Safe Electrical Installations Policy

Brief

<table>
<thead>
<tr>
<th>Title:</th>
<th>Safe Electrical Installations Policy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Publication date:</td>
<td>7/31/2015</td>
</tr>
<tr>
<td>Effective date:</td>
<td>11/24/2014</td>
</tr>
</tbody>
</table>

BRIEF

Policy Summary

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 and
- Maintain the integrity of electrical distribution systems at Berkeley Lab

The Electrical Authority Having Jurisdiction for Safe Installations (IAHJ) is delegated the Electrical AHJ authority 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.

Who Should Read This Policy

All employees, visitors, and subcontractors involved with the planning, inspection, testing, and approval of new electrical installations and modifications to existing electrical systems and equipment

To Read the Full Policy, Go To:

The POLICY tab on this wiki page

Contact Information

Electrical Authority Having Jurisdiction for Safe Installations
Facilities Division

Policy

<table>
<thead>
<tr>
<th>Title:</th>
<th>Safe Electrical Installations Policy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Publication date:</td>
<td>7/31/2015</td>
</tr>
<tr>
<td>Effective date:</td>
<td>11/24/2014</td>
</tr>
</tbody>
</table>

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 and
- Maintain the integrity of electrical distribution systems at 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 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:
   - Transmission lines and support structures, duct banks, raceways, and conduits
   - Transformers, unit substations, and switchgears
   - 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
   - Power factor correction capacitor banks
   - Grounding and corrosion-protection systems
   - Meters and instrumentation
   - Switchboards, motor control centers, and panelboards
   - Emergency and standby power-generation equipment, and photovoltaic panels
   - Automatic-transfer switches and uninterruptible power supplies
   - Feeder and branch circuits, electrical control panels, and wiring connections
   - Inverters (variable speed drives), motor drives, and connections to motors
   - Lighting, low-voltage signals, and building controls wiring
   - Information technology systems, networks, and fiber-optic cables
   - Fire detection, fire alarm, security, and notification-systems wiring,
   - Facilities monitoring and control systems and
   - 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:
   - 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)
   - 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
   - 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 IAHJ review at his/her discretion under any circumstances.

4. Under the direction of the Electrical AHJ for Safe Installations (IAHJ), the Chief Electrical Inspector, Compliance Engineer(s) and Inspector(s) of Record have the responsibility to administer and enforce the IAHJ 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.

5. The effective code date for new and remodeled Berkeley Lab building projects is the edition of California Code of Regulations (CCR) Title 24 adopted by the Laboratory 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 CCR Title 24 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 CCR Title 24 in effect on the date of receipt of the Construction Documents by the Berkeley Lab Fire Marshal will apply.

6. 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 IAHJ.

7. 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.

8. 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 IAHJ. 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 IAHJ's interpretation.

E. Roles and Responsibilities

Under the direction of the Electrical AHJ for Safe Installations (IAHJ), the Chief Electrical Inspector, Compliance Engineer(s) and Inspector(s) of Record have responsibility to administer and enforce the IAHJ 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.

