CHAPTER 3

LABORATORY ENVIRONMENT

1. LIGHTING Page 3-1

2. ENVIRONMENT Page 3-5

3. EQUIPMENT SAFETY Page 3-5

4. LABORATORY SAFETY Page 3-7

CHAPTER 3

LABORATORY ENVIRONMENT

1. LIGHTING

a. General. The true color of a material or substance is best determined under natural daylight conditions, such as north-sky light on a semi-overcast day, or under artificial light in a room with muted tones. Since it is impossible to maintain natural lighting in a laboratory throughout any given day, artificial illumination that simulates north-sky daylight is essential. For official purposes, only use artificial lights that are:

(1) A type and model approved by FGIS;

(2) Maintained in good operating condition; and

(3) Tested in accordance with section 1.e.

b. Specifications.

(1) Illumination- (flux density) 150 - 200 foot candles (180 optimum).

(2) Diffusers- Non-color selective glass or plastic. Polarized diffusers are acceptable.

(3) Reflectors- Heat-resistant, nonyellowing, white enamel or highly polished metal.

(4) Emitters- Fluorescent emitters of a type and model approved by FGIS. (See list of approved equipment.)

Table 1, Fluorescent Emitter Specifications	
Lamp Radiation: 2000 to 2499 Lumens	Color Rendering Index ≥ 92 Color Temperature 7500 °K Rated Average Life ≥ 15,000 Hours
OR	
Lamp Radiation: ≥ 2500 Lumens	Color Rendering Index ≥87 Color Temperature 7500 °K Rated Average Life ≥ 12,000 Hours

c. Installation.

(1) Install light sources in full compliance with the national and local electrical codes.

(2) Design installations to provide for the dissipation of emitter and ballast heat through the source enclosure to prevent reflector discoloration and ballast damage.

(3) Install light sources[1] to evenly distribute light and place end-to-end in rows whenever possible. For example, if the light fixtures are installed in rows end-to-end, then there should be 5 feet between rows (center-to-center) for ceilings lower than 8 ½ feet high, and 4 feet between rows for ceilings higher than 8 ½ feet.

(4) If window openings allow bright or glaring light to strike the work surface, cover the window openings with shades, venetian blinds, or plastic film of a neutral shade.

d. Maintenance.

(1) Clean light sources whenever necessary. Remove and wash fluorescent tubes and diffuser with detergent and water.

[1]A metal enclosure fitted with the necessary wiring, ballasts, sockets, fluorescent tubes, incandescent bulbs, reflectors, and diffusers to furnish illumination of suitable color quality and intensity for inspection purposes.

(2) Exercise care in handling fluorescent tubes; if broken, avoid breathing dust emitted from the tubes.

(3) To attain the expected life of fluorescent tubes, turn on the light source in the morning when the analysis work commences, and leave on until analysis work is completed.

(4) Relamp light sources as needed. Labs with ample levels of illumination may replace tubes as they burn out or after 80 percent of the expected life of the fluorescent tubes. At labs where levels of illumination are difficult to maintain, it is recommended that the lamps be replaced approximately every 2 years for a 10-hour use cycle, 5 days per week. A 1 ½-year relamp is recommended for a 24-hour use cycle, 7 days per week.

e. Testing.

(1) General. Check illumination at the time of initial installation, when a laboratory is remodeled, and at the discretion of the agency or field office manager. When possible, new tubes should be allowed to "burn-in" (stabilize) for approximately 100 hours before testing.

(2) Pre-Test Examination. Before testing the illumination, check the color fidelity of the diffuser.

(a) Remove the diffuser and observe the color of the undiffused light.

(b) Replace the diffuser and observe the color.

(c) If the color is different when the diffuser is in place, the diffuser should be replaced.

(3) Testing Procedures.

(a) Place an FGIS-approved light meter face up on an analysis surface. If necessary, turn the meter on and set it to the proper range.

(b) Stand away from the meter so that you do not block the light, but close enough to read the meter dial. Allow the meter to stabilize. It should be at room temperature.

(c) Read the dial. If the meter reading is between 150 and 200 foot candles (optimum 180 foot candles), the light source is acceptable.

(d) If the reading is outside the acceptance range, the illumination must be corrected by varying the distance of the source to the surface, changing the spacing of the sources, altering the number of emitters, or relamping.

(e) Repeat the test for all analysis surfaces.

(f) Upon completion of the test, record the results of the test on letterhead paper.

(g) In the case of out-of-tolerance lights, document on the record all pertinent facts and actions (including adjustments, retest, and follow-up action).

(h) After all test results are recorded, file the original record. Agencies shall also submit one copy of the record to the appropriate FGIS field office. (FGIS field offices do not need to submit copies of this particular record to FGIS Headquarters.)

(4) Light Meters.

(a) Only use light meters that are approved by FGIS.

(b) After any repairs, ensure that the meter is either factory adjusted or used with a calibration table. Calibration tables give the actual corrections to apply to each light meter at several reference readings. They are available from the FGIS Technical Services Division

2. ENVIRONMENT

a. The quality of an artificial light source may be affected by the color environment surrounding the source. To preserve the proper color environment:

(1) Exclude bright outside illumination from the laboratory.

