Welcome and thank you for attending!
SAFETY/EMERGENCY CONTACT INFORMATION

- Lab door safety placard contacts which include phone numbers for:
  - Primary Contact - Principal Investigator (PI) responsible for lab
  - Secondary contact responsible for lab
  - Department Safety Officer
  - Department Head
  - Emergency numbers e.g.,
    - Police/Fire/Medical: 911
    - UT Police: 974-3111
    - Environmental Health & Safety (EHS) 974-5084
    - Facilities Services 946-7777

- Robert B. Martin – EECS Laboratory Safety Advocate (LSA)
  - Email: rmarti47@utk.edu
  - Phone: Office – (865) 974-9023, Cell – (865) 771-3694
IMPORTANCE OF SAFETY

• Unsafe work practices can and do impact everyone working at UT

• Hazards can have serious consequences
  • Death, short and long term health conditions
  • Property damage to buildings and equipment
  • Funding loss
  • Short and long term shut down of operations
  • Increased short and long term costs
FEDERAL, STATE & LOCAL SAFETY REQUIREMENTS

• Occupational Safety and Health Administration (OSHA & TOSHA)
  • Requires all employers to provide a safe work environment
  • Requires all employees to be trained in and implement safety in the work environment

• National Fire Protection Association
  • National Electrical Code (NEC)
  • NFPA 70E – Standard for Electrical Safety in the Workplace
  • Building Codes

• OSHA and TOSHA inspectors

• State Fire Marshal

• Local Building Inspectors
SAFETY IS EVERYONE’S RESPONSIBILITY

• Safety shall be considered and implemented at every step of the way
  • Individual daily actions
  • Designs - protections
  • Experiments
    • Test set-ups
    • Test procedures
    • Personal Protective Equipment (PPE)
  • Lab & public spaces
  • Environmental impacts due to:
    • Radiation
    • Biological
    • Chemicals
RISK CONTROL

- As engineers, each of us should carefully consider the following in relation to the lab situation you’re in

- Risk control hierarchy – in order from best to worst
  - Eliminate the risk to make it go away – Best solution
  - Substitution to eliminate or reduce the risk – Change process, procedure, design
  - Isolation to separate the risk from personnel – Barriers, shields, etc.
  - Engineering controls to reduce the risk – circuit protection, Ground Fault Circuit Interrupter (GFCI), Arc Fault Circuit Interrupter (AFCI), Arc Flash Detector, interlocks, etc.
  - Administrative controls to lessen the risk by increasing personnel awareness – signs, training, reviews, policies, procedures, etc.
  - Personal protective equipment (PPE) – Last resort

- Most people think PPE is the starting point for safety, it’s not and we need to rethink
SAFETY TRAINING

• Everyone is required to be trained including:
  • Faculty
  • Staff
  • Students
  • Visiting personnel using our space

• Training records must be maintained and available for 15 years

• Online Training Platforms
  • K@TE – Managed by UT Human Resources
    • Access at https://kate.tennessee.edu, under Health, Safety & Emergency Preparedness grouping
    • For full time University employees both faculty & staff
    • Records training results for individual
    • Maintains record in IRIS for documentation requirement
  • Canvas
    • Access at https://utk.instructure.com, Under Courses, All Courses, Environmental Health & Safety
    • For Everyone with a UT log-in
    • Records training results for individual
    • Record of training must be printed out and saved in file for documentation requirement
TRAINING REQUIREMENTS

• Basic training everyone must take yearly
  • Hazardous Waste (Canvas)
  • Hazard Communication and General Health Safety Updates (Canvas)
  • Fire Extinguisher Training (Canvas)
  • Personal Protective Equipment (Canvas)
GENERAL LAB TRAINING

• This training should be taken by all lab users
  • General Lab Safety (Canvas)
  • Fire Safety in Laboratories (Canvas)
  • Personal Protective Equipment (Canvas)
  • Electrical Safety Orientation Level (Canvas)
SPECIALIZED LAB TRAINING

• Additional training that may be required depending on the situation
  • Chemical Fume Hood Safety Training (Canvas)
  • Compressed Gas Cylinder Training (Canvas)
  • Laboratory Safety for Undergraduates and Minors (Canvas)
  • Lead Awareness Training (Canvas)
  • Hot Work (Canvas)
  • Equipment or Machine Tool Use (Personal Instruction)
  • Lockout/Tagout (Personal Instruction)
  • CPR/AED/1st Aid (Classroom) – Provided by outside organizations & requires funding
BEST LAB PRACTICES

• Keep your work area clean and organized
  • Place instruments on bench shelves if possible
  • Place large power supplies next to bench instead of aisles
  • Protect personnel from touching burn hazards, i.e. soldering irons, heat guns, load resistors, etc.
  • Neatly arrange wiring to minimize chance of entanglement. Route power wiring to side or back of bench, not hanging over front.
  • Check for & remove unnecessary items from around the test set up like, tools, paper, wire, fasteners, etc.

