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Safe Electrical Installations Policy

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Title:	Safe Electrical Installations Policy
Publication date:	1/18/2019
Effective date:	11/24/2014

POLICY

A. Purpose

The Safe Electrical Installations Policy is intended to:

- Define distinct roles and responsibilities and describe the required independence between design and approval.
- Minimize the risk of personnel injury and property loss.
- Maintain the integrity of electrical distribution systems at Lawrence Berkeley National Laboratory (Berkeley Lab).

The Electrical Authority Having Jurisdiction for Safe Installations (IAHJ) is delegated the Electrical AHJ over electrical distribution and supply systems and equipment throughout the Berkeley Lab main site and within Berkeley Lab buildings. The IAHJ has the authority to approve planning, inspection, testing, and energization of new electrical installations and modifications to existing electrical systems and equipment.

The IAHJ Program is designed to implement and ensure compliance with National Fire Protection Association (NFPA) 70, *National Electrical Code*; NFPA 70E, *Standard for Electrical Safety in the Workplace*; federal Occupational Safety and Health Administration (OSHA) regulations as identified in the Worker Safety and Health Program (10 CFR 851); and the Berkeley Lab Facilities *Master Specification and Standards*.

B. Persons Affected

This procedure applies to all employees, visitors, and subcontractors at the Berkeley Lab main site involved with planning, inspection, testing, or energization of new electrical installations and modifications to existing electrical systems and equipment.

C. Exceptions

This policy does not apply to facilities outside the Berkeley Lab main site or to main-site facilities housing activities not pursuant to the UC-DOE Prime Contract (Contract 31), and where the University of California (UC) or other state, city, or county Authority Having Jurisdictions (AHJs)/Building Code Official jurisdictions apply.

This policy does not apply to incidental work, such as electrical systems and equipment preventive maintenance, troubleshooting, minor repair, or routine switching. In addition, it does not apply to scientific research equipment or to a utility service provider's equipment and wiring maintenance at Berkeley Lab and UC Berkeley substations.

The following sites have been specifically excluded from this procedure:

- Building 1 (Donner Lab) on the UC Berkeley (UCB) campus.

- DOE-funded research activities on the UCB campus.
- Building 23 (Guest House) on the Berkeley Lab main site.
- Building 32 (UCB substation) on the Berkeley Lab main site inclusive of connection with UCB switching and metering.
- Building 54A ATM kiosk on the Berkeley Lab main site.
- Buildings 100, 310, 400, and 500 (the Joint Genome Institute [JGI], Walnut Creek, CA)
- Building 943 (Oakland Scientific Facility, Oakland, CA).
- Building 971 (Office of the Chief Financial Officer, Emeryville, CA).
- Building 975 (Physical Biosciences Division, KBase, Emeryville, CA).
- Building 976 (Materials Sciences Division, the Joint Center for Artificial Photosynthesis [JCAP], Berkeley, CA).
- Building 977 (Life Sciences Division at Potter St., Berkeley, CA).
- Building 978 (Physical Biosciences Division, the Joint BioEnergy Institute [JBEI] and the Advanced Biofuels Process Demonstration Unit [ABPDU], Emeryville, CA).
- Leased facilities and research programs outside the San Francisco Bay Area such as the Sanford Underground Research Facility (SURF), the IceCube Laboratory, etc.

D. Policy Statement

1. The IAHJ process requires review, inspection, testing, and approval of all electrical work consisting of construction, modifications, and/or demolitions of new electrical installations and modifications to existing electrical systems and equipment. This includes permanent or temporary wiring and connections from the service point or power source through the high-, medium-, and/or low-voltage power distribution to power outlets or hardwired connections to equipment, including but not limited to:
 - a. Transmission lines and support structures, duct banks, raceways, and conduits
 - b. Transformers, unit substations, and switchgears
 - c. High-, medium-, and low-voltage (as defined by Institute of Electrical and Electronics Engineers [IEEE] 141.1993, *Recommended Practice for Electric Power Distribution for Industrial Plants*) distribution wiring and equipment
 - d. Power factor correction capacitor banks
 - e. Grounding and corrosion-protection systems
 - f. Meters and instrumentation
 - g. Switchboards, motor control centers, and panelboards
 - h. Emergency and standby power-generation equipment, and photovoltaic panels
 - i. Automatic-transfer switches and uninterruptible power supplies
 - j. Feeder and branch circuits, electrical control panels, and wiring connections
 - k. Inverters (variable speed drives), motor drives, and connections to motors
 - l. Lighting, low-voltage signals, and building controls wiring
 - m. Information technology systems, networks, and fiber-optic cables
 - n. Fire detection, fire alarm, security, and notification-systems wiring
 - o. Facilities monitoring and control systems and
 - p. Associated hardware, fittings, and wiring devices
2. The IAHJ process is also required to field verify noncompliant electrical equipment, assemblies, and systems, including but not limited to:
 - a. Field validation of Nationally Recognized Testing Laboratory (NRTL) listed/labeled equipment for electrical distribution and general facility use (e.g., control panels, switches, cranes, elevators).
 - b. Acceptance or rejection of equipment that does not comply with National Fire Protection Association (NFPA) 70, or that does not adhere to Berkeley Lab Facilities Division standards and specifications.
 - c. When an installation does not meet the requirements of NFPA 70E.
3. If there is uncertainty about the need for an IAHJ review, contact the Berkeley Lab IAHJ for guidance. Furthermore, the project manager, construction