(2) Paint the analysis rooms with nonreflecting paint (light gray or green preferred). Note: A flat white paint or an off-white acoustical tile may be used on ceilings, providing the white color does not extend below the level of the artificial lighting.

(3) Install light-colored, unpolished floors.

(4) Encourage the use of clean non-color selective glass or plastic eyewear.

(5) Cover a 16 inch x 24 inch (minimum) analysis surface with material approved by FGIS.

3. EQUIPMENT SAFETY

a. General Tips.

(1) Keep equipment clean and properly maintained.

(2) Keep all machine guards properly attached.

(3) Keep electrically-powered equipment clear of waterlines and drains. Extension cords, if necessary, shall have the proper load capacity to operate the equipment without danger of overheating.

(4) Do not use extension cords across the floor at doorways or as a substitute for fixed wiring.

(5) Do not make repairs or adjustments to equipment while the equipment is operating. Electrical repairs shall only be made when the device is disconnected from the power source.

(6) Fit inspection lights that are mounted above analysis tables with bumpers on all exposed edges where employees might strike their heads.

b. Electrical Safety Inspection--Grounding.

(1) The accepted electrical standards are in the Code of Federal Regulations, Subpart S (1910.301 to .309), effective April 16, 1981. Much confusion exists because the Code uses the word "grounding" to mean several different things. It is important to know the difference between "equipment grounding" and "system grounding". The distinction is that equipment grounding connects all of the noncurrent-carrying metal surfaces together and to ground; whereas system grounding actually connects one of the current-carrying conductors (wires) to ground.

(a) Equipment grounding bonds all metal equipment surfaces together so there can be no voltage between them; and it provides a ground-fault current path from a fault location back to the electrical source, so that the fault current will rise to a level high enough to operate the over current protective device.

(b) System grounding provides the final connection from equipment-grounding conductors to the grounded circuit conductor thus completing the ground-fault loop; and it solidly ties one circuit conductor to "ground," so that voltages from any source cannot cause harmfully high voltage to ground.

It should be noted that equipment grounding--bonding all equipment surfaces together to ground with a grounded, three-wire plug--is required whether or not the system is to be grounded.

(2) All equipment shall be inspected for proper grounding at least once a year.

(a) Equipment Grounding. All equipment and appliances that are not double insulated must be equipped with a grounded, blind front 3-wire plug.

1) Unplug the equipment and check with a simple battery-powered continuity tester such as an Allied, model 70305 (catalog No. 979-7000).

2) There should be continuity from the ground pin of the plug to the body or case of the equipment. This indicates that all noncurrent carrying metal surfaces are connected to ground.

(b) System Grounding.

1) Unplug all equipment and appliances.

2) Test each receptacle for correct wiring by using a 3-wire circuit monitor such as Fisher Scientific #09-525-Ground Monitor or Lab Safety Supply #YB-1509.

(c) Record. Record the results in a memorandum to your file.

4. LABORATORY SAFETY

a. Fire Protection.

(1) All personnel shall be familiar with building evacuation plans and follow recommendations of building management on evacuation procedures.

(2) Building elevators shall not be used for emergency evacuations unless specifically designed for this purpose.

b. Other Hazards.

(1) New methods and equipment are being developed to speed and improve grain inspection. Use of these methods and equipment may create special hazards.

(a) Thoroughly study all operating instructions and test procedures.

(b) Use protective equipment.

(2) When using high-intensity black lights, wear glass-lens safety glasses or ultraviolet light filtering goggles.

(a) Do not look into a black light beam or shine it at another individual.

(b) Do not use a black light on a highly reflective surface.

(3) Chemicals used in some inspection processes can be hazardous; read labels and use according to instructions. Read the material safety data sheet.

(a) Use proper chemicals and label all chemical containers.

(b) Use proper disposal procedures for all chemicals and their waste products.

(c) Store chemicals properly to prevent accidental container breakage; heed storage temperature requirements and chemical compatibility warnings.

(d) Store syringes and needles in separate locked containers. After they are used they shall be placed in puncture-resistant containers for disposal. Do not bend or break needles by hand.

(e) When using chemicals, ensure that the area is properly ventilated.

(f) When it is necessary to use a fume hood, make sure the hood is operating properly and the face-velocity of the air being moved by the fume hood is a minimum of 100 - 150 cubic feet per minute. (An inexpensive vaneometer, such as the Dwyer No. 480, can easily and quickly determine the air velocity. Follow the manufacturer's instructions for using the vaneometer.)

c. Safety Consciousness. Safety in a controlled environment such as the inspection laboratory is the responsibility of all personnel.

(1) Follow proper procedures, be alert for possible hazards, and correct or eliminate potential hazards immediately.

(2) Respect your coworkers' right to a safe environment by working safely yourself.

(3) Maintain a basic First Aid Kit.

(4) Train employees in First Aid and Cardiopulmonary Resuscitation.

(5) Pick up spills immediately. Keep surplus grain buildup to a minimum.

d. Safety Reference for Laboratories.

(1) OSHA Safety and Health Standards, 29 CFR 1910 is available from Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, or your local OSHA office.

(2) Safety manuals and pamphlets are available from most major laboratory supply companies.

(3) Collateral duty safety and health officers maintain material safety data sheets for chemicals encountered on the job.