<table>
<thead>
<tr>
<th>Role</th>
<th>Responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Building Code Official</td>
<td>The Berkeley Lab Building Code Official (BCO) oversees major organizational</td>
</tr>
<tr>
<td></td>
<td>components of code enforcement and is accountable for ensuring building codes</td>
</tr>
<tr>
<td></td>
<td>are met in new facilities, and that a path to compliance is developed and</td>
</tr>
<tr>
<td></td>
<td>implemented for older infrastructures. This accountability is informed by</td>
</tr>
<tr>
<td></td>
<td>engineering staff, Electrical Authorities Having Jurisdiction (AHJs), the</td>
</tr>
<tr>
<td></td>
<td>Fire Marshal, and inspectors.</td>
</tr>
<tr>
<td>Electrical AHJ for Safe Installations</td>
<td>The IAHJ is the qualified individual delegated the Electrical AHJ authority</td>
</tr>
<tr>
<td>(IAHJ)</td>
<td>having jurisdiction over the electrical distribution and supply systems and</td>
</tr>
<tr>
<td></td>
<td>equipment throughout the Berkeley Lab main site and within all Berkeley Lab</td>
</tr>
<tr>
<td></td>
<td>buildings. The IAHJ:</td>
</tr>
<tr>
<td></td>
<td>• Interprets the requirements of electrical codes, regulations, standards, and</td>
</tr>
<tr>
<td></td>
<td>Berkeley Lab specifications</td>
</tr>
<tr>
<td></td>
<td>• Maintains the related Berkeley Lab and Facilities Division policy,</td>
</tr>
<tr>
<td></td>
<td>implementation, and enforcement documents</td>
</tr>
<tr>
<td></td>
<td>• Manages the Electrical AHJ for Safe Installations Program and staff</td>
</tr>
<tr>
<td></td>
<td>• Attends the Electrical Safety Advisory Board and DOE Berkeley Site Office</td>
</tr>
<tr>
<td></td>
<td>AHJ meetings</td>
</tr>
<tr>
<td></td>
<td>• Is a member of the Electrical Safety Committee</td>
</tr>
<tr>
<td></td>
<td>• Determines applicable electrical code of record for each new project and</td>
</tr>
<tr>
<td></td>
<td>existing Berkeley Lab buildings and</td>
</tr>
<tr>
<td></td>
<td>• Approves electrical equipment and wiring installations in new construction,</td>
</tr>
<tr>
<td></td>
<td>modifications, repairs, and demolitions</td>
</tr>
<tr>
<td>Chief Electrical Inspector</td>
<td>• Administers and enforces the requirements of the IAHJ Program procedures</td>
</tr>
<tr>
<td></td>
<td>• Supervises the Compliance Engineer(s) and Inspectors of Record (IORs)</td>
</tr>
<tr>
<td></td>
<td>• Provides backup coverage for the Compliance Engineer and IORs as needed</td>
</tr>
<tr>
<td></td>
<td>• Reviews all compliance, inspection, and punch-list-item reports for</td>
</tr>
<tr>
<td></td>
<td>adherence to procedures</td>
</tr>
<tr>
<td></td>
<td>• Confirms that all electrical-related punch-list items are completed and</td>
</tr>
<tr>
<td></td>
<td>• Validates sign-off affidavits</td>
</tr>
</tbody>
</table>
Compliance Engineer

- Enforces and implements the IAHJ 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 Master Specifications and Standards, 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 and safety.
- Identifies non-NRTL equipment and assemblies, tracks field examinations, and validates completion of corrections for required NRTL labeling per equipment requirements.

Design and Construction Management

The Design and Construction Management (DCM) Department follows the DCM Procedures Manual and is subject to the requirements of the IAHJ 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 Master Specifications and Standards. 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 IAHJ is delegated the authority having jurisdiction over all of Berkeley Lab's electrical premises wiring, up to but excluding electrical utilization equipment. The IAHJ 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 IAHJ Program requirements.

Inspector of Record (IOR)

- Provides inspection of electrical wiring and equipment installations, and witnesses testing and procedures when electrical equipment is being energized to verify adherence to design specifications.
- Performs site inspections as needed to assure compliance with codes, subcontract specifications, Berkeley Lab Master Specifications and Standards, 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 IAHJ Program database and updates the IAHJ 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 IAHJ 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 ES&H Manual (PUB-3000) Electrical Safety requirements for a complete QEW definition.
F. Definitions/Acronyms

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energization Validation &amp; Authorization Package (EVAP)</td>
<td>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&amp;H Core Policy and the Electrical Safety program.</td>
</tr>
<tr>
<td>Hold Point</td>
<td>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.</td>
</tr>
<tr>
<td>IAHJ Review</td>
<td>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 &amp; 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.</td>
</tr>
<tr>
<td>Method of Procedure (MOP)</td>
<td>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.</td>
</tr>
<tr>
<td>Nationally Recognized Testing Laboratory (NRTL)</td>
<td>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).</td>
</tr>
<tr>
<td>Witness Point</td>
<td>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.</td>
</tr>
</tbody>
</table>

G. Recordkeeping Requirements

The Chief Electrical Inspector will ensure that IAHJ Review, Plan, and Inspection forms in the IAHJ 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 Maximo work order and inspection reports shall be filed with the IAHJ Review form in the IAHJ database for in-house craft work.

