CRITERION 501

INTERIOR LIGHTING SYSTEMS

SIGNATURES

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RECORD OF REVISIONS

Revision No.	Date	Description
0	8/27/98	Initial Issue. Reformatted to support LIR 230-05-01 (replaces 3.9-501, Rev. 1).
1	1/15/03	This revision includes the incorporation of ORPS & NRC lessons learned 1/1/95 to 6/2000. This revision also includes the incorporation of all formatting changes addressed in Revision 3 of the O&M Criterion 101 Writer's Guide.

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1.0 PURPOSE

The purpose of this Criterion is to establish the minimum requirements and best practices for operation and maintenance of interior-lighting systems at LANL.

This document addresses the requirements of LIR 230-05-01(Ref 10.1), "Operations and Maintenance Manual."

Implementation of this Criterion satisfies DOE Order 430.1A (Ref 10.2) for the subject equipment / system. DOE Order 430.1A (Ref 10.2)"Life Cycle Asset Management," Attachment 2 "Contractor Requirements Document," Paragraph 2, Sections A through C, which in part requires UC to "…maintain physical assets in a condition suitable for their intended purpose," and employ "preventive, predictive, and corrective maintenance to ensure physical asset availability for planned use and/or proper disposition." Compliance with DOE Order 430.1A is required by Appendix G of the UC Contract.

2.0 SCOPE

The scope of this Criterion includes the routine inspection, testing and preventive and predictive maintenance of interior lighting systems at all nuclear and non-nuclear LANL facilities. This document covers the cleaning of lighting equipment, relamping of lighting equipment, and the inspection of auxiliary units such as ballasts, starters, and sockets. It excludes emergency lighting systems that are the subject of Criterion 503. This Criterion does not address corrective maintenance actions required to repair or replace equipment.

3.0 ACRONYMS AND DEFINITIONS

3.1 Acronyms

AHJ	Authority Having Jurisdiction
CFR	Code of Federal Regulations
DOE	Department of Energy
LIG	Laboratory Implementing Guidance
LIR	Laboratory Implementing Requirement

LPR	Laboratory Performance Requirement
O&M	Operations and Maintenance
PPE	Personal Protective Equipment
PP&PE	Personal Property and Programmatic Equipment
RP&IE	Real Property and Installed Equipment
SSC	Structures, Systems, and Components
TCLP	Toxicity Characteristic Leaching Procedure
UC	University of California

3.2 Definitions

Cleaning. The removal of accumulated dirt and other contaminants from lamps, reflectors and lenses

Group Relamping. The replacement of all the lamps in an area at a defined time interval or when the lighting system output falls below the desired level.

Rated-Average Lamp Life. The number of operating hours at which one-half of lamps will have failed.

Spot Relamping. The replacement of individual lamps as they fail.

4.0 RESPONSIBILITIES

4.1 FWO-Systems, Engineering and Maintenance (SEM)

4.1.1 FWO-SEM is responsible for the technical content of this Criterion and monitoring the applicability and the implementation status of this Criteria and either assisting the organizations that are not applying or meeting the implementation expectations contained herein or elevating their concerns to the director(s).

Basis: LIR 301-00-01.11; Issuing and Managing Laboratory Operations Implementation Requirements and Guidance, Section 5.4, OIC Implementation Requirements.

4.1.2 FWO-SEM shall provide technical assistance to support implementation of this Criterion.

4.2 Facility Manager

4.2.1 Responsible for operations and maintenance of institutional, or Real Property and Installed Equipment (RP&IE) under their jurisdiction, in accordance with the requirements of this document.

4.2.2 Responsible for operations and maintenance of those Personal Property and Programmatic Equipment (PP&PE) systems and equipment addressed by this document that may be assigned to the FM in accordance with the FMU-specific Facility/Tenant Agreement.

4.3 Group Leader

4.3.1 Responsible for operations and maintenance of those Personal Property and Programmatic Equipment (PP&PE) systems and equipment addressed by this document, which are under their jurisdiction.

4.3.2 Responsible for system performance analysis and subsequent replacement or refurbishment of assigned PP&PE.

4.4 Authority Having Jurisdiction (AHJ) - POC for Electrical Chapter of LANL Engineering Manual

4.4.1 The AHJ is responsible for providing a decision on a specific technical question regarding this criterion.

5.0 PRECAUTIONS AND LIMITATIONS

5.1 Precautions

This section is not intended to identify all applicable precautions necessary for implementation of this Criterion. A compilation of all applicable precautions shall be contained in the implementing procedure(s) or work control authorization documents. The following precautions are intended only to assist the author of a procedure or work control document in the identification of hazards/precautions that may not be immediately obvious.

