3. Maintenance of Laboratory Equipment

Introduction

Equipment maintenance is one important aspect of quality assurance in the laboratory. Accuracy of a report depends partly on error free machines. Laboratory equipments are also costly items. Daily routine procedures in maintenance can help to increase the life span of the equipment thereby preventing unnecessary burdens on the state finances. Faulty equipment can also be unsafe for the users. Use of this guideline could help in overcoming most of the problems encountered in equipment maintenance in the Microbiology laboratories.

Why a Clinical Practice Guideline?

In implementing laboratory quality assurance a breakdown prevention maintenance programme for the equipment has to be drawn up and practised. One of the activities in this program would be to prepare Standard Operating Procedures Manual (SOPM) for equipment maintenance within each laboratory as applicable to its own work expectations. The SOPM should include clearly written instructions for operation of the equipment. At the moment as there are no national guidelines to meet this demand it is expected that this guideline would help in initiating such programmes in Microbiology laboratories in the country.

For whom is this guideline intended?

It is intended to guide all laboratory personnel in hospitals where Microbiological services are available. It is also intended to guide the administrators who have to decide on finance management in planning.

Although it is targeted for the institutions under the Ministry of Health, the guideline is encouraged to be used in any private health facility where Microbiological services are to be provided.

Objectives

- To provide evidence based recommendations to laboratory personnel to choose the best course of management of the laboratory equipment.
- To provide recommendations to the administration to help in the improvement of quality in service delivery.

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Quick Reference guide

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Maintenance of Laboratory Equipment

This guideline deals with some equipment commonly used in the Microbiology laboratories. However these principles could be applied in the maintenance of other equipment in the laboratory as well. The maintenance programme to be developed in the laboratory should include the following components.

1. A preventive maintenance programme for all equipment. This involves periodic performance checks as recommended by the manufacturer.
2. Maintenance of a register of all equipment indicating serial numbers, hospital identification numbers and specific locations in the laboratory.
3. A mechanism has to be developed to get all new equipment checked by the Bio-Medical Engineering Division to ensure safety of the equipment.
4. Records of all break downs.
5. Mechanism for validation of equipment.
6. Mechanism for calibration of equipment.

3.1 Maintenance of Microscope

Special care should be paid to each part of the microscope. Maintenance should be done according to a time schedule.

Figure 1.

3.1.1 Daily procedure in maintaining a Microscope (X)

A. Optical surfaces

- Use a fine hairbrush to remove dust from all optical surfaces.
- Remove oil and finger marks immediately from the lenses with several thickness of lens tissue.
- Do not use any type of tissue other than lens tissue otherwise you may scratch the lens.

- Use very little pressure to prevent removal of the coatings of the lenses.

B. Cleaning Solutions (X)

- Use water-based solutions for normal cleaning.
- If you have to use organic solvents, use them in very small amounts and only if absolutely necessary to remove oil from the lens.
- Since microscope manufacturers do not agree on solvents to be used, each company's recommendations should be consulted.
- One recommended solvent is 1, 1, 1-trichloroethane; it is good for removing immersion oil and mounting media and will not soften the lens sealers and cements.
- Xylene, any alcohols, acetone, or any other ketones should never be used as cleaning fluids.

C. Lamp (X)

To remove oil received from fingers;

- Clean the lamp after it has been installed into the lamp holder, with lens tissue moistened in 70% isopropyl or ethyl alcohol.

- Make sure that the lamp is cool and the switch is in the off position when replacing or removing the lamp.

D. Stage (X)

- Clean the stage with a small amount of disinfectant (70% isopropyl or ethyl alcohol) when it becomes contaminated.

E. Condenser (X)

- Using petroleum jelly or light grease, clean and lubricate the sub-stage condenser slide as needed.

F. Dust Cover (X)

- Cover the microscope when not in use.
- In extremely humid climates (a relative humidity of more than 50%) good ventilation is necessary to prevent fungal growth on the optical elements.

3.1.2 Periodic procedure in maintaining a microscope

vii. By whom & when to do?

i. Factory-trained and authorized individual should do this.
ii. Should be done at least once a year.
iii. If microscopes are used continuously, maintenance should be performed twice a year.
iv. Schedule a complete general cleaning and readjustment.

viii. Record all preventive maintenance and repair data as shown below.

- Date of maintenance
- Microscope identification number
- Names of company and representative
- Type of maintenance and /or repairs done
- Part replaced
- Recommendations for next evaluation
- Estimated cost if you have such information
- This information should be cumulative so that a review for each piece of equipment can be scanned quickly for continuing problems, justification, information for replacement requests, etc.

3.2 Maintenance of Centrifuge

Figure 2.

Daily procedure in maintaining a centrifuge

i. Inspection before each run

- Visually check the carrier cups, trunnions and rotor for corrosion and cracks.
- If anything is found to be defective, replace it immediately or remove the equipment from service.
- Check for the presence and insertion of the proper cup cushions before each run.

ii. Quarterly and periodic checks

- At least quarterly checks need to be done
- Check the speed at all regularly used speeds with a stroboscopic light to verify the accuracy of a built-in tachometer or speed settings.
- Remember to record the results.