H. Implementing Documents

<table>
<thead>
<tr>
<th>Document number</th>
<th>Title</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>07.07.011.003</td>
<td>Work Process B, Electrical Authority Having Jurisdiction (AHJ)</td>
<td>Work Process</td>
</tr>
<tr>
<td>07.07.034.000</td>
<td>Electrical Equipment Safety Program</td>
<td>Program</td>
</tr>
<tr>
<td>07.07.020.000</td>
<td>Lockout/Tagout Program</td>
<td>Program</td>
</tr>
<tr>
<td>ADMN-059</td>
<td>Planned Utility Shutdown Coordination</td>
<td>Procedure</td>
</tr>
<tr>
<td>DCM-001</td>
<td>Work Requiring Responsible Individual (RI)</td>
<td>Procedure</td>
</tr>
<tr>
<td>FACILGEN-001</td>
<td>Deactivation Plans for Building Electrical and Mechanical Systems and Site Utilities</td>
<td></td>
</tr>
<tr>
<td>FM-059-01</td>
<td>Quality Plant Engineering &amp; Utilities Modifications Authority and Roles Form</td>
<td>Form</td>
</tr>
<tr>
<td>FM-059-02</td>
<td>Application for Utility Service</td>
<td>Form</td>
</tr>
<tr>
<td>FORM-INS-001</td>
<td>IAHJ Review Form</td>
<td>Form</td>
</tr>
</tbody>
</table>
I. Contact Information

Electrical Authority Having Jurisdiction for Safe Installations
Facilities Division

J. Revision History

<table>
<thead>
<tr>
<th>Date</th>
<th>Revision</th>
<th>By whom</th>
<th>Revision Description</th>
<th>Section(s) affected</th>
<th>Change Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>7/31/2015</td>
<td>0</td>
<td>D. Nielsen</td>
<td>Re-formatted for wiki</td>
<td>All</td>
<td>Major</td>
</tr>
</tbody>
</table>

IAHJ Processes

<table>
<thead>
<tr>
<th>Title:</th>
<th>Safe Electrical Installations Policy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Publication date:</td>
<td>7/31/2015</td>
</tr>
<tr>
<td>Effective date:</td>
<td>11/24/2014</td>
</tr>
</tbody>
</table>

IAHJ PROCESSES

A. IAHJ Services

1. IAHJ inspection services include, but are not limited to, the items defined in Section A, Purpose for compliance with NFPA 70 and NFPA 70E, and adherence to Berkeley Lab Master Specifications and Standards. Other services provided by the IAHJ Program include witnessing tests; recording results; developing inspection matrices; applying codes and standards to tests and inspections; validating that equipment and installation are suitable per their listing; validating quality of workmanship; and verification of the testing equipment used with documentation of type, calibration dates, model, and serial numbers, etc. The Compliance Engineer (CE) may suggest work solutions to the project manager, construction manager, engineer(s), and or performing craft when the installation does not meet code, standards, specifications, or a neat and workman-like manner.

2. IAHJ staff may conduct field evaluations of the equipment or systems without the use of tools unless approved per Work Planning & Control to perform Lockout/Tagout (LOTO) as a qualified electrical worker; otherwise, IAHJ staff DO NOT perform LOTO or other hands-on activities. In addition, the IAHJ, Chief Electrical Inspector, and Inspectors of Record (IOBs) do not perform design reviews. The CE will review the design for general code compliance per the IAHJ Program and specification adherence. IAHJ staff do not sign a statement stipulating that designs meet all requirements prior to construction, as these duties are the responsibility of the Plant Engineering and Utilities Group.

B. IAHJ Inspections

1. IAHJ Inspection Workflow Summary:
   a. A minimum of 48 hours’ (two business days’) advance notification is required for scheduling an inspection during normal business hours to assure adequate resource availability. A minimum of 2 weeks’ advance notification is required for scheduling an inspection on a weekend day. A minimum of one month of advance notification is required for scheduling an inspection on a holiday other than in December. A minimum of one month of advance notification is required for scheduling an inspection during the December holiday shutdown.
   b. The Responsible Individual (RI) provides the IOR with a copy of the field-ready work package and schedule for inspection(s), including the scope of work, plans, and specifications. The RI also provides the IOR with safety-related documentation and requirements such as personal protective equipment (PPE) and any applicable safety trainings.
   c. The RI coordinates inspections as defined in the project FORM-INS-0001, IAHJ Review Sheet.
   d. The IOR conducts the pre-concealment, witnessing of tests, and final inspections; updates the project FORM-INS-0001 with a status summary; and appends detailed inspection reports as completed.
   e. The RI facilitates any work required to address deficiencies identified by the IOR as documented in the project FORM-INS-0001 and detailed inspection reports. The RI coordinates re-inspections as required until the IOR documents that all work is approved and accepted in accordance with the scope of work and applicable codes, standards, and specifications.
   f. The completed inspection process documents are finalized and made available in the IAHJ database for review and closeout.

