



EARTHQUAKE PREPAREDNESS FOR LABORATORIES

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Earthquakes occur with little or no warning, and so planning and preparations must be done in advance. The following information is provided to help department chairs, principal investigators, lab supervisors, and lab personnel assess their areas of responsibility to determine safety procedures and use this information to mitigate situations that may pose a problem in case of an earthquake.

While most historical earthquakes were minor, Indiana's proximity to two seismic zones is of concern (Figure 1). Since 1811, several moderate to strong earthquakes have occurred recorded in the central United States, some of which were located in the Wabash River Valley where known faults related to the New Madrid seismic zone exist.

The bedrock in this region permits seismic waves to travel greater distances without a rapid decrease in wave amplitude (energy), a property referred to as "low attenuation." Low attenuation can lead to a wide area of damage because the wave amplitude remains high over great distances as it propagates away from the epicenter.

The composition of surface soils also contributes to earthquake hazards. Soils composed of loose sand, gravel, and clays in floodplains allow the amplitude of the passing seismic waves to increase causing more intense ground motion. Also, thick soils saturated with groundwater may liquefy and flow during strong earthquakes, causing buildings to move, tilt, subside, or collapse completely.

Although Indiana has not experienced a severe earthquake in recent times, we are susceptible to the negative effects of these unpredictable natural occurrences. Approximately 40 earthquakes, ranging from magnitude 3.0 to 4.9 (M3.0-M4.9), have occurred in Indiana since 1817 (Figure 2). Geologists have located evidence of liquefied soils, suggesting a number of strong earthquakes happened within the state during the last 12,000 years.

For more information related to earthquakes in Indiana, visit the Indiana Geological Survey Website at <http://igs.indiana.edu>.

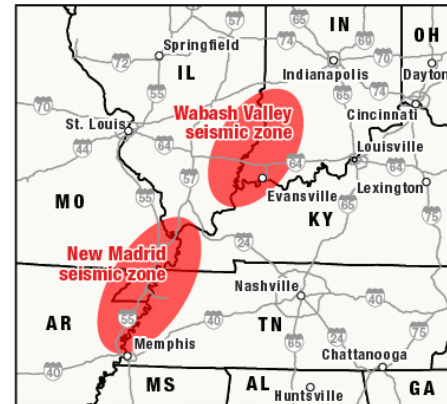


Figure 1. Map showing locations of two seismic zones near Indiana.

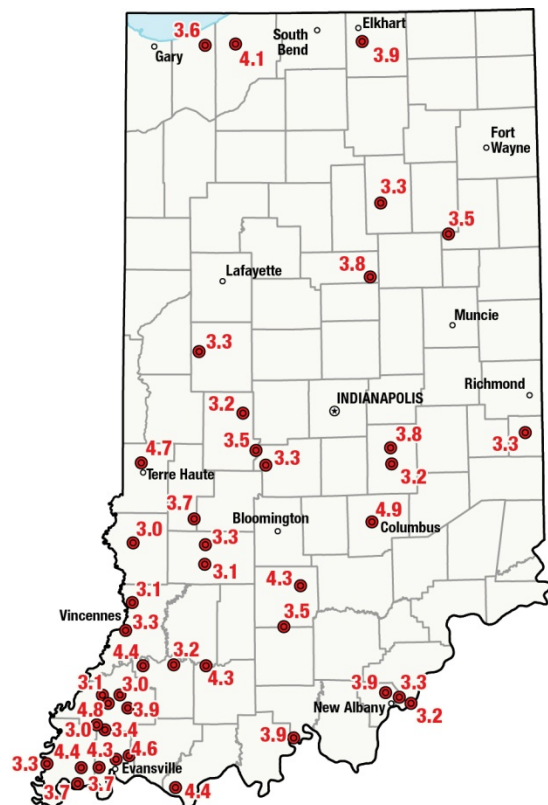


Figure 2. Map showing the locations and magnitude of earthquakes that have occurred within Indiana.

Administration

Campus administrators must ensure that the following plans are in place and up-to-date.