manager, engineer(s), and/or performing craft may request an IAHH review at his/her discretion under any circumstances. The IAHH Program does not define design solutions or remedies to code or specification deficiencies.

- Under the direction of the Electrical AHJ for Safe Installations (IAHH), the Lead Electrical Inspector, Compliance Engineer(s)/Electrical Codes and Standards Compliance Professional, and Inspector(s) of Record have the responsibility to administer and enforce the IAHH Program. The authority to perform assigned tasks may be delegated to another qualified position in the same organization, but the responsibility for the action remains with the position named. The Berkeley Lab position description for each staff member includes a full listing of the job duties, responsibilities, and education and certification/license requirements.
- The effective code date (code of record) for new and remodeled Berkeley Lab building projects is the edition of the NFPA 70 National Electrical Code (NEC) as adopted by the Laboratory per 10 CFR 851, formalized by Berkeley Lab's Worker Safety & Health Program document (PUB-3851) at the time of the final submittal of Preliminary Drawings (Design Development Drawings and Specifications). The date of receipt of this submittal is the official "date of record" for the project. The edition of the NEC in effect on that date as adopted by Berkeley Lab will be applied for the duration of the project. In the event Preliminary Drawings are not submitted to the Berkeley Lab Fire Marshal prior to submission of Construction Documents (defined as Working Drawings and Specifications), the edition of the NEC in effect on the date of receipt of the Construction Documents by the Berkeley Lab Fire Marshal will apply.
- Generally, consensus codes and standards do not obligate an owner to retrofit existing installations to more current editions of the document. However, modifications to existing facilities or infrastructure equipment, assemblies, and wiring are subject to inspection to verify compliance with the codes and standards as of the date of record for the installation. If the modification presents a hazard to life, equipment, or property, current codes and standards shall be used to define requirements for mitigating the hazard. Any NRTL listing invalidated by a modification will require an NRTL field examination by the Berkeley Lab Electrical AHJ for Safe Equipment and re-listing prior to acceptance by the IAHH.
- The Design Professional, whether a Berkeley Lab employee or a subcontracted Electrical Engineer, is responsible for designing the electrical installation in accordance with applicable codes and in adherence to the Berkeley Lab *Master Specifications and Standards* and *Construction Design and Detail Guidelines*.
- When an outside Design Professional and a Berkeley Lab Electrical Engineer subject matter expert (SME) have a difference of interpretation regarding the NEC code or Berkeley Lab *Master Specifications and Standards*, then a binding interpretation will be provided by the IAHH. The Design Professional shall submit supporting documentation, including but not limited to a concise statement on the scope of work, applicable code or specification sections, calculations, a description of the difference of interpretation, etc., to inform the IAHH's interpretation.

E. Roles and Responsibilities

Under the direction of the Electrical AHJ for Safe Installations (IAHH), the Lead Electrical Inspector, Compliance Engineer(s)/Electrical Codes and Standards Compliance Professional, and Inspector(s) of Record have responsibility to administer and enforce the IAHH Program. The authority to perform assigned tasks may be delegated to another qualified position in the same organization, but the responsibility for the action remains with the position named in the table below. The position description for each Berkeley Lab staff member includes a full listing of the position's job duties, responsibilities, and education and certification/license requirements.

Role	Responsibility
Building Code Official	The Berkeley Lab Building Code Official (BCO) oversees major organizational components of code enforcement and is accountable for ensuring building codes are met in new facilities, and that a path to compliance is developed and implemented for older infrastructures. This accountability is informed by engineering staff, Electrical Authorities Having Jurisdiction (AHJs), the Fire Marshal, and inspectors.
Electrical AHJ for Safe Installations (IAHH)	The IAHH is the qualified individual delegated the Electrical AHJ over the electrical distribution and supply systems and equipment throughout the Berkeley Lab main site and within all Berkeley Lab buildings. The IAHH: • Interprets the requirements of electrical codes, regulations, standards, and Berkeley Lab specifications. • Maintains the related Berkeley Lab and Facilities Division policy, implementation, and enforcement documents. • Manages the Electrical AHJ for Safe Installations Program and staff. • Attends the Electrical Safety Advisory Board and DOE Berkeley Site Office AHJ meetings. • Is a member of the Electrical Safety Committee. • Determines applicable electrical code of record for each new project and existing Berkeley Lab buildings.