2. Witness and Hold Inspections will be based on the Witness and Hold Inspection Plan and performed by the IOR to document deviations from, or compliance with, the subcontract documents, Berkeley Lab Master Specifications and Standards, and/or Original Equipment Manufacturer (OEM) requirements. Upon written notice from the construction subcontractor or in-house craft that work is substantially complete, an inspection site visit shall be coordinated by the Project Manager (PM) RI/Craft Supervisor. Inspection reports will be organized by the Berkeley Lab Master Specifications and Standards and correlated with the equipment numbering, location, and inspection type. Any changes to the project scope of work identified by the inspector in the field shall be documented on the project’s set of as-built drawings.

3. A “nonconformance” is any deviation from the construction subcontract documents, codes, or Berkeley Lab Master Specifications and Standards. Each nonconformance is documented by the IOR on an inspection report identifying the condition. (The IOR should allow
room in the form for the future entry of the time and manner of correction.) The inspection reports shall include the FORM-INS-0001 permit number and be uploaded with the corresponding INS-0001 review sheet applicable to the inspection. The entire IAHJ staff may be informed of serious or unusual nonconformance deviations for training or management-awareness purposes.

a. The electrical components and wiring associated with any deviation are denied approval to energize until corrective actions are taken, the work is re-inspected, and the work is accepted by the IOR. The Berkeley Lab Project Manager or RI is responsible for seeing that corrective action is taken to resolve each nonconformance. If the work is carried out by the performing craft without an assigned PM/RI, then the superintendent/ supervisor of the performing craft is responsible for seeing that corrective action is taken to resolve the nonconformance. When the correction can be made on the spot in a timely manner, it may be handled while the IOR is present. The PM/RI shall keep a running log of deviations requiring resolution and re-inspection. The PM/RI may request that the Design Professional, Berkeley Lab Facilities Electrical Engineer, or Compliance Engineer help review the nonconforming work to determine a resolution. The PM/RI must ensure that corrections are made and then re-inspected by the IOR for conformance. All inspections will be recorded on the appropriate inspection report and summarized on the project's FORM-INS-0001.

4. A Request for Information (RFI) submitted by a PM/RI for a clarification of a specification requirement or inspected work not meeting Berkeley Lab specifications may result in a request for a temporary or permanent alternative configuration equivalent to the protection afforded by the Berkeley Lab Master Specifications and Standards. Written requests for permanent or temporary equivalencies to Berkeley Lab specifications submitted by the Responsible Individual (RI), Project Manager (PM), or Design Professional shall include: a description of the issue, the reason for requesting an equivalency, and the specific subcontract or Master Specifications and Standards citation of the section, paragraph, and exact language for reference; applicable OEM documentation, calculations, and drawings; all codes or standards sections related to the reason for requesting an equivalency; and proposed mitigation steps to be taken, such as warning signs, barriers, and procedures to provide equivalent protection.

a. In the scenario described in Section B.4, above, the IAHJ will be informed by other Berkeley Lab Electrical AHJs, the Compliance Engineer, the IOR, the Design Professional, SMEs, the Fire Marshal, the Project Manager, the Construction Manager, or others as needed in order to make a risk-based decision on the equivalency interpretation for adherence to Berkeley Lab specifications. In addition, the IAHJ may require additional tests or inspections to inform the equivalency decision to assure a safe electrical installation.

b. The IAHJ may deny the request, in which case the project must adhere to the Berkeley Lab Master Specifications and Standards. If the IAHJ approves the request, the Project Manager or Craft Supervisor may then elect to implement the IAHJ’s interpretation of the equivalency or adhere to the Berkeley Lab Master Specifications and Standards.

c. Temporary equivalencies are typically not granted for: (a) longer than 30 days unless extended by the IAHJ; (b) longer than the time it takes to correct the deficiency; or (c) the duration of an IAHJ-approved activity, program, or operation.

