

Electrical Training

- **Facility Training**
- **R&D Training**
- **Subcontractor Training**

Facility Training Subgroup

- Andrew Olsen – Hammer
- Frank Perrotta – ANL
- Gary Becken – WTP (Hanford Bechtel)
- Don Lehman – INL
- Alan Aunspaugh – Hanford MSA
- William Brisrsmouth – Hanford MSA
- James Dewey – Hanford
- Mark R. Hilbert – Hoydar-Buck/Paducha
- Ken Gray – Hanford MSA-HAMTC
- Kevin Schoonover – Hanford MSA-HAMTC
- Bobby Sparks – PNNL WS & H

Facility Electrical Safety Training (FEST), for 2017 EFCOG

Step 1 -

General Employee Training (GET)

Step 2 - Personnel who may be in proximity to an electrical hazard, choose one of the following training paths:

Non Electrical Person

For non-electrical personnel subject to an elevated electrical shock risk (e.g. industrial machine operators, painters, welders, janitorial staff, and some laboratory personnel).

Electrical Awareness Training for Non-Electrical Personnel

One (or more) of the following as applicable:

- First Responders
- Equip. operation near overhead lines
- *Breaker operation
- Blind penetration
- Bench personnel & tool repair

*Breakers Operation requires special training and approval

Task Qualified Person

For personnel who supervise or perform any activity within a shock limited approach boundary. This does not qualify for entry into an arc flash boundary. These personnel are considered qualified for that specific activity or scope.

Shock Hazard Training Limited NFPA 70E

Limited Personnel for R&D EX:

- Furnaces with Shock Hazards
- Working Near Shock Hazards
- Diag. & Test of Single Equipment

Limited Personnel for F&O:

- Technicians
- Vendors

Qualified Arc Flash Person

For personnel who supervise or perform work in an arc flash boundary. These personnel also require training for entry into limited approach boundary. Activities include a variety of tasks that expose them to electrical hazards.

Arc Flash Hazard Training NFPA 70E

Electrical Safety for R&D work only (e.g. Researchers)

Electrical Safety for F&O and Const work (e.g. Crafts)

Activity-Specific Electrical Worker Qualification Document

*NEC, CPR, First Aid, Batteries, Capacitors, and Contact Release

*Electrical Equipment Inspector



Facility Electrical Safety Training (FEST), for 2017 EFCOG

Step 1 -

General Employee Training (GET)

Step 2 - Personnel who may be in proximity to an electrical hazard, choose one of the following training paths:

Telecom

For Telecommunications who supervise or perform work for transmission and distribution tasks, in accordance with 1910.268

1910.268 Training

One (or more) of the following as applicable:

- Equip. operation near overhead lines
- Bucket Truck Operation
- Traffic Control
- Fall Protection including tower climbing

Qualified Power Generation Person

For personnel who supervise or perform any generation activities and connectivity to the power grid.

1910.269 Training and Applicable State Codes

Personnel for R&D:

- Photo Voltaic
- Wind
- Nuclear
- Wave & Tide

Personnel for Maintenance and Operations:

- Photo Voltaic
- Wind
- Nuclear
- Hydro

Qualified T&D Person

For personnel who supervise or perform work for transmission and distribution tasks, in accordance with 1910.269 and NESC.

1910.269 Training and Applicable State Codes

Additional training per job description:

- Transmission
- Distribution
- Substation
- Meter & Relay
- Dispatcher or Regional Control

Activity-Specific Electrical Worker Qualification Document

*CPR, First Aid, Batteries, Capacitors, and Contact Release

Non Electrical Person

Electrical Awareness Training for Non-Electrical Personnel: This training is for personnel who may work in areas where electrical hazards may exist. The personnel will not interact with these hazards (this person does not do electrical work), but is trained to recognize the hazards. This is for persons handling cord and plug application.

Task Qualified Person

Shock Hazard Training Limited NFPA 70E: For personnel who supervise or perform any activity within a shock limited approach boundary. This does not qualify for entry into an arc flash boundary. These personnel are considered qualified for that specific activity or scope.

Task-Specific Demonstration of Skills and Knowledge: Implemented and document in accordance with site training requirements.

Activity-Specific Electrical Worker Qualification Document: This form documents the manager's authorization of the electrical personnel to perform the work.

Qualified Arc Flash Person

Qualified Person: For personnel who supervise or perform work in an arc flash boundary. These personnel also require training for entry into limited approach boundary. Activities include a variety of tasks that expose them to electrical hazards.

Electrical Safety for F&O and R&D Work: This course is for personnel who work on facility power and power distribution systems, where there can be a significant risk of arc flash, in addition to shock hazards (generally, these personnel are electricians).

Electrical Safety for R&D work only: This course is for personnel who work primarily on electrical equipment and instrumentation that may not be limited to low risk, generally excluding the risk of arc flash (primarily, researchers). This is a classroom course with demonstration components.

Activity-Specific Electrical Worker Qualification Document: This form documents the employer's authorization of the electrical person to perform the work.

Additional courses:

Electrical Equipment Inspector: This course is for personnel who will inspect non-NRTL equipment, whether purchased or fabricated on-site.

Use of PPE by Non-Electrical Personnel: This course is for personnel not doing electrical work, but where the possibility of inadvertent exposure exists (excavation, blind penetrations).

National Electrical Code: This course covers key points of the National Electrical Code as the code is updated.

CPR/AED/First Aid

Telecom

For Telecommunications who supervise or perform work for transmission and distribution tasks, in accordance with 1910.268.

Qualified Power Generation Person

For personnel who supervise or perform any generation activities and connectivity to the power grid.

Qualified T&D Person

For personnel who supervise or perform work for transmission and distribution tasks, in accordance with 1910.269 and NESC.

