EARL WARREN HALL and the BIOCHEMISTRY BUILDING

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Introduction

Earl Warren Hall, which houses the School of Public Health, the Public Health Library, and the Cancer Research Genetics Laboratory, and the Biochemistry Building were chosen for this survey because both contain lecture halls that are heavily used for undergraduate courses. In Warren this is Room 22, having a capacity of 174 persons, and in Biochemistry it is Room 101, which holds 130 people. Neither building has many classrooms; Biochemistry has only one, Room 110. Both have laboratories used by undergraduate and graduate students, as well as research laboratories. Warren, although its upper floors are predominantly small offices, shows more of a diversity of room types than does Biochemistry, whose rooms are principally laboratories. The laboratories found in both buildings, with their glassware, equipment, chemicals and organisms, represent unique earthquake hazards.

Earl Warren Hall and the Biochemistry Building are located in the extreme northwest corner of the Berkeley campus bounded by Oxford Street and Hearst Avenue (FIGURE 1).

Warren Hall was built in 1955 and is a six-story concrete and brick structure. It was rated "good" in a recent campus survey for structural safety.[6] The ground floor is in the shape of a T. Administrative offices, student lounge, and a small conference room form the base of the T. The library forms one wing of the crossbar and a lecture hall, classroom, and Media Resource Center make up the other half. Two elevators (one runs only between the ground and third floors for transporting hazardous materials) and one stairwell are located where all three wings meet. Another interior stairwell is located in the west end of the buildings, at the base of the T, and is lit by narrow windows.

The first floor is in the shape of an L. Two undergraduate laboratories, an animal room, storeroom, media preparation room, and a research laboratory form one wing. The other wing contains newly completed laboratory facilities. The Cancer Research Genetics Laboratory, currently located on the second floor, is in the process of moving into these facilities.

The upper floors consist of only one wing. Faculty offices and two classrooms are found on the third floor. Two small and one large seminar rooms and numerous faculty offices make up the fourth and fifth floors, respectively.

Biochemistry was constructed in 1964 and is a six-story concrete box structure which was rated "poor" by structural engineers with regard to seismic design.[6] One enters the building on the first floor from entrances located at the northeast and southwest ends, the ground floor being the basement. Elevators are located in the west end of the building. Interior stairways are near the northeast entrance and an exterior stairway is located in the southwest corner of the building.

A lecture hall, classroom, research laboratory, two undergraduate laboratories, cold room, storeroom, balance room, and small office are located on the first floor. The remaining upper four stories primarily house research laboratories and a few faculty offices. The Biochemistry Library and the Biochemistry Department offices are located on the fourth floor. There is a P-3 laboratory on the roof, the P-3 designation referring to the U.S. Public Health Department class of hazardous agent used.

The Santa Barbara campus during the 1978 earthquake

On August 13, 1978 the University of California Santa Barbara campus suffered a 5.1 magnitude earthquake.[5] The Chemistry and Biological Sciences buildings on the Santa Barbara campus are comparable to Earl Warren Hall and the Biochemistry building, and many of the hazardous situations discovered at Santa Barbara are also found on the Berkeley campus.

Earthquake damages in the laboratories of the Santa Barbara buildings amounted to slightly less than $100,000. They were primarily due to damage to poorly secured instruments which fell over and subsequently had to be either replaced or repaired.[19]

Each building at Santa Barbara has its own natural gas system. The power was automatically turned off after the earthquake, minimizing the chance of fire, and the water supply left on for fire fighting purposes. Broken pipes resulted in water damage on lower floors. There was some spillage of chemicals but it appeared that nothing incompatible mixed together as no fires broke out. Gas odors were prevalent, and firemen wore gasmasks while inspecting the damage. Chemists already present in the building during the earthquake did not wear masks while cleaning up after the earthquake and did not appear to suffer from inhalation of noxious fumes.[19]

All gas cylinders fell, even though attached prior to the earthquake. Those which had been fastened using "C" clamps came loose or chains broke. Regulators broke from three cylinders.[19]

No major damage occurred in the storerooms, which already had seismic strips on shelves. In other rooms diffusers falling from ceiling fixtures were a common problem. Many 84-inch unbolted bookcases fell over, denting desks onto which they fell. Four or five wall cabinets full of glassware and chemicals fell to the floor in the Biological Sciences building.[15] Everything on the racks in the walk-in refrigerators spilled or fell to the floor. Many animals escaped when their cages fell over. None of the Santa Barbara electron microscopes were damaged,

although on the fourth floor of the Chemistry building a 5000 pound piece of machinery sheared bolts and moved four inches.[19]

A potentially hazardous example of falling ceiling panels occurred in a lecture hall of the Chemistry building. Sheet metal panels weighing several pounds each were dislodged from ceiling strip openings and rained down on unoccupied seats below, leaving gashes in the back of the seats.[15]

Much of the damage incurred at Santa Barbara as a result of the earthquake could easily have been prevented had hazards been foreseen and remedied. What similar hazards exist on the Berkeley campus and how can they be minimized?

