Chapter A3:

Equipment management

Chapter A2 provided information on overall commodity management. This chapter covers some additional considerations required for managing tuberculosis (TB) laboratory equipment.

A3.1 National equipment policy

Countries should develop a laboratory equipment policy that includes all relevant activities. The policy should include an equipment maintenance plan, a budget for equipment maintenance (i.e. for repairs and spare parts) and guidance on equipment donations.

A3.2 Criteria for selecting equipment

When selecting equipment for purchase, laboratories need to take into account:

- the proposed use of the equipment
- how well the equipment accords with the service provided
- performance characteristics
- facility and infrastructural requirements
- cost
- availability of reagents and consumables, and arrangements for supply of these materials
- ease of operation
- warranty
- availability of technical support from the manufacturer
- service contracts
- location in the laboratory
- available space and accessibility
- safety.

Part B of this document provides detailed equipment specifications that will be useful when selecting equipment.

A3.3 Acquisition

Equipment may be acquired through direct purchase, lease or rental. It is often best to procure items of equipment centrally. If many of the same items are required, then bulk procurement may be the most cost-effective and practical approach. Similar considerations apply when acquiring equipment from donors.

Regardless of how the equipment is acquired, laboratories must take into consideration:

- responsibilities of the manufacturer or distributor
- conditions of the commercial sales contract
- customer-support plan and maintenance contracts.

Each of these aspects is discussed below.

A3.3.1 Responsibilities of the manufacturer or distributor

The manufacturer or distributor must guarantee:

- provision of all reagents, consumables and culture materials at an affordable and sustainable price (note: distributors usually offer reduced prices for high consumption, so bulk or central ordering may be a distinct advantage);
- a reasonably lengthy expiration date on all reagents and consumables;
- acceptable shipment conditions and assistance with customs logistics, to avoid damage to equipment or deterioration of reagents;
- installation of the equipment, staff training and ongoing technical support;
- provision of a parts manual and an operator's manual;
- a trial period for the equipment, after which it can be returned if it is not deemed suitable;
- ongoing maintenance and repairs, including emergency services.

A3.3.2 Conditions of the commercial sales contract

The sales contract must be reviewed carefully before completing the purchase. The contract should clearly stipulate all of the above responsibilities of the manufacturer or distributor.

A3.3.3 Customer-support plan and maintenance contracts

A customer-support plan and maintenance contracts should be available for all items of capital equipment. Maintenance contracts are essential for all automated equipment (e.g. *Mycobacterium* growth indicator tubes) and biosafety equipment. Laboratories should pay particular attention to contracts for biological safety cabinets – these should provide for regular maintenance.

A3.4 Installation

Before installation:

- verify that physical requirements have been met; these include electrical, space, ventilation, water supply and ambient-temperature requirements, and safety checks;
- confirm who is responsible for installation.

Upon receipt:

- verify the package contents;
- do not attempt to use the equipment before it has been properly installed;
- generally, in the case of capital equipment, ensure that the equipment is installed by the manufacturer.

After installation:

- establish an inventory record for the equipment
- define the conditions for use
- develop and implement protocols for calibration, performance verification and operating procedures
- establish a maintenance programme
- provide training for all operators.

A3.5 Validation and calibration

Validate the performance of new equipment and calibrate it before use by:

- testing known samples and analysing the data
- establishing stability or uniformity in temperature-controlled equipment
- checking the accuracy or precision of pipettes
- checking the speed (in revolutions per minute [rpm]) of a centrifuge.

A3.6 Maintenance and troubleshooting

Maintenance involves systematic and routine cleaning, and adjustment or replacement of instrument and equipment parts. It should be performed regularly – either daily, weekly or monthly, depending on the equipment. Examples of maintenance include cleaning optical lenses, adjusting thermostats and changing motor brushes.

If a piece of equipment malfunctions, users should:

- check the manufacturer's instructions;
- determine the source of the problem – for example, the sample, the reagent, the equipment, the electrical supply or the water supply;
- make one change at a time, to attempt to diagnose the source of the problem.

A3.7 Professional service and repair

In terms of professional service and repair, laboratory managers should schedule regular servicing, by the manufacturer or representative, for all key items of equipment. To ensure cost effectiveness, it is preferable that all items of the same model (e.g. microscopes) are serviced at the same time. Basic items of equipment such as water-baths may be maintained by local biomedical service technicians.

A3.8 Retiring equipment

Questions to ask in terms of retiring equipment include the following.

- *When* should an item be retired? This might occur when experts indicate that the item cannot be repaired, or is outmoded and should be replaced with a new model.
- *Why* should an item be retired? Reasons might be to avoid issuing inaccurate test results, to free up valuable space and to reduce hazards.
- *How* should an item be retired? A useful approach is to salvage any usable parts, taking into account any biohazards, and then follow safety disposal procedures for any parts that cannot be reused.

A3.9 Equipment maintenance programmes

The benefits of maintenance programmes are:

- safety of equipment
- fewer interruptions of work
- lower repair costs
- equipment lasting longer, rather than needing to be replaced prematurely
- less need for standby equipment
- identification of high maintenance costs
- reduction of variation in test results
- greater confidence in the reliability of results.

A good equipment maintenance programme:

- helps the laboratory to achieve a high level of performance
- lengthens instrument life
- reduces interruption of services due to breakdowns and failures
- improves customer satisfaction
- improves the confidence and knowledge of laboratory technologists.

A3.10 Equipment management oversight

In terms of oversight of equipment management, laboratories should:

- assign responsibilities for all activities;
- train all personnel on equipment management requirements and responsibilities;
- monitor equipment management activities by:
  - routinely reviewing all records;
  - ensuring that all procedures are followed;
  - updating procedures, if necessary.

A3.11 Donations of laboratory equipment and other commodities

Countries and laboratories need to ensure that donations of commodities to TB laboratories are handled properly. This means making sure that:

- donations are based on need expressed by the recipient country, ministry of health or a national TB control programme;
- all donated capital equipment and TB diagnostic commodities comply with the quality standards of both the donor and the recipient country;
- on arrival, all donated TB diagnostic commodities have a remaining shelf-life of at least one year;
- all TB laboratory equipment and diagnostic commodities are labelled and have instructions in English or in a country's national official language that is easily understood by health professionals;
- recipients are made aware of all donations of TB diagnostic equipment and commodities that are being considered or are under way;
- the declared value of the TB diagnostic equipment and commodity donation is based on the wholesale price of its equivalent in the donating country;
- wherever possible, costs of international and local transport, warehousing and port clearance are paid by the donor agency;
- wherever possible, a maintenance contract and adequate supplies of consumables accompany donations of capital equipment.