• Use terminal shields and equipment guards to prevent touching and shorting

• Check connections to make sure they are tight

• Use safety shields on benches and wear proper PPE for task

• Throw away trash, shipping containers/packing materials, etc.

• Keep aisles clear of instruments, power supplies, boxes, wires, cables & trip hazards

• Never run experimental circuits unattended without prior approval and protections in place
BEST LAB PRACTICES (CONTINUED)

• Always have a second person present when running live experiments above 50 V
• Always verify that the conductor used (wire, cords, cable) is rated for your intended application.
• Always shut down power before making any changes to the test set-up including moving components, probes, etc.
• Dress appropriately
  • Remove jewelry (rings, necklaces)
  • Don’t wear shorts & open shoes when soldering
  • Don’t wear synthetic fabrics if Arc Flash hazard exists
• Conduct a hazard analysis of the test set-up prior to first use
• Perform an Arc Flash calculation to understand the Arc Flash risk for any experimental testing above 100 V
• Generate a step by step test procedure and follow it
• Do your homework. You’ll be surprised what safety information is in equipment manuals, Safety Data Sheets, etc.
• Never float or disable safety grounds
• Never cut corners and jeopardize safety
RESOURCES & LINKS FOR SAFETY INFORMATION

• Occupational Safety and Health Administration (OSHA) - https://www.osha.gov/

• National Electrical Code (NEC) - https://www.nfpa.org/

• National Fire Protection Association (NFPA) 70E - https://www.nfpa.org/

• UT Environmental Health and Safety - https://ehs.utk.edu/

• CURENT Lab Community Action Plan - https://wiki.curent.utk.edu/
INFO SPECIFIC TO CURENT LABS

• Safety Requirements are identified in CURENT Student WIKI - https://wiki.curent.utk.edu/
  • Safety Training Requirements
    • All personnel must take training prior to getting lab access
    • Personnel must retake the following training yearly to retain their lab access
      • Hazardous Waste (Canvas)
      • Hazard Communication and General Health Safety Updates (Canvas)
      • Fire Extinguisher Training (Canvas)
      • Personal Protective Equipment (Canvas)
  • Safety Policy - CURENT Lab Community Action Plan
  • Lockout Procedure
  • Energy Control Procedure form
  • Project Definition form
COMPLIANCE REQUIREMENTS

• All personnel using the labs are required to comply with all safety policies and procedures.

• Quarterly Reviews will now take place to evaluate compliance requirements.

• Lockout Procedure – must be followed for all work on circuits >50 V.

• Energy Control Procedure form – must be filled out for all experimental circuits.

• Project Definition form – Everyone must fill out this form for any lab activity > 50 V.
TEST PROCEDURES

• Generated by designer of the circuit/experiment
• Reviewed by lab manager and advisor or Principle Investigator (PI)
• Required for all experiments operating at > 50 V
• May be simple for one source experimental set-ups with one user
• Will be more complicated for multiple source experimental set-ups or multiple users
• Provides personnel with insight into safety issues which may be encountered during testing
• Plans for and documents responses needed in the event of a hazardous condition occurring
208 V, 1 KW, ARC FAULT EVENT IN CURRENT LAB
DAMAGED TABLE CORDS
COMMON SAFETY ISSUES

• Blocking aisles and egress with equipment and boxes
• Daisy chaining power strips
• Improperly tightened connections
• Improper wire or cable used
• Trip hazards e.g., wires on floors, boxes and other items left on floor
• Items placed blocking access to electrical panels, <36 inches front clearance
• Safety covers and panels removed from equipment
• MSDS or SDS not made available or utilized by personnel
THE THINGS I’VE SEEN & HEARD

• Disabled safety interlock nearly killed person – RADAR

• Working alone – Caught up in 120V circuit @ 2AM

• Fooling around can kill someone – 1” Rod through two walls

• The unexpected – 10V Power Supply on top of 208V converter

• The risk of probing live circuits – Prius battery pack short

• Doing stupid things – Stripped wires plugged into electrical outlets

• Disabling grounds – Modified power strip/cheater plugs

• Not knowing & not asking – Student drilling with no bit in the drill chuck
Feedback?
Suggestions?