5.1.1 Consider ballasts and capacitors manufactured before 1978 and ballasts and capacitors with no labeling concerning PCB content as PCB-containing. Dispose of PCB-containing ballasts and capacitors following LIR 404-00-03. (Ref. 10.10)

5.1.2 Consider used fluorescent or high intensity discharge (HID) lamps with no labeling concerning mercury content as mercury containing. Dispose of mercury-containing lamps following LIR-404-00-03. (Ref.10.10)

5.1.3 Consider used incandescent and high intensity discharge lamp bases as lead containing. Dispose of lead-containing lamp bases following LIR 404-00-03. (Ref.10.10)

5.1.4 Smoking or odorous ballasts are a potential fire hazard. Investigate and repair these items.

5.1.5 Electrical Safety – LIR 402-600-01.1 shall apply (Ref. 10.6.)

5.2 Limitations

The intent of this Criterion is to identify the minimum generic requirements and recommendations for SSC operation and maintenance across the Laboratory. Each user is responsible for the identification and implementation of additional facility-specific requirements and recommendations based on their authorization basis and unique equipment and conditions, (e.g., equipment history, manufacturer warranties, operating environment, vendor O&M requirements and guidance, etc.).

Nuclear facilities and moderate to high-hazard non-nuclear facilities will typically have additional facility-specific requirements beyond those presented in this Criterion. Nuclear facilities shall implement the requirements of DOE Order 4330.4B (Ref. 10.3) as the minimum programmatic requirements for a maintenance program. Additional requirements and recommendations for SSC operation and maintenance may be necessary to fully comply with the current DOE Order or CFR identified above.

6.0 REQUIREMENTS

Minimum requirements that Criterion users shall follow are specified in this section. Requested variances to these requirements shall be prepared and submitted to FWO-SEM in accordance with LIR 301-00-02 (Ref. 10.4), "Variances and Exceptions to Laboratory Operations Requirements," for review and approval. The Criterion users are responsible for analysis of operational performance and SSC replacement or refurbishment based on this analysis. Laws, codes, contractual requirements, engineering judgement, safety matters, and operations and maintenance experience drive the requirements contained in this section.

6.1 Operations Requirements

6.1.1 Replacement lamps and ballasts shall comply with the National Energy Policy Act of 1992.

Basis: EO 13123 Section 403(c) calls for government agencies to strive to meet EPA Energy Star building criteria. (Ref. 10.11)

6.1.2 Relamping shall be performed only by personnel qualified in the handling and disposal of potentially hazardous materials.

Basis: LIR 404-00-03 Section 6.4.6 specifically addresses lamps. (Ref. 10.10)

6.2 Maintenance Requirements

6.2.1 No requirements beyond those stated in Section 5.2, Limitations.

7.0 RECOMMENDATIONS AND GOOD PRACTICES

The information provided in this section is recommended based on acceptable industry practices and should be implemented by each user based on his/her unique application and operating history of the subject systems/equipment.

7.1 Operations Recommendations

7.1.1 In situations where lighting may be on longer than needed, left on in unoccupied areas, or used when sufficient daylight exists, the EPA Energy Star Building Manual (EPA-430-B-98-004A) suggest installing automatic controls since they have the potential to reduce lighting energy use by up to 35%.

Basis: EO 13123 Sec. 403(e) states that Federal Agencies should strive to meet Energy Star Building Criteria

7.1.2 As an aid to determine proper occupancy sensor applications this table should be used.

Basis: EPA Energy Star Building Manual (EPA-430-B-98-004A) Table 7.

OCCUPANCY SENSOR APPLICATIONS								
Sensor Technology	**Private Office**	**Large Open Office Plan**	**Partitioned Office Plan**	**Conference Room**	**Restroom**	**Closets/ Copy Rooms**	**Hallways & Corridors**	**Warehouse Aisles**
Ultrasonic Wall Switch	✔			✔	✔	✔		
Ultrasonic Ceiling Mount	✔	✔	✔	✔	✔	✔		
Infrared Wall Mount	✔			✔		✔		
Infrared Ceiling Mount	✔	✔	✔	✔		✔		
Ultrasonic Narrow View							✔	
Infrared High-Mount							✔	✔

OCCUPANCY SENSOR APPLICATIONS								
Sensor Technology	**Private Office**	**Large Open Office Plan**	**Partitioned Office Plan**	**Conference Room**	**Restroom**	**Closets/ Copy Rooms**	**Hallways & Corridors**	**Warehouse Aisles**
Narrow View								
Corner-Mount Wide-View Technology		✔		✔				

7.2 Maintenance Recommendations

7.2.1 Cleaning

7.2.1.1 Lighting equipment should be cleaned periodically. Fixtures should be cleaned at relamping and when lighting levels fall 15 to 20 percent below design level (i.e. 40 ft-cd)

Basis: NFPA 70B-15-2.1 recommends this activity. (Ref. 10.7)

7.2.1.2 Fixture washing is generally better than wiping. The cleaning procedure should be in accordance with the instruction of the fixture manufacturer.

