Stanford | Environmental Health & Safety
Research Safety

Power Outages in Research: Prepare, Respond, Recover

Guidance for Researchers

Power outages are unpredictable, yet sure to happen. Exactly when they will occur, or how long they will last, are typically unknown. Research groups should plan for prolonged outages, to be best prepared. Follow this guidance to manage power outage events at the research group level to minimize uncertainty and recover promptly.

Normal occupancy and research operations are always prohibited in affected buildings during power outages, regardless of emergency generator status.

Prepare

Maintain Local Emergency Plans

- Complete the emergency preparedness checklist for each research group, and all the locations where the group conducts research (e.g., lab/office space in multiple buildings, or rooms).
    - Keep local emergency plans current.
- Identify and memorize closest exits from work locations, and ensure that group members know how to identify the closest emergency exit.
- Prepare to implement the appropriate general (and specific if applicable) shutdown procedures shown in the *Respond* section below.
- During onboarding, train all research group members on how to prepare for, respond to, and recover from power outages.
    - All group members should be able to carry out general shutdown procedures pertaining to their work.
    - Designate and assign which researchers will complete specific, specialized, or advanced shutdown procedures.
        - Only knowledgeable, experienced researchers should perform specific shutdown procedures.
    - Ensure researchers are aware of their responsibilities.
- Designate an emergency contact person and back-up for the research group.
    - Ensure the contacts are aware of their responsibilities and fully available 24/7.
- Update and maintain emergency contact phone numbers in the Life Safety Box and BioRAFT.
- Equip areas with battery-powered or hand-crank flashlights.
    - Keep spare batteries for flashlights immediately accessible and mark the location with a label.

Ready Equipment for Outages

- Install appropriately-rated surge protection devices for ALL sensitive and/or expensive electronics.
- Connect ***only*** essential equipment to emergency power circuits powered by emergency generators. Remember that the supply of back-up power is limited.

    - These circuits vary by building (i.e., red or white cover plates, marked with an “E”, or sometimes no markings at all).
    - Confirm circuit locations with the building manager.
    - Generators are designed to run only for a limited period of time and do not provide unlimited power to internal equipment.
        - Understand the limitations of equipment at each location: consult with the building manager, district staff, or LBRE representatives to learn more.
- Maintain appropriate auxiliary energy sources (e.g. an uninterruptible power source (UPS) or other backup system) for critical equipment and systems.
    - Items on backup power will experience power gaps of up to 10 minutes during transfer operations (i.e. at the start of an outage when power is transferred to backup power and again when utility power is restored). Devices that require continuous power need to be supported during these gaps with UPSs.
    - To appropriately size and install the UPS, consult with the building manager.
    - Note that UPSs require periodic maintenance and replacement about every 2 years. Follow manufacturer guidelines.
- Make a comprehensive list of equipment that must be reset, reprogrammed, restarted, or recalibrated upon power restoration.
    - Post the list in a highly visible spot, or multiple spots near the equipment.
- Equipment that operates unattended must be programmed to shut down safely during a power failure, and not restart automatically when power returns.
- Identify an emergency source of dry ice for items that need to be kept cold safely if refrigerators or backup generators fail.

Observe Safe Work Practices to Minimize Hazards when Outages Occur

- Keep containers of chemicals and other hazardous materials closed and put away when not immediately in use.
- Do not leave open containers on bench tops, shelves, desks or other work surfaces.
- Do not leave open chemicals in fume hoods when unattended.
- Always safely close and store chemicals after use.

Monitor Shutoff Events

PG&E will try to notify customers when weather, wildfires, or other conditions prompt power shutoffs to increase safety. PG&E issues Public Safety Power Shutoff (PSPS) watch and warning notifications with estimated shutoff and restoration times two days and one day respectively, before a planned shutoff. California Independent System Operator (Cal-ISO) notifies Stanford when rolling power outages due to high demand and supply shortages can be expected.

Respond

Implement Emergency Procedures if Outage is Concurrent with an Emergency Incident

If a power outage occurs concurrent with a local emergency incident such as an earthquake, major fire, or significant hazardous materials spill that affects occupied research buildings, everyone must immediately implement emergency procedures.