Electrical Safety training for non-Staff (Service Engineer/Vendor/Subcontractor):

If the non-Staff is doing no electrical work, then GET is sufficient.
Otherwise, for non-Staff doing Low Risk electrical work.



R&D Training Subgroup

- **Ray Joggerst LANL**
- **Lloyd Gordon LANL**
- **Jackie Mirabal-Martinez LANL**
- **Robert Fry Ames**
- **Martin Iedema PNNL**
- **Vince Bollinger NREL**
- **Richard Green LLNL**

R&D Training Working Group - Goals

- **Terminology**
- **Low Risk Electrical Worker Training (LREW)**
- **Field Demonstrations of Competency**
- **Focus Classes**
- **Reciprocity of EWQF (Electrical Worker Qualification Form)**
- **Qualified Electrical Worker Training (R&D)**
 - Future

R&D Training Survey Results

- R&D labs surveyed
 - LLNL, LANL, NREL, PNNL, ANL, FNL, Ames, ORNL, LBNL
- Most use “Qualified Electrical Worker” as a term
- No consistent term for “unqualified” electrical worker
- Labs that use Modes of Work and Hazard Classification – 5
- Low Risk workers – 2 live class, 5 on-line
- QEWs – 8 labs – live class
- Demonstration of Competencies – 6 Yes, 2 No
- Special topics (e.g., DC) – 6 Yes, 2 No

Consistent Terminology needed for Training

~~- will expand throughout the project~~

- **Low Risk Electrical Workers (LREW)** - Electrical workers who work on equipment that does not pose an electrical hazard by virtue of:
 - engineered controls,
 - electrically safe work condition, or
 - electrical energy is below thresholds for injury or damage to health.
- **Electrical worker** - A worker who comes into contact with electrical conductors or circuit parts.
- **Electrical Hazard (NFPA 70E)** - A dangerous condition such that contact or equipment failure can result in electric shock, arc flash burn, thermal burn, or blast.

Thresholds for Defining Electrical Hazards

Thresholds for Defining Shock Hazards

Source	Includes	Thresholds
AC	60 Hz	>50 V and >5 mA
DC	All	>100 V and >40 mA
Capacitors	All	$400 \leq V < 1000$ V and >1 J, or >400 V and >0.25 J
Batteries	All	>100 V
Sub-RF	1 Hz to 3 kHz	>50 V and >5 mA
RF	3 kHz to 100 MHz	A function of frequency

LREWs may only work on or near electrical equipment below these thresholds

Thermal Burn Hazards

Source	Includes	Thresholds
Sub-RF	1 Hz to 3 kHz	<50 V and >1000 W
DC	All	<100 V and >1000 W
Capacitors	All	<100 V and >100 J
Batteries	All	<100 V and >1000 W
RF	NA	NA



Suggested Outline for LREW training

- **Introduction**
 - Definitions
 - Why?—because of National Standards (standardization)
- **Lessons learned**
 - Accidents
 - Common mistakes
- **What is Electricity, e.g., current, voltage, power, energy**
 - Hazard
 - Injury
 - Consequences
- **Hazard classification**
 - Electrically Safe work
 - Exposed
- **Identification of Electrical Risk**
 - Approach Boundaries
 - Working limits
 - Protection & controls
 - Electrical Equipment Approval process
- **Emergency Response**
 - What do you do?

Demonstrations of Competencies

- **Types of demonstrations performed**
 - None
 - Single task
 - Examples - using a meter, dielectric PPE inspection
 - Skill-type qualification
 - e.g., battery technician, 10 page checklist
- **The group chose to start with single task evaluations: meter, PPE, etc.**

Proposed Deliverables – ~~drafts of training modules, terminology, etc.~~

- **Low Risk Electrical Worker (LREW)**
 - December 2017, lead Ray Joggerst (LANL)
- **Field Demonstration** – lead Rich Green (LLNL)
 - Meters (Sept 2017), Dielectric PPE (Oct 2017)
 - Etc., TBD
- **Focus Classes**
 - DC (Oct. 2017) – lead Lloyd Gordon
- **Terminology** – lead Martin Iedema (PNNL)
- **Reciprocity of EWQF (Electrical Worker Qualification Form)** – lead Vince Bollinger (NREL)

Subcontractor Electrical Safety Management (SESM) Working Group

Recommendations for Contact Release Training

Participants

- **David Inskeep** INL
- **Ron Gough** KCP
- **Don Bourcier** LANL
- **Bobby Gray** Hoydar Buck
- **Heath Garrison** NREL
- **Scot Winningham** ORNL
- **John Dierkej** Schneider Electric
- **Jeff Williams** NNSA/LAFO
- **Jim Watson** LLNL

SESM Contract Release Recommendations

- **Contact release is an improbable event unless working under an EEWP**
- **Training materials need to be concise – in the extremely unlikely situation where a worker is “latched on” there’s little time to react. We recommend a single slide, e.g.....**

Helping Someone Getting Shocked

Electrical
WORKPLACE SAFETY

e-Hazard

DO NOT touch the person.
You will only become a second victim.

- Turn off energy source, if possible
- Dislodge the person from the energy source by using a non-conductive item
 - **Best practice: dielectric rescue hook or rubber insulating gloves**
 - Dry wooden broom or board may be effective for low-voltage, but carries risk



SESM Contract Release Recommendations

- **Include in pre-job brief for *energized work***
 - Discussion of work-site specific rescue scenarios and techniques before work activity
 - When operating under an EEWP
 - identify appropriate disconnect points
 - Include rescue hooks at the jobsite
 - Review non-electrical hazards with regard to the risk presented to the rescuer
 - Confined Space
 - radiological/hazardous
 - Scaffolding/working at heights, etc

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