	• Approves electrical equipment and wiring installations in new construction, modifications, repairs, and demolitions.
Lead Electrical Inspector	• Administers and enforces the requirements of the IAHH Program procedures. • Supervises the Inspectors of Record (IORs). • Provides backup coverage for the Compliance Engineer and IORs as needed. • Reviews all compliance, inspection, and punch-list-item reports for adherence to procedures. • Confirms that all electrical-related punch-list items are completed. • Validates sign-off affidavits.
Compliance Engineer/ Electrical Codes and Standards Compliance Professional	• Enforces and implements the IAHH Program at the project level for designs, installations, and modifications of new and existing electrical equipment and wiring. • Performs design reviews and provides advice on design requirements, code compliance, specification adherence, and inspection and testing requirements. • Maintains expert-level knowledge of electrical codes, Occupational Safety and Health Administration (OSHA) regulations, the Facilities <i>Master Specifications and Standards</i>, and other electrical equipment and wiring installation requirements. • Works with the Building Code Official to approve or reject proposed configurations or technologies that deviate from specifications but comply with Berkeley Lab's interpretation of applicable codes. • Reviews energization plans and Energization Validation and Authorization Package (EVAP) documents, and performs field visits to validate electrical equipment and wiring configuration for planning and testing integrity. • Identifies non-NRTL equipment and assemblies, tracks field examinations, and validates completion of corrections for required NRTL labeling per equipment.
Design and Construction Management, Project Management Office	The Design and Construction Management (DCM) Department follows the DCM Procedures Manual and is subject to the requirements of the IAHH Program.
Design Professional	The Electrical Engineer who is responsible for designing the electrical installation in accordance with applicable codes and in adherence to the Berkeley Lab <i>Master Specifications and Standards</i> . The Design Professional must hold an electrical professional engineer (PE) license issued by the state of California, apply design principles appropriate to the scope of the project, and compile complete drawings and specifications, as needed, for accurate cost estimating, bidding, and constructing with a minimum of changes.
Electrical AHJ for Safe Equipment (EAHJ)	The EAHJ is delegated the authority having jurisdiction over all of the Laboratory's electrical utilization equipment. The EAHJ ensures compliance with utilization equipment safety codes, standards, and specifications. The process for accepting electrical equipment is detailed in PUB-3000 Chapter 14, Electrical Equipment Safety Program , and includes the inspection and acceptance of unlisted (non-NRTL) electrical equipment. The Electrical Engineer who is responsible for designing the electrical installation in accordance with applicable codes and in adherence to the Berkeley Lab master specifications and details.
Electrical AHJ for Safe Installations (IAHJ)	The IAHH is delegated the authority having jurisdiction over all of Berkeley Lab's electrical premises wiring, up to but excluding electrical utilization equipment. The IAHH ensures compliance with installation codes, standards, and specifications for the infrastructure power distribution and premises wiring of the Laboratory.
Electrical AHJ for Safe Work Practices (PAHJ)	The PAHJ is delegated the authority having jurisdiction over electrical safe work practices and workplace conditions. The PAHJ ensures compliance with all electrical safety requirements that pertain to maintaining safe electrical work practices and workplace conditions and thereby for protecting Berkeley Lab employees, contractors, and subcontract personnel from injury or death as a result of electrical hazards.
Facilities Work Planning & Control (WPC)	Facilities WPC reviews work requests and coordinates with Berkeley Lab Plant Engineering & Utilities and Maintenance, Repair, and Operations (MRO) supervisors to schedule facilities and infrastructure maintenance, repair, modification, construction support, and associated activities, such as utility shutdown notifications. WPC also schedules electrical equipment and wiring inspections as defined in the IAHH Program requirements.
Inspector of	• Provides inspection of electrical wiring and equipment installations, and witnesses testing and procedures when electrical