- If there is a life-threatening emergency, call 911.
- Upon notification, building occupants may be required to evacuate and gather at the designated Emergency Assembly Point (EAP).
- Help persons in darkened work areas move to safety.
- Do not light candles or use other types of open flames for lighting.
- During an incident and immediately afterwards, the emergency condition may prevent completing all shutdown procedures.
- Do not re-enter buildings after evacuation for the duration of the emergency incident, unless expressly permitted to do so by an authorized Stanford staff member.

*The following guidance in this Respond section pertains to power outages that are **not** concurrent with a local emergency incident as described above.*

Pause and Understand

Usually when an outage occurs, the goal is to establish and maintain safety in laboratory and research areas while buildings are without power or operating on emergency generator power.

- Life safety is the first priority.
    - If there is a life-threatening emergency, call 911 immediately.
    - For non-health-threatening chemical spills or other incidents, immediately notify EH&S at (650) 725-9999.
- Depending on the outage causes and conditions, other priorities may include preventing catastrophic damage to or failure of research operations and equipment, and conserving emergency generator power.

Remember: Normal occupancy and research operations are always prohibited in affected buildings during power outages, regardless of emergency generator status.

After general shutdown procedures are complete, only researchers and staff who are designated to perform specific, specialized, or advanced response and recovery tasks are permitted in buildings during power outages to complete additional tasks safely, only for the necessary duration.

- Power outage conditions are dynamic. The power status of individual buildings and installations can change over the course of one power outage event.

- For information during a prolonged outage, call the Stanford Emergency Information Hotline (650) 725-5555 or check the Stanford University Emergency Information website (https://emergency.stanford.edu).
- Monitor communications closely and be prepared to adjust response and recovery activities accordingly.

Implement General Shutdown Procedures

Researchers should take initial steps to pause work and stabilize the research, without creating undue hazards or risks to health and safety. Immediately and quickly pause work by completing tasks such as those shown below.

- Ensure lighting is adequate to carry out shutdown procedures
  - Do not light candles or use other types of open flames for lighting.
- If working in fume hoods, biosafety cabinets, glove boxes, gas cabinets,or solvent stills, when an outage occurs, take these precautions, as necessary:
  - If hoods are in alarm, stop work and leave the area
  - Stop any reactions and operations that may emit hazardous airborne contaminants
  - Secure caps and covers on containers of hazardous materials
  - Close sashes on fume hoods and biosafety cabinets
- Do not start new work or experiments involving hazardous materials and equipment
- Reduce electrical load demands, conserve emergency generator fuel, and minimize the risk of power surges:
  - Turn off unnecessary lights, computers, and non-essential equipment
  - Turn off equipment such as hot plates, spinners, heating mantles, vacuum pumps, sterilizers, water baths, ovens, and shop equipment
  - Turn off robots, lasers, etc. that may reactivate automatically when power is restored
- Keep refrigerators and freezers closed to maintain temperatures (up to several hours)

When initial general shutdown procedures are complete, researchers (other than those designated to perform additional, specific shutdown procedures shown below if applicable), should evacuate the building and notify their group's emergency contact of their expected whereabouts.

Implement Specific Shutdown Procedures

As building conditions permit and while or after general shutdown procedures are completed, designated researchers and staff identified in the group's emergency plan should implement specific, specialized, or advanced procedures as necessary. Procedures may include the confirmatory and other actions from the list below.

- Ensure that only designated researchers performing specific shutdown procedures are present; other researchers are prohibited from research areas affected by an outage·
- Follow Working Alone guidance if applicable.
- Clear the floor of any hazards
- Assume ventilation may not be normal
    - Check that containers are closed and secured
    - Confirm that fume hood and biosafety cabinet sashes are down
- Confirm that lights and equipment are turned off
- Confirm that only designated essential equipment is properly connected to emergency power as planned
    - o Emergency power may require 20 to 30 seconds to activate after a power failure
    - o Do not daisy chain power strips or extension cords to supply emergency power to non-essential or additional equipment
- Ensure that emergency evacuation routes and walkways are clear
- Turn off plumbed natural gas
- Glove boxes: do not disturb contents to protect reactive materials from exposure to oxygen and water vapor; ensure inert gas connections are intact
- Return all animals to proper housing areas to be cared for by Veterinary Service Center (VSC) husbandry staff; notify the VSC of animals housed in PI-managed spaces to ensure proper husbandry care
- Check for proper set-up and safety of freezers, cell storage dewars, and other equipment that use liquid nitrogen
- Do not use dry ice in walk-in refrigerators, cold rooms, or other confined areas
    - Dry ice poses an asphyxiation hazard, especially in small, unventilated spaces; do not use it for cooling samples unless safe to do so
- Note the status of research activities at the time of shutdown, including operation of essential equipment on emergency generator and/or back-up power

After completing specific shutdown procedures, designated researchers and staff should then vacate the building, notify the group's emergency contact of whereabouts, and monitor conditions remotely until notified that recovery tasks may begin.