5. Exemptions or variances from code require approval by DOE and must follow a process in compliance with 10 CFR 851, as defined by the UC-DOE Prime Contract (Contract 31). The process will require agreement from the IAHJ and Berkeley Lab Senior Management. It is highly recommended to review other code-compliant options prior to pursuing this approach.

6. Adherence to the non-NRTL field evaluation program is required per the protocol defined by the Electrical Equipment Safety Program, Chapter 14, of the Berkeley Lab ES&H Manual (PUB-3000). Unlisted commercially available products that have been certified by the manufacturer to recognized domestic or foreign standards but have not been validated by a third-party NRTL evaluation require further field examination to be suitable for use in accordance with the IAHJ prior to energization, operation, and use.

a. When equipment is identified in the field as non-NRTL-approved, the IOR will notify the Electrical AHJ for Safe Equipment (EAHJ) to initiate the non-NRTL field evaluation for that equipment. Energization of the equipment will not be made until the equipment passes the inspection protocol and/or the non-NRTL field evaluation requirements.

C. IAHJ Review Process Steps

The RI is responsible for requesting the services of a Compliance Engineer or Inspector of Record (IOR) in accordance with this procedure. The IAHJ Review Workflow summary is as follows:

1. Access the Facilities website for requesting an IAHJ review.
2. Place cursor over “Request a Service” and select “Electrical Installations Inspections.”
3. Input data into the Electrical AHJ Installation Review and Inspection Request Form.
4. Upon receipt of a work order, the Facilities WPC Planner will consult with the Compliance Engineer or IOR to determine the need for an IAHJ Review document given the project scope definition.
   a. If an IAHJ Review document is not necessary, the Compliance Engineer or IOR will discuss the issue with the RI and assure compliance using appropriate alternate means. In this case, no additional work order will be generated and no further action such as that defined below is required.
   b. If an IAHJ Review document is necessary, an additional work order will be generated and further action as defined below is required.
5. An IOR will be assigned to respond to the work order submitted by the RI. The Compliance Engineer will define the inspection and test requirements on FORM-INS-0001 and/or a Witness and Hold Inspection Plan based on the project documentation provided and submit it to the Facilities WPC planner and/or assigned IOR.
   i. FORM-INS-0001 serves as the IAHJ inspection planning and summary status report to be completed by the IOR and filed in the Berkeley Lab IAHJ Program database. It is the intention that more detailed inspection reports be appended to FORM-INS-0001 as completed. The key components of FORM-INS-0001 include:
      ii. Project and contact information
      iii. Project inspection plan and overall status
      iv. Scope of work checklist of items to be inspected
      v. Summary status of inspections
      vi. A checklist of Berkeley Lab Master Specifications and Standards containing applicable inspection requirements
6. The inspection and test requirements are intended to provide an inspection coverage that at a minimum includes the following:
   a. Progress and quality of work, i.e., pre-concealment, witness testing, and final at completion
b. Equipment and materials suitability for installation, location, and use

c. NRTL listing or labeling quality control

d. Workmanship

e. Wiring integrity

f. Construction operations, i.e., provisions for safety, energization of equipment, witness testing of equipment, and conductor/cable performance tests and

g. Recordkeeping

7. A Witness and Hold Inspection Plan will be developed by the Compliance Engineer and/or IOR to establish the hold and witness points for each project. The Berkeley Lab Construction Manager/RI and/or Project Manager will follow the Witness and Hold Inspection Plan to develop the inspection schedule with the subcontractor or in-house electrician.