Record (IOR)	equipment is being energized to verify adherence to design and specifications. • Performs site inspections as needed to assure compliance with codes, subcontract specifications, Berkeley Lab <i>Master Specifications and Standards</i>, and NRTL certification. • Responsible for following up by tracking nonconformance issues with re-inspections, and final signoff affidavits as applicable. • Develops and completes all pre-concealment, testing, and final inspection reports. • Uploads and maintains all inspection reports and records accordingly within the IAHH Program database. • Updates the IAHH Program metrics.
Maintenance, Repair, and Operations (MRO)	MRO functions include maintenance, repair, replacement, and modifications to existing electrical and electronics equipment and wiring systems. MRO is subject to the requirements of the IAHH Program.
Plant Engineering and Utilities	The organization within the Facilities Division with the mission to provide accurate Berkeley Lab infrastructure documentation, facility/equipment capacity verification, and review and/or development of MOPs.
Responsible Individual (RI)	The RI is responsible for requesting the services of an Inspector of Record or Compliance Engineer in an effective and timely manner. See the DCM Procedures Manual for a complete RI definition.
Subject Matter Expert	A Berkeley Lab employee or consultant with specialized knowledge about a certain topic or field of interest. The individual must also be knowledgeable about an operation or activity and be responsible for the quality evaluation and control of the operation or activity.
Qualified Electrical Worker (QEW)	California state certified electricians (subcontract and in-house Berkeley Lab personnel) responsible for performing or supervising the electrical work of installing or modifying electrical equipment and wiring. See the Berkeley Lab <i>ES&H Manual</i> (PUB-3000) Electrical Safety requirements for a complete QEW definition.

F. Definitions/Acronyms

Term	Definition
Energization Validation & Authorization Package (EVAP)	An authorized work-control package of documents assembled by the Responsible Individual to establish readiness for energization. Each EVAP must be reviewed and approved by all applicable Electrical AHJs: the Electrical AHJ for Safe Work Practices (PAHJ); the Electrical AHJ for Safe Installations (IAHJ); and the Electrical AHJ for Safe Equipment (PAHJ, IAHJ, and EAHJ). The EVAP is required for minor to complex work with adherence to Berkeley Lab's ES&H Core Policy and the Electrical Safety program.
Hold Point	A point at which the Responsible Individual (RI) is required to notify the Inspector of Record (IOR) prior to undertaking subsequent work. Subsequent work may not proceed until the RI requests an inspection; an inspection of the work is performed by the IOR; and the IOR passes the Hold Point, indicating that the subcontractor may proceed with subsequent activities.
IAHJ Review	A review by the IAHJ staff of a project's scope of work (construction, installation, modification, and/or demolition) to plan and formalize inspection, testing, and Energization Validation & Authorization Package (EVAP) requirements for electrical work. An IAHJ review may also include a field-condition assessment; pre-concealment, testing, and final inspections; and reviews of test results and engineering evaluations, etc.
Method of Procedure (MOP)	A step-by-step procedure followed when performing energization, utility tie-in, or equipment start-up. This document references Lockout/Tagout permits, equipment numbers, etc., included in a switching tag that documents all steps for shutdown/deactivation and activation/energization of new or existing electrical equipment and wiring installations and modifications.
Nationally Recognized Testing Laboratory (NRTL)	An NRTL is a U.S. Occupational Safety and Health Administration (OSHA) designation given to testing facilities that provide product safety testing and certification services to manufacturers. The testing and certification are done to U.S. consensus-based product safety test standards issued by organizations such as the American National Standards Institute (ANSI).
Witness Point	A point identified in the Witness and Hold Inspection Plan during the construction of a given element in which the IOR inspects the activity point that has been reached.

G. Recordkeeping Requirements

The Lead Electrical Inspector will ensure that IAHH Review, Plan, and Inspection forms in the IAHH Program database are current and tracked for closeout. Project inspection reports and test results shall also be included with the project records and organized in accordance with the subcontract document record requirements filed under direction of the Project Manager. The inspection reports shall be filed with the IAHH Review form in the IAHH database for in-house craft work.

H. Implementing Documents

Document number	Title	Type
07.07.011.002	Work Process A, Electrical Safety Program Structure	Work Process
07.07.011.003	Work Process B, Electrical Authority Having Jurisdiction (AHJ)	Work Process
07.07.034.000	Electrical Equipment Safety Program	Program
07.07.020.000	Lockout/Tagout Program	Program
ADMN-059	Planned Utility Shutdown Coordination	Procedure
DCM-001	Work Requiring Responsible Individual (RI)	Procedure
FACILGEN-001	Deactivation Plans for Building Electrical and Mechanical Systems and Site Utilities	
FM-059-01	Quality Plant Engineering & Utilities Modifications Authority and Roles Form	Form
FM-059-02	Application for Utility Service	Form
FORM-INS-001	IAHH Review Form	Form

I. Contact Information

Electrical Authority Having Jurisdiction for Safe Installations
Facilities Division

J. Revision History

Date	Revision	By Whom	Revision Description	Section(s) Affected	Change Type
7/31/2015	0	D. Nielsen	Re-formatted for wiki	All	Major
1/17/2019	1	D. Nielsen	Update language to conform with adoption of NEC 2017	Policy Statement Roles/ResponsibilitiesRecordkeeping	Minor

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