Recover

Researchers and other occupants are permitted to **resume normal occupancy and operations only when formally notified** by local building management, department executive, or other authorized Stanford University staff.

Ideally only designated researchers should perform recovery steps shown below, before all researchers are permitted back into research areas to resume normal activities.

Be Aware of Hazards Before Resuming Work

- Seek assistance and **DO NOT ENTER** research work areas if:
    - Fire alarm horns and strobes are active.
    - Power is off and lights cannot be turned on.
    - Exit signs are not illuminated.
    - Mechanical systems are off or in an uncontrolled state.
    - Other serious, imminent hazards are present like a spill or fire.
- Examine surroundings and identify any slip hazards on floors, walkways and other surfaces from melted ice near refrigerators and freezers.
    - Be particularly cautious of areas where liquids may be present near electrical equipment, outlets, power cords, or other sources of electricity.
    - Do not assume all clear liquids are water; many hazardous liquid chemicals are clear.
    - If in doubt, isolate the area, warn others of the spill with signage or other means, and assess the hazard. Call for assistance for hazard assessment and response if needed.
- Clean up spills only when safe to do so.

Check Research Work Areas to Ensure Safe Conditions

- The group's PI, lab manager and/or other designated researchers or staff should conduct a walkthrough of research work areas to confirm spaces are safe once power is restored and building management has cleared areas for restoration activities.
    - Use the emergency preparedness checklist linked on page 1 as a guide.
- Wear Personal Protective Equipment (PPE) as appropriate for the hazards present in the space when entering rooms and work spaces.
- Exercise caution when entering laser use areas. Wear the appropriate protective eyewear if the lasers could be powered on or the status is unknown.
- Make sure that all emergency walkways and exits are clear of obstructions including boxes, or other materials that may pose a trip hazard.

Confirm Proper Ventilation

- Ensure the general ventilation system in laboratories and other research work areas has been on for at least 30 minutes after AlertSU all-clear message or all-clear notifications from local building management.
- Confirm proper operation of exposure control devices (e.g., fume hoods, biosafety cabinets, glove boxes, snorkels, canopy hoods, and other vented enclosures)
    - Fume hoods: Confirm airflow is restored on airflow monitors.
    - Biosafety cabinets: Run cabinet blowers for 5 minutes then disinfect BSC prior to use.
    - Gas cabinets: ensure proper operation
- Contact Facilities at (650) 723-2281 (or SOM dispatch at (650) 721-2146) to correct deficiencies.
    - **Do not resume work until ventilation systems are properly restored and exposure control devices operate properly.**

Check, Restart and Monitor Equipment

- Be aware of equipment that might have automatically restarted when power is restored.
- Reset and restart equipment per manufacturer instructions.
- Recalibrate and reprogram equipment as necessary.
- Ensure refrigerators /freezers/ cold rooms return to safe working temperature prior to opening doors or at least 12 hours and, keep doors closed on refrigerators/freezers if they have failed.
- Check that equipment previously turned off (e.g., hot plates, spinners, heating mantles, vacuum pumps, sterilizers, water baths, ovens) can operate properly
- Ensure that interlocks, light curtains, powered machine guards, other safeguards, and all engineering and equipment hazard controls operate properly.
- For equipment that operates on cycles, such as autoclaves and dishwashers, check that a cycle was fully completed before opening the door, or re-run the appropriate cycle.
- Ensure cooling water is available before restarting solvent stills.

Debrief Outage Event: Identify Lessons Learned and Adjust Local Emergency Plans

- Assemble the research group members to review the effectiveness of the preparation and response for each outage event.
    - Assess what went well, and what did not.
    - Seek input from all research group members, and provide everyone at all levels an opportunity to contribute to feedback.
- Identify any lessons learned, implement improvements, and adjust emergency plans accordingly. Common improvement measures may include:
    - Clarify roles and responsibilities
    - Modify training for power outages
    - Adjust equipment emergency back-up configurations and plans

- Provide illumination for key areas during outages