- The campus Emergency Action Plan
- The campus Business Continuity Plan

General Preparation

To prepare your lab and protect your research assets from the dangers associated with an earthquake, the following procedures should be implemented:

- Develop an Emergency Action Plan (EAP) for your workplace, including a predetermined location where you and your co-workers will meet after the earthquake. This should be a safe area outside the building that is clear of overhead dangers. Among other information, the EAP should identify key personnel and alternates who will coordinate emergency services, accept damage reports, provide instructions after an event.
- Designate an alternate meeting place if your primary location is too dangerous.
- Develop a Business Continuity Plan for recovery after an event to ensure that business operations continue with little interruption by assigning appropriate responsibilities in advance.
- Biosafety Level 3 (BSL-3) laboratories must have standard operating procedures in place to follow in case of a loss of electricity or ventilation.
- Establish a long distance contact. Let them know that in the event of an earthquake, you will call them to discuss how you are doing and to collect information about others who have called.

Laboratory Preparation Prior to an Event

Earthquakes occur with little or **no** warning. Thorough preparation and diligence is the key to minimizing injuries and impact on the lab and assets.

- Ensure that all contact information on your laboratory signage is correct and up-to-date. Add temporary contact information if you are away and cell phone numbers, if possible.
- Post the current Emergency Procedure Handbook in the laboratory.
- Ensure that safety equipment (i.e., fire extinguishers, safety showers, eye washes) are accessible and in proper operating condition and that everyone in the lab knows how to operate them.
- Make spill containment supplies available.
- Maintain an emergency evacuation kit with first aid, flashlight, radios, fresh batteries, food, water, and clothing in an accessible easy-to-carry bag.
- Keep exits and aisles free of obstructions.
- Secure furniture and equipment (Figure 3) that might move or tip over in an earthquake including heavy equipment and furniture that could block exit routes. Look for top-heavy free-standing furniture, bookcases, heavy or breakable objects, electronic equipment and appliances, hanging items, unsecured cabinet doors, drawers, and utilities (gas, water, electrical).

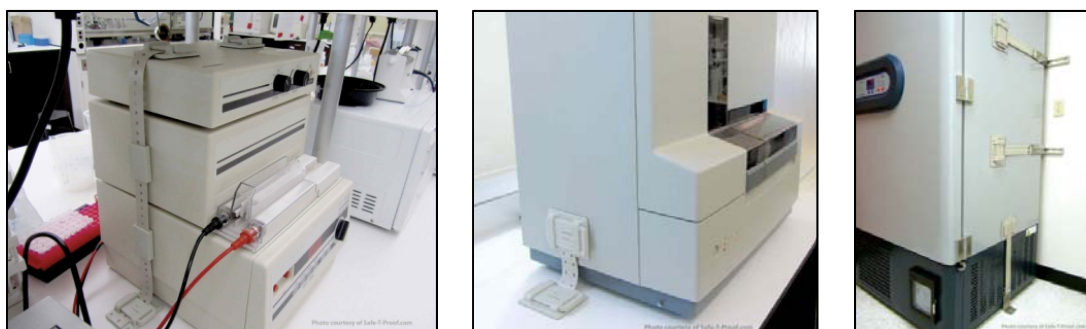


Figure 3. Photographs showing secured laboratory equipment (photos provided by Safe-T-Proof).

- Look for reagent containers and dangerous, hot, radioactive, biological, or hazardous materials that need special attention. Know what to do if a leak occurs.
- Identify equipment and processes that could be damaged or pose a fire or health hazard if power was suddenly lost.
- Establish contingencies to provide backup or emergency power to maintain critical systems.

- Locate safe and dangerous places in your area. Pick a place under a desk or table, in a safe corner, or out of the lab against a corridor wall. Consider flying glass from windows, lights, and glassware or falling objects such as books and equipment when selecting safe spots.
- Know the emergency assembly point for your building, department, or work unit.
- Know your alternate assembly point.
- Secure all gas cylinders. Two cylinder straps or chains fastened to the lab wall are recommended in seismic areas for each cylinder.
- Ensure that pressure regulators are removed and cylinder caps in place on cylinders that are not in use.
- Store chemicals properly.
- Recap chemicals and return them to their storage cabinets immediately after use.
- Close and latch chemical storage cabinets.
- Secure chemical storage cabinets to prevent tipping or movement.
- Equip chemical storage shelves with lips or restraints to keep chemicals and glassware in place (Figure 4).
- Store chemicals in secondary containment trays or tubs (Figure 4).