- Perform this function every six months or yearly.

1. Following a breakage or spill and at least monthly;
   - Disinfect the centrifuge bowl, buckets, trunnions, and rotor with 10% household bleach or phenolic solution.
   - Following disinfection, rinse the parts with warm water and perform a final rinse with distilled water.
   - Thoroughly dry the parts with a clean absorbent towel to prevent corrosion.

2. At least at quarterly intervals;
   - Brush the inside of the cups with mild warm soapy water and use fine steel wool to remove deposits; the cups should then be rinsed in distilled water and thoroughly dried.

3. Follow manufacturer's recommendations for preventive maintenance (lubrication).

4. Semiannually, check brushes and replace if worn to ¼ in. (1 in. = 2.54 cm) of the spring. Also semiannually, check the autotransformer brush and replace if worn to ¼ in. of the spring.

5 Record all information relating to preventive maintenance and repair .This information should be cumulative so that a review for each piece of equipment can be scanned quickly for continuing problems, justification information for replacement requests etc.

3.3 Maintenance of Fume hood

Figure 3.

Checking should be done at least yearly,

Air Velocity

- Keep the sash fully open and the cabinet empty.
- Check the air velocity with a thermoanemo meter (minimum acceptable face velocity, 100 ft (1ft = 30.48cm)/min.

Smoke containment

- A smoke containment test should be performed with the cabinet empty to verify proper directional face velocity.

Lubrication

- Lubricate the sash guides as needed.

3.4 Maintenance of the Biological Safety Cabinet

Figure 4.

Routine

- After each use, disinfect the work area. Since UV radiation has very **limited penetrating power**, do not depend on UV irradiation to decontaminate the work surface. Clean UV lamps (in the off position) with 70% isopropyl or ethyl alcohol, **at least once a week.**

Periodic checks

- Have class 1 biological safety cabinets certified at least annually.

- They should also be certified after installation but before use and after they have been relocated or moved.
- Certification should include the following and will be documented by the trained company representative. (Contracted to handle the biological safety cabinet inspection).

A. Air Velocity

- Measurements of the air velocity will be taken at the midpoint height approximately 1 inch behind the front opening. Measurement should be made at approximately every 6 inch.
- The average face velocity should be at least 75 linear ft / min.

B. Smoke containment

- With the cabinet containing the routine work items, such as Bunsen burner, test tube rack, bacteriological loop and holder, etc., a smoke containment test should be performed to determine the proper directional velocity.

C.

- Record the date of re-certification, the names of the individual and company re-certifying the cabinet, and any recommendations for future service. Any maintenance performed should also be documented in writing.

- Replace the filters as needed.
- On installation, have a class 11 biological safety cabinet certified to meet standard 49 of the National Sanitation foundation.

3.5 Maintenance of the Refrigerator-Freezer

Figure 5.

Daily records

- On a daily basis, monitor and record the temperature of the refrigerator. The thermometer should be placed into a liquid to permit stable temperature recording, or thermocouples may be used.
- On a daily basis, monitor and record the temperature of the freezer. The thermometer should be placed in anti-freeze to permit stable temperature recording.

Periodic checks

- Periodically when the door is opened check whether the fan is functioning.
- Monthly, check the door gasket for deterioration, cracks and proper seal. Seal problems are often seen when ice begins to build up in a freezer or the temperature is not holding. Periodically, petroleum jelly can be rubbed onto the door gasket to lubricate the material and to help maintain flexibility for a tight seal when the door is shut.
- Semiannually, clean the condenser tubing and air grill with a vacuum cleaner.
- Semiannually, check to ensure that the drain tubes are kept open.
- Annually, wash the interior with a warm solution of baking soda and water. Rinse with clean water, and dry. Also, wash the door gasket and water collection tray with a mild soap and water. If the gasket accumulates a black mold, scrub with 50% household bleach solution and a small brush. Rinse with clean water and dry.

3.6 Maintenance of Autoclaves

Figure 6.

Daily

1. Remove the outlet screen and clean with detergent and a brush under running water.
2. Clean the chamber using a cloth. Do not use abrasive cleansers or steel wool, as these will scratch the surface and increase corrosion.
3. Clean the door or lid gaskets with a cloth and check for defects. Replace defective gaskets.
4. Clean the shelves in the autoclave or the basket or cart that holds packs (including the wheels of the cart) with detergent and a cloth.

Weekly

Check the manufacturer's instructions for maintenance of the exhaust line. If the instructions are unavailable using the following instructions, flush the exhaust line or chamber drain to keep it free of material that may interfere with air and steam leaving the chamber.

1. Remove the outlet screen.
2. Pour 1 liter of detergent and hot water solution down the drain with a funnel.
3. Pour 1 liter of hot water down the drain to rinse out the detergent solution.
4. Replace the screen.

NOTE: These guidelines apply to most, but not all, autoclaves. Refer to the manufacture's manual for specific instructions.

References:

1. National committee for Clinical laboratory standards. 1996. Clinical laboratory manuals, 3rd ed. approved guideline 3P2-3A.Villanova, Pa
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