8. Additional review requirements may apply upon determination by the Compliance Engineer, such as:

a. If assistance is required with design, load calculations, fault-current and arc-flash calculations and wire sizing, etc.

b. For special or expert/SME IOR, high-voltage, and/or distribution support services due to the complexity of installations, modifications, or equipment energization

D. Equipment Energization/Decommission Readiness

1. An EVAP is a work package that must be completed and authorized prior to energizing new and modified electrical wiring and equipment installations. The EVAP will follow the Equipment Energization Plan. An approved EVAP (Mechanical EVAP for utilization and generation equipment) shall permit work that is done in a manner that ensures a complete wiring and electrical equipment installation to be energized. The EVAP package assembled by the RI must include the following documents:

a. The EVAP contains all the necessary information to perform the work.

b. The EVAP contains all the necessary information to perform the work.

c. The EVAP contains all the necessary information to perform the work.

d. The EVAP contains all the necessary information to perform the work.

e. The EVAP contains all the necessary information to perform the work.

f. Work authorizations for Lockout/Tagout (LOTO) as applicable to energize the electrical equipment, and safety trainings for performing the work.

2. The IAHJ Chief Electrical Inspector/IAHJ will review the EVAP to determine the completeness of the package and approve or deny the electrical installation for energization. IAHJ approval will comprise of EVAPs where all equipment is installed and the wiring is complete at the level to be energized, including all feeders or branch circuits from that level. This will be referred to as a one-level-above-completed basis. This is where in planning the work there is progression of energizing equipment from the electrical power service to the branch circuit load or utilization equipment.

a. For example, if a newly installed panel board is to be energized (also as applied to utility distribution equipment, switchboards, motor control centers, dedicated fixed utilization equipment wiring, power generation, etc.) then the work must be completed within the panel, and all branch circuit wireways, raceways, cable trays, conduits, and installed wiring and connections must also be complete.

b. There may be cases in which the Original Equipment Manufacturer’s representative will be required to perform checkout/start-up activities during the MOP that include inspections, testing, and/or provisions of future work.

3. An EVAP will not be approved for ongoing work in which a portion of the switchgear, motor control center, panels, feeders, branch circuits, grounding, etc., installation is incomplete. There may be circumstances where the circuitry to a new or existing load can be made safely and securely within a dedicated wireway, raceway, and/or wiring system where no other energized or associated circuits are contained. In these instances, the EVAP will be reviewed on a per-case basis by the IAHJ Chief Electrical Inspector/IAHJ with consideration for approval pending the implementation of additional assurance criteria for practical safeguarding and hazardous energy control. EVAP approval for installations that include incomplete work will only be provided when the incomplete work is designed to provide for future installations.

a. Other instances may involve an additional planned shutdown to connect from the existing source to a new dedicated source. In all cases, the direction is to avoid re-entry to the panel and/or working within enclosures or raceways to complete work where other energized circuits exist to avoid exposing the worker to hazardous energy.

4. Effective management of the EVAPs by the PM/RI in submitting requests for review and approval will be to submit complete packages and schedule an appropriate duration of time. Requests for energizing partially completed circuits will not be approved except as noted above.

5. The EVAP process for Berkeley Lab in-house craft applies when the work is applicable and managed by the in-house Craft Supervisor or Superintendent. The EVAP process is as follows:

a. The Craft Supervisor/Superintendent obtains the factory, field, and independent test reports/results.

b. The Craft Supervisor/Superintendent confirms the work is complete.

c. The Craft Supervisor/Superintendent obtains a review of the IOR’s inspection results from the Compliance Engineer.

d. The IAHJ Compliance Engineer/Chief Electrical Inspector confirms readiness for energization with a validation memo/signature.

6. The EVAP process for subcontractor projects applies when the work is managed by a project manager and the applicable work is performed by subcontractor OEWs. This process is as follows:

a. The subcontractor/PM develops an Equipment Energization Plan (EEP). The plan reflects the requirements above that will be followed in creating the EVAP package(s).

b. The subcontractor provides written certification of completion of the electrical installation and work to the RI.

c. The PM/RI obtains the factory, field, and independent test reports/results from the subcontractor and the IOR inspection reports per the subcontract documents.
d. The subcontractor/RI/PM prepares the MOP, which is reviewed by the Plant Utilities and Engineering/SME and includes a legible single-line drawing(s) (11 in. x 17 in. minimum) marked to indicate the equipment to be energized.

e. The IAHJ Compliance Engineer confirms readiness for energization with a validation memo/signature based on the review and approval of field inspection IOR reports and test results. The memo is added to the EVAP package.

