6.5 Furniture, Fixtures, Equipment and Contents

6.5.4 Hazardous Materials Storage

6.5.4.1 Hazardous Materials Storage

Unsecured or improperly stored hazardous materials resulting in a release may close businesses located in an otherwise undamaged building. Hazardous materials may include cleaning supplies, laboratory or production chemicals, medical sharps, and biohazard containers. These may be stored in fragile containers or may be in open vats in an industrial setting.

Provisions

BUILDING CODE PROVISIONS

The seismic design requirements of ASCE/SEI 7-10, *Minimum Design Loads for Buildings and Other Structures*, (ASCE, 2010) Chapter 13 are intended to apply only to permanently attached components, not to furnishings, temporary items, or mobile units. Storage cabinets and shelving units that contain hazardous materials are not considered to be exempt and should be anchored or braced. In addition, storage cabinets and shelving units that contain toxic, highly toxic, or explosive materials above a threshold quantity are considered designated seismic systems with a component importance factor, I_p, of 1.5 and may require engineering calculations, special certification, and additional inspections.

Permanent floor-supported shelving or storage cabinets over 6 ft tall must be designed as architectural components per ASCE/SEI 7-10. Bracing and anchorage for these units should be designed considering the weight of the unit and weight of shelved contents.

RETROFIT STANDARD PROVISIONS

ASCE/SEI 41-06, *Seismic Rehabilitation of Existing Buildings*, (ASCE, 2007) classifies hazardous materials storage as force controlled, and the principal objective of the code provisions is to prevent the component from sliding or overturning. The emphasis of the hazardous materials storage provisions is on materials in containers. For materials stored in cabinets or shelves, the provisions for storage racks may be used. ASCE/SEI 41-06 requires compliance with the provisions of the standard for hazardous materials storage when:

- The performance level is Immediate Occupancy or Life Safety in high and moderate seismicity areas.

- The performance level is Life Safety in low seismicity areas or Hazards Reduced in high, moderate, and low seismicity areas and the system is in close proximity to occupancy such that leakage could cause an immediate life safety threat.

Typical Causes of Damage

- Loose containers may slide, tip, overturn, or fall. Glassware may break; hazardous contents may slosh or spill and create noxious fumes and toxic mixtures.
- Spilled flammable liquids may cause a fire and destroy a home or business that otherwise may have survived an earthquake without damage.
- Unknown spills may cause building closure until a HAZMAT team can investigate.

DAMAGE EXAMPLES

Figure 6.5.4.1-1 Spilled chemicals in high school chemistry lab in the 1971 magnitude-6.6 San Fernando Earthquake (Photo courtesy of EERI).

Figure 6.5.4.1-2 Spilled pharmaceutical and medical supplies in the 1994 magnitude-6.7 Northridge Earthquake (Photo courtesy of Robert Reitherman).

Figure 6.5.4.1-3 Spilled fluids in a hospital in the Costa Rica Earthquake (Photo courtesy of Degenkolb Engineers).

Figure 6.5.4.1-4 Fire destroyed the chemistry building containing the entire chemistry department at the University of Concepción in the 2010 magnitude-8.8 Chile Earthquake; fire exacerbated by the presence of hazardous chemicals (Photo courtesy of Bill Holmes, Rutherford & Chekene).

Seismic Mitigation Considerations

- The National Fire Protection Association (NFPA), the International Building Code, and the International Fire Code (IFC) contain many requirements pertaining to the classification, labeling, handling, monitoring, shipping, containment, and storage of hazardous materials. Check the applicable jurisdiction for requirements. See also the discussion of hazardous materials piping in Section 6.4.5.1.
- Hazardous materials storage cabinets and lockers are available with secure door closures and internal containment in case materials spill inside the cabinet. Brace and anchor all shelving units or cabinets used for storage of hazardous materials. See Section 6.5.1.1 and 6.5.2.1 for restraint details. Where shelving or cabinets are anchored to a partition wall, check that the partition, bracing and attachments to the structure above are adequate for the imposed loads.
- See Section 6.5.6.1 for recommendations for edge restraints and arrangement of shelved items. Provide edge restraints for containers of flammable or hazardous substances even if they are in closed cabinets.
- Secure large containers of production chemicals or cleaning supplies; these may be secured using tether cables or chains. See Section 6.4.2.3 or Section 6.5.5.3 for similar restraint details.
- Store small or breakable items in original packaging or in “egg crate” type boxes; not loose on shelves or in drawers.
- Ensure that all toxic items are in the correct containers and properly labeled.

- Ensure that employees know what to do in case of a spill. Make sure they know where to find the Material Data Safety Sheets (MSDS). The MSDS contains physical data for chemicals, chemical compounds and chemical mixtures and provides information for workers and emergency personnel regarding the safe use and potential hazards of each product. The MSDS includes information such as melting point, boiling point, flash point, reactivity, toxicity, health effects, protective equipment required, first aid procedures, storage and disposal procedures, spill-handling procedures, and labeling requirements. Facilities that use or store chemicals should have an MSDS for each product on site; employees should know where to locate the MSDS binder and know what steps to take in case of a spill.

- Store incompatible materials at a safe distance from each other to avoid mixing if the containers fall and break.
- Order hazardous lab chemicals in unbreakable plastic bottles or in glass bottles with an exterior plastic safety coating.

- Keep all large containers or vats of toxic, hot, or hazardous items covered to prevent surging in an earthquake.