Figure 4. Chemical storage areas showing use of shelf restraints and secondary containment tubs.

- Store incompatible chemicals separately.
- Remove waste chemicals from the lab regularly.
- Plug refrigerators, freezers, and other equipment into emergency power whenever possible. Red outlets are typically connected to an emergency generator. Avoid opening freezers and refrigerators during power outages to maximize cooling ability.
- Secure and protect valuable research samples, radioactive isotopes, biohazardous agents, recombinant materials, synthesized chemicals, radioisotopes, and regulated materials (i.e., controlled substances, explosives, etc.) to prevent breakage, release, or theft.
- Place critical samples and cell lines in multiple locations and under different storage conditions to maximize probability of survival (i.e., frozen samples in ultra-low freezers and liquid nitrogen vessels). Note: Do not store liquid nitrogen vessels in walk-in refrigerators.
- Keep cryogenic Dewars and reservoirs full for any critical sample storage.
- Be prepared for the housing, care, and security of laboratory animals.
- Close fume hoods when not in use to contain spills and provide ventilation (even when closed).
- Back-up computer files, make more than one copy, and store in several different locations.
- Protect any laboratory documents, such as lab notes, computer discs, and research documentation.
- Post an evacuation checklist (a simplified list of instructions) in large print.
- Keep your identification with you.

During an Earthquake

- DROP under a desk or sturdy table. Stay away from windows, bookcases, file cabinets, and other objects that could fall.
- COVER until the shaking stops.
- HOLD ON to the desk or table. If it moves, move with it.
- Do not leave the building until the tremors have stopped.

Additional tips if you are:

- In a LABORATORY or other hazardous location, stay away from flames, furnaces, gas containers, glassware, and fume hoods.
- In a HIGH-RISE BUILDING and not near a desk or table, move against an interior wall, and protect your head with your arms. Face away from windows. Do not use elevators. Do not be surprised if alarm or sprinkler systems come on.
- OUTDOORS, move to a clear area, away from trees, signs, buildings, or downed electrical wires and poles.
- On a SIDEWALK near a tall building, get into a building's doorway to protect yourself from falling bricks, glass, and other debris.
- DRIVING, slowly pull over to the side of the road and stop.
- In a PUBLIC PLACE, do not rush for exits. Move away from display shelves with objects that could fall on you.
- In a WHEELCHAIR, stay in it. Be aware that they can tip over. Move to cover, if possible, lock your wheels, and protect your head with your arms.
- In the KITCHEN, move away from the refrigerator, stove and overhead cupboards.
- In a THEATER or STADIUM, stay in your seat or get under it if possible, and protect your head with your arms. Do not try to leave until the shaking is over.



After an Earthquake

Depending on the time and circumstances of the earthquake, you may be asked to stay out of the building for a few minutes to a few days, or indefinitely.

Follow the evacuation checklist of items identified in your self-assessment of the laboratory. Have it posted near the exit. This is a checklist of essential steps to take before leaving the building. In order of priority, these include but are not limited to:

- Turn off gas burners.
- Check quickly for fires, fire hazards, or spilled chemicals.
- Check for injured or physically limited people who might have trouble evacuating the building.
- Bring emergency supplies (first aid kit, flashlights, etc.) to the emergency assembly point.
- Close the lab door as you leave.
- Evacuate slowly and carefully. Look before exiting to make sure there is no overhead danger from falling objects, or electrical or gas utilities.
- Report to your predetermined location.
- Report or send a runner to report missing persons, injuries, or hazards to emergency management personnel.
- At your meeting spot, assist others and check on loved ones. Let someone know if you leave.

Implement the Business Continuity Plan when it is safe to restart operations.

Summary

The procedures outlined in this document are critical for the health and safety of laboratory occupants in earthquakes. Please remember that building fires, tornadoes, floods, power outages, and other natural or man-made disasters could have similar impacts on your laboratory space and staff. Most of these preparations also apply to those circumstances. Discuss these plans and take whatever action is necessary to ensure that all issues are addressed. Practice your disaster plans periodically to assure that:

- The plans meet the requirements of current laboratory operations,
- All staff are familiar with both the overall plan and their specific role, and
- The plan is successful in accounting for staff and in reporting staff and laboratory conditions to key personnel.