f. The subcontractor requests Work Authorization permits for implementation of LOTO to facilitate the MOP in energizing the equipment. These are developed and then approved in accordance with the Berkeley Lab ES&H Manual (PUB-3000) Lockout/Tagout Program after review of the MOP and single-line drawing(s). The subcontractor prepares the Pre-task Hazard Analysis document and provides it to the RI.

g. The PM/RI assembles the EVAP package with the checklist for the documents listed in Section D.5 or D.6 above, as applicable, to include the dates and initials.

h. The RI reviews the package to ensure all documents are accounted for and complete, and the information is cross-checked for execution prior to submittal to the IAHJ Chief Electrical Inspector/IAHJ. At least two business days are required to review the package for completeness and approval that the electrical installation is ready for energization. The RI schedules the work after signatures are obtained.

i. The RI oversees all activities of the EVAP, inclusive of all required data or field information entries and signatures during execution.

j. The completed EVAP is filed in the Project Inspections File by the project management team and copied to the IAHJ Compliance Engineer.

7. For decommissioning of facilities or buildings, see the Maintenance and Operations procedure FACILGEN-001, Deactivation Plans for Building Electrical and Mechanical Systems and Site Utilities.

Document Information

<table>
<thead>
<tr>
<th>Title: Safe Electrical Installations Policy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Document number 07.12.001.000</td>
</tr>
<tr>
<td>Revision number 0</td>
</tr>
<tr>
<td>Publication date: 7/31/2015</td>
</tr>
<tr>
<td>Effective date: 11/24/2014</td>
</tr>
<tr>
<td>Next review date: 11/1/2017</td>
</tr>
<tr>
<td>Policy Area: Electrical Safety</td>
</tr>
<tr>
<td>RPM Section (home) ESH</td>
</tr>
<tr>
<td>RPM Section (cross-reference) Facilities Management (Major Construction, Facilities)</td>
</tr>
<tr>
<td>Functional Division EHS</td>
</tr>
</tbody>
</table>

Source Requirements Documents

- 10 CFR 851, Worker Safety and Health Program
- OSHA, 29 CFR 1910, Occupational Safety and Health Standards and 1926, Safety and Health Regulations For Construction
- NFPA 70, National Electrical Code
- NFPA 70E, Standard for Electrical Safety in the Workplace
- California Code of Regulations (CCR), Title 24, California Building Standards Code, Part 3 - California Electrical Code
- DOE G 440.1, Worker Safety and Health Program for DOE (Including the National Nuclear Security Administration) Federal and Contractor Employees
- DOE-HDBK-1092-2013, DOE Handbook: Electrical Safety
- IEEE Std 3007.3-2012, Recommended Practice for Electrical Safety in Industrial and Commercial Power Systems
- NFPA 790-2012, Standard for Competency of Third-Party Field Evaluating Bodies
- NFPA 791-2012, Recommended Practice and Procedures for Unlabeled Electrical Equipment Evaluation

Implementing Documents

<table>
<thead>
<tr>
<th>Document number</th>
<th>Title</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>07.07.011.003</td>
<td>Work Process B, Electrical Authority Having Jurisdiction (AHJ)</td>
<td>Work Process</td>
</tr>
<tr>
<td>07.07.034.000</td>
<td>Electrical Equipment Safety Program</td>
<td>Program</td>
</tr>
<tr>
<td>Code</td>
<td>Description</td>
<td></td>
</tr>
<tr>
<td>------------</td>
<td>------------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>07.07.020.000</td>
<td>Lockout/Tagout Program</td>
<td></td>
</tr>
<tr>
<td>ADMN-059</td>
<td>Planned Utility Shutdown Coordination</td>
<td></td>
</tr>
<tr>
<td>DCM-001</td>
<td>Work Requiring Responsible Individual (RI)</td>
<td></td>
</tr>
<tr>
<td>FACILGEN-001</td>
<td>Deactivation Plans for Building Electrical and Mechanical Systems and Site Utilities</td>
<td></td>
</tr>
<tr>
<td>FM-059-01</td>
<td>Quality Plant Engineering &amp; Utilities Modifications Authority and Roles Form</td>
<td></td>
</tr>
<tr>
<td>FM-059-02</td>
<td>Application for Utility Service</td>
<td></td>
</tr>
<tr>
<td>FORM-INS-001</td>
<td>IAHJ Review Form</td>
<td></td>
</tr>
</tbody>
</table>