Basis: NFPA 70B-15-2.2 recommend washing. (Ref. 10.7)

7.2.1.3 Cleaning should be as follows:

- Wipe with a moist cloth or sponge. When incrustation is not removed by sponging, use nylon abrasive pad to remove dirt film. Steel wool should only be used if nylon fails to clean fixture. Care should be taken to ensure that shreds of steel wool do not touch the pin contacts or get into the lamp socket.

NOTE: If steel wool is used to clean the fixture then use Lockout/Tagout in accordance with LIR 402-860-01.0, "Lockout/Tagout for Personal Safety."

- Wipe off excess moisture with a clean cloth. Clean fixtures holders and stem hangers with a moist sponge or cloth and wipe dry. Reflecting surfaces that cannot be adequately cleaned and polished should be replaced.

Basis: TM 5-683/NAVFAC MO-116/AFJMAN 32-1083 Paragraph 9-5 deals with cleaning techniques. (Ref. 10.8)

7.2.2 Group relamping can reduce the cost of operating a lighting system while keeping illuminance level close to design value.

Basis: IESNA Lighting Handbook page 28-2 deal with planned maintenance techniques. (Ref. 10.9)

7.2.2.1 The recommended relamping method is a follows: Replace all lamps in a given area upon completion of 80% of rated manufactures burning life. While the existing lamps are lighted, pick the best 20% of old lamps and save for replacement stock. Discard the remainder of lamps. Install new lamps in all sockets. Use the replacement stock to replace individual lamps as they burn out.

Basis: TM 5-683 Paragraph 9-6 gives the DOD recommended relamping procedures. (Ref. 10.8)

7.2.2.2 Replacement lamps should be of the same type, color, wattage and voltage as those being replaced. (Does not apply to energy conservation upgrades.).

Basis: TM 5-683 Paragraph 9-6 gives the DOD recommended relamping procedures. (Ref. 10.8)

7.2.2.3 Fluorescent replacement lamps should pass the EPAs Toxicity Characteristic Leaching Procedure (TCLP) test for low mercury content to reduce disposal of potentially hazardous waste.

Basis: NFPA 70-B-15-3.3 addresses relamping. (Ref. 10.7)

8.0 GUIDANCE

8.1 Operations Guidance

No implementing guidance available.

8.2 Maintenance Guidance

No implementing guidance available.

9.0 REQUIRED DOCUMENTATION

Maintenance history shall be maintained by FM for interior lighting systems to include, as a minimum, the parameters listed in the Table 9-1 below:

Table 9-1 Documentation Parameters

MAINTENANCE HISTORY DOCUMENTATION PARAMETERS				
Parameter	**ML 1**	**ML 2**	**ML 3**	**ML 4**
Maintenance Activities				
Repair / Adjustments	**X**	**X**	**X**	**X**
PM Activities	**X**	**X**		
Equipment Problems				
Failure Dates				
Failure Root Cause				
Inspection Results				
Inspection Date	**X**	**X**		
SSC Condition				

Basis: Documentation of the parameters listed in Table 9-1 above satisfies the requirements of LPR 230-07-00, Criteria 2, (Ref. 10.5) which states; "Maintenance activities, equipment problems, and inspection and test results are documented."

10.0 REFERENCES

10.1 LIR 230-05-01.0, Operation and Maintenance Manual.

10.2 DOE O 430.1A, Attachment 2 "Contractor Requirements Document" (Paragraph 2, Sections A through C), a requirement of Appendix G of the UC Contract.

10.3 DOE Order 4330.4B, Maintenance Management Program, Section 3.4.9.

10.4 LIR 301-00-02.0, Variances and Exceptions to Laboratory Operation Requirements.

10.5 LPR 230-07-00.0, Maintenance History, Performance Criteria [2].

10.6 LIR 402-600-01.1, Electrical Safety

10.7 NFPA 70B, Electrical Equipment Maintenance

10.8 ARMY TM 5-683, NAVY NAVFAC MO-116, AIR FORCE AFJMAN 32-1003, Electrical Interior Facilities

10.9 IESNA, Lighting Handbook.

10.10 LIR 404-00-03.1, Hazardous & Mixed Waste Requirements.

10.11 EO 13123 Section 403(c) - Greening the Government through Efficient Energy Management.

11.0 APPENDICES

None.