Results

The major danger expected to occur throughout Earl Warren Hall and the Biochemistry building during an earthquake is from falling hazards and would result in personal peril to occupants, as well as in costly damage to equipment. Classrooms and lecture halls are relatively safe, but other parts of these buildings are not. Particularly hazardous is the Public Health Library where falling books, catalogue files, concrete masonry, light fixture diffusers, ventilator coverings and broken glass are potential hazards. In the Biochemistry building the research laboratories can expect showers of glassware and spilled chemicals, including carcinogens. Cluttered hallways impeding egress from the buildings (more of a problem in Warren than in Biochemistry) and exposed overhead steam and gas pipes are dangerous. Many of the small faculty offices suffer from poor spatial arrangements of furniture, creating falling hazards and blocked doorways.

There are fewer hazardous chemicals in Warren than in Biochemistry but more nocuous organisms such as oncogenic viruses and pathogenic bacteria. Since many are fastidious organisms with special growth requirements, they would not be expected to pose significant health risks in the outside environment, but would pose a risk to persons cleaning up after an earthquake.

In either building ruptured gas and water lines and the presence of gas and spilled chemicals may be potent fire hazards. Custodians are not trained to shut off gas mains, but personnel from the Office of Facilities Management are expected to be able to respond quickly and shut off the appropriate systems.[18]

Earl Warren Hall

The Public Health Library has several potentially hazardous situations. Falling glass from the large 1/4 inch plate glass windows forming the west wall of the library could be a hazard to persons sitting at the reading tables or exiting. Also, a wheeled photocopier is situated next to the windows and could break through the glass if given adequate momentum by an earthquake. Seven masonry structural columns running the length of the library could spill, creating

debris and a falling hazard. Catalogue files are not bolted down, although they are backed against metal files, giving them some support. Drawers are necessarily unlatched and could fall on the floor, hindering egress from the library. Library offices are behind partitions whose upper half is glass. Here contents from bookcases along the back wall could fall and injure persons sitting at desks directly in their path.

In the stacks other falling hazards include metal grills that could be shaken off the light fixtures suspended from overhead pipes. Metal ventilator coverings high on the walls at the ends of most rows of stacks could fall. The books would be thrown from the shelves and the shelving itself might collapse, posing a significant hazard to persons in the stacks. The entire structure would not be expected to fail, since the stacks are bolted at the top and the bottom.

The Media Resource Center, Room 26, has several unbolted bookcases containing cassette tapes, boxes of film, speakers, microphones, and other equipment. Seismic strips are not appropiate for shelves with boxes of tapes or film, since they could not be removed from the shelves with the strips in place unless the shelves were widely spaced apart. Tilting the entire bookcase or individual shelves so that the front edge is higher than the back, would keep these from coming off the shelf in the event of an earthquake.

The lecture hall, Room 22, is relatively safe. Although there are no "safe sites" where one could get under and be protected from falling objects (since the seating is auditorium-style folding seats) there is little that could fall, except for light fixtures and insulation tiles. The room has no windows. One of the exits leads directly outside, where the major hazard might be falling trees. The other exit leads to a hall where, as in the library, falling glass from large plate glass windows would be a hazard.

Room 26, a classroom, also has few falling hazards. A speaker perched high on a shelf in the front of the room, a movie screen, lighting fixtures, and insulation tiles pose the only significant hazards.

The first floor undergraduate laboratories have relatively few hazards. Exceptions are light fixtures whose diffusers could fall, unbolted incubators and refrigerators, and microscopes on shelves behind a pulley-style blackboard. The latter could fall when the blackboard is raised. The refrigerators in these labs contain vaccine preparations, inoculated media on plastic petri plates and slants, microtiter plates, bottles of hydrogen peroxide, and cans of ether. The incubators also contain inoculated media. These could create a mess as the result of an earthquake but probably not pose a significant health risk, although proper precautions should be observed in cleaning up such materials.

In the animal room, Room 158, some cages are suspended from a pipe network and are very secure. Others are on shelving without any lipped edges and these cages could slide off onto the floor. Cages with unattached lids that simply rest on top, could easily come off, allowing the animals to escape. Those cages with pressure release latches may be opened when they fall. There are also some wheeled carts stacked with cages that could topple over. The main danger is that some of these animals are infectious, having been injected with bacterial or viral organisms, and could possibly be a health threat to someone trying to catch them and put them back into their cages after an earthquake. Their escape into other parts of the building is minimized, since there are two separate sets of doors between the room in which the animals are kept and the hall.

