justifications for why calibration is crucial to the calibre of your output. A new instrument has to be calibrated to make sure it is operating correctly and in accordance with the appropriate standard. When the instrument has been subjected to unfavourable circumstances, turbulent processes, etc., calibration is necessary. Additionally, when an instrument has been fixed or altered, calibration is necessary.

4.3 How are measurements Done

It is essential to remember that each kind of equipment has a unique calibration procedure and approach when thinking about how calibration is done. However, there are certain essential fundamental procedures that must be considered before calibration may begin. Here are the actions to take:

i. Decide what kind of instrument you are calibrating, such as if it measures temperature or pressure.
ii. Select a calibration tool that can accurately assess the calibration range of the target device.
iii. Organise the calibration environment.

iv. Make sure the calibrator is correctly attached to each instrument you are calibrating. This will assist in avoiding errors in your readings and save you from making incorrect observations.

v. You now carry out the calibration. However, it is suggested that you calibrate your device two or three times. This process of "iteration" is carried out to guarantee the accuracy of your results. Even if you always obtain the desired outcome the first time, always do this.

vi. Make a note of your readings and see if any variances exist. If there are, make sure it falls within the equipment's allowable deviation. That device did not pass the calibration if the variation was outside of its allowed range. Recommendations may be made in light of the findings.

4.4 List of calibration equipment

Here's a list of some of the calibration instruments that are popularly used:

- Dead weight tester
- Loop calibrator
- Comparison pump
- Multimeter
- Temperature bath
- Test flange
- Test bench

4.5 **What equipment has to be calibrated?**

Every measuring device eventually has to have its calibration checked. Scales, speedometers, thermometers, flow metres, temperature probes, and other devices need to be calibrated. The reality is that practically every instrument will eventually start to lose accuracy as a result of difficult working circumstances, exposure to severe environments, mechanical shocks, etc. Additionally, as it is usual for instruments to depart from pre-set parameters, such deviations must be fixed beforehand to avoid having an impact on the final product's quality.

4.6 How often an instrument should be calibrated

i. The frequency of instrument calibration is yet another inquiry we often get. And although a straightforward response would be wonderful, the reality is that it's not so straightforward since it mostly relies on use.

ii. A shorter interval between calibrations, such as monthly, quarterly, or semi-annually, can provide you better results if your business makes essential measurements.

iii. Annual calibration will be your best choice if your firm performs both crucial and less essential measurements.

iv. Regardless of the procedure and environmental factors, it is a legal necessity that all process equipment be calibrated yearly or twice a year.