The first floor hallway is cluttered with unbolted furniture. Empty bookcases, desks, cabinets, gas cylinders chained against the wall, bags of animal feed on dollies, wheeled carts with laboratory media or contaminated material to be autoclaved, and refrigerators line the hallway. These could fall, spilling any contents, and block exits. Overhead exposed gas and water pipes and ventilator shafts run the length of the hallway.

The storeroom, Room 140, has seismic strips on some but not all of its shelves. The shelving units are bolted on the bottom but not at the top.

The cancer laboratory on the second floor has no seismic strips on the lab benches or countertops, nor do the new facilities they are moving into on the first floor. The hallway on the second floor has many unbolted bookcases and file cabinets that could hinder egress and pose falling hazards. Safe storage practices of placing lightweight plastic objects up high and glassware and heavy objects low and preferably behind well-latched doors are observed in some rooms but not in all.

On the third floor the two classrooms are relatively safe, the desks providing "safe sites" from possible falling diffusers and broken windows. The upper one-third of the interior walls is glass. Clocks on the wall are placed low and to the side away from where persons might be standing or sitting. Most of the third floor hallway is lined with windows which pose a hazard from broken glass. Bookcases full of boxed pamphlets and filing cabinets, all unbolted, pose a hazard, as do numerous small pictures on the walls.

There are interconnecting doorways between the classrooms so that there is a variety of ways to leave the floor and reach the stairs.

Some offices on the third, fourth, and fifth floors show poor spatial arrangements, such as unbolted bookcases overloaded with heavy objects placed on top which could easily fall, blocking doorways, as would file drawers thrown out of their frames if they were not locked or firmly latched. Plants suspended over desks, while aesthetically pleasing, could fall or swing and

break windows. Desks are often next to windows where the hazard from broken glass is the greatest.

Biochemistry

The Biochemistry building has many of the same types of hazards as Warren. The halls are like those on the first floor of Warren, with exposed pipes and ventilator shafts overhead, but the lights suspended from pipes have light-weight plastic diffusers. The first floor hall also has a number of built-in display cases, often near exits, which could create a broken glass problem.

In general, the same hazards occurred in all the research laboratories surveyed. Floor-to-ceiling glass-windowed cabinets with chemicals, glassware, and equipment on shelves lacking seismic strips or similar kind of restraint were prevalent in most of the labs. Only a few labs have seismic strips on their shelving or lab benches, but all are supposed to get them soon.[1] Too often glassware is stored high, bookcases are unbolted, desks are under windows and have precariously perched shelving. Large five-gallon glass water bottles (plastic would be safer), refrigerators, incubators, scintillation counters, and other large pieces of equipment are unsecured. Cold rooms have glassware and equipment on benchtops and unchained gas cylinders.

Some of the offices showed poor spatial arrangements, but the doors open out into the hallways, and the halls are not cluttered with objects that could roll, topple, or shift and block doorways.

Conclusion

In both Warren and Biochemistry many of the hazards that might be incurred as a result of an earthquake can be rather easily remedied, minimizing the amount of injury to persons in these buildings. Flying objects and toppling or shifting of heavy equipment or furniture during an earthquake can be serious hazards. Overturned furniture is not just an immediate hazard to occupants of a room, but can also block egress from the room or building. Unlatched drawers can be thrown out of filing cabinets into exits or passages. If the cabinet is not anchored to the wall or floor, it can tip, spilling the top drawers to the floor. Loose materials stored on high shelves should be held in place with seismic strips or face bars. If this is not practical, tilting the shelves back can help keep things from falling. Chemicals and glassware should be on shelves with seismic strips or behind sliding or well-latched doors in cabinets well anchored to the wall or floor.

Display cases and interior windows in doors or partitions should be of tempered or safety glass. Displays in wall mounts or recessed showcases should be tied down so they cannot come

loose and break glass fronts. Changing the use pattern or arrangement of furniture to minimize exposure to falling glass or objects is often more feasible than totally eliminating such hazards.

Damage due to excessive pipe movement or differential deflections between pipe systems and connected equipment has been known to occur during earthquakes.[3] The type of fitting used and the way the pipe is supported is important in eliminating hazards from ruptured pipes. Interior stairwells should have battery-powered emergency lighting units which are securely tied to the building, so that safe exit will be possible if the electrical power is shut off or fails. Lighting fixtures pose an ubiquitous hazard, with few designs having taken seismic safety into consideration.

Because of the nature of research work and the necessity of using glassware and the fact that much equipment must be kept out on lab benches and cannot be easily or practically secured, some damage is unavoidable in any laboratory. Bolting down and securing heavy equipment and the use of seismic strips can do a great deal to decrease the amount of property damage and make rooms safer for their occupants by lowering the risk of flying objects and chemicals and blocked exits. If persons are more aware of what can happen as a result of an earthquake, they may be able to recognize hazards before the next earthquake happens, and less injury and damage may be the result.