LIFE SCIENCES BUILDING

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Introduction

The Life Sciences Building on the Berkeley campus was completed in 1931. The five-story building, one of the largest buildings on campus, is located 300 yards west of the Campanile, and about 600 yards west northwest of the Hayward fault (FIGURE 1). The building is rectangular with exterior walls of poured concrete. The floor and internal columns which support the floors and ceiling are also concrete. The inner walls have no bearing strength. They are hollow tile and only serve as partitions. These can be easily pulled down and rearranged to meet the needs of faculty and students. Hollow tile walls are not secure and have been known to collapse.[16] Structurally, the building was rated "fair" in a recent survey.[6]

The Life Sciences Building was chosen for this survey because of its size, function and the large number of people that use it. It has over 500 rooms and laboratories. There are administrative offices, lecture halls, classrooms and auditoriums. The main corridor runs all the way around the interior of the building with rooms opening from both sides. Some rooms on the ground floor are below ground level. There are two main stairwells that service the building: one at the east end, one at the west end. Both are internal, neither has natural lighting, and both lack fire blocks (e.g., fire doors). There are five major exits from the building. One is at the southwest corner on the ground floor. The other four are on the second floor: one at the east end, one at the southeast corner, one at the northeast corner, and one at the northwest corner.

The departments of Bacteriology and Immunology, Biology Physiology, and Zoology are housed in the Life Sciences Building. There are 631 permanent employees (staff and faculty) in the building. Approximately six thousand students and visitors pass through Life Sciences on an average school day.

The Life Sciences has a number of special purpose rooms. The main auditorium and two other large assembly rooms are located near the east entrance of the second floor and part of the third floor. In the courtyard there is an aviary, a vivarium, five water pools and a few heavy air-conditioning units. There were smaller air-conditioning units hanging out of windows, overlooking the courtyard. There is an herbarium, structured in nine levels, but reaching from the first to the fifth and upper floor. This structure has its own stairwell.

The Museum of Vertebrate Zoology is located at the west end of the Life Sciences Building and extends from the second floor through to the fourth floor. Live animals are kept in cages mostly on the fifth floor and present unique problems during an earthquake.

The biology library has substantial stacks of books in the eastern part of the building. This has six levels starting on the third floor and extending up to the fifth floor.

The machine shop, which contains some heavy equipment, is located on the ground floor. Classrooms, undergraduate laboratories, faculty and graduate research laboratories, offices, stock rooms and rest rooms are distributed throughout the entire building. Although there are many animals housed in the building, and many experiments, there is no central emergency power system. This is particularly a problem in the stairwells, which have no natural lighting. A few faculty members have their own portable auxiliary power supply to use on their experiments in the event of power loss. Water sprinkler systems run throughout the hallways, a measure taken to reduce the hazard of fire.

The Santa Barbara Earthquake: A Case Study

Reports and photos of damage suffered by the Biological Sciences building on the Santa Barbara campus during the 1978 earthquake were studied. All the general hazards, such as falling ceiling tiles and lighting fixtures, toppling shelves and damaged equipment which usually accompanies a large seismic event were observed.[19] There was approximately one hundred thousand dollars worth of damage to equipment due to the earthquake. The greatest cost was in damaged equipment that was expensive to replace. Some chemical spillage did occur, however, since the water sprinkler system was left on to fight any fire that may have broken out. Some gas pipe lines ruptured and leaked. Wall cabinets full of glassware, chemicals and equipment fell off the wall onto the floor. Very few things which were on racks or table tops survived the movements. Laboratory animal cages fell to the floor releasing many animals. Some of the chains securing the gas cylinders broke, resulting in the gas cylinders falling over and releasing gas.[19] Gas cylinders are usually equipped with a two-valve outlet. Only when both valves are off, is the risk of leakage avoided. Many workers fail to turn both valves off before leaving.

It was found that no damage occurred in areas where seismic strips had been installed.[19] Much of the damage might have been prevented by appropriate prior action. Similar hazards exist in the Life Sciences Building on the Berkeley campus and ought to be corrected.

Analysis of Results

A survey was made of the Zoology department as a sample of the type of equipment and facilities in the Life Sciences Building. Following are the results of the survey.

The ground floor of Life Sciences opens onto an inner courtyard. The major hazard in the courtyard comes from the air-conditioning units that protrude from the windows above. The larger air-conditioning units are bolted to springs and appear secure.

The aviary is presently not being used and does not appear to be hazardous. The vivarium is in the middle of the courtyard and is largely below ground. There is only one exit from the vivarium, on the west end, and this may pose a problem, since the area is small and houses many chemicals and gas cylinders, which may be fire hazards. The Zoology department is trying to get another door put in which would lead directly into the courtyard. This is a very good step in terms of emergency preparedness. There are a very large number of gas cylinders that are not secured and often placed in areas that would become impassable if these cylinders were to fall over. An increased awareness on the part of the users of these laboratories could reduce this hazard substantially. Seismic strips have been placed along most storage shelves. There are fire extinguishers and a first aid kit available, but the long narrow, crowded layout of the vivarium could cause delay in reaching them. The main hazard in the courtyard is debris (such as air-conditioners) falling from above.

There is one main outside entrance from the east end leading to the main auditorium and lecture halls. The main auditorium is the largest of the three. It has four rear exits and two side exits. The spotlights suspended above the side exits may cause injury or block the exit by falling during an earthquake. There are no other obvious overhead hazards. All the light covers are installed from above and have negligible chance of falling. In the event of an emergency, congestion may cause delay in leaving the building due to the narrow aisles. The two other lecture halls on either side of the main auditorium are similar in design and pose similar problems. These lecture halls have suspended light fixtures of the type that fell in the Santa Barbara earthquake. Each hall has one side exit and two rear exits. All eight rear exits lead into a common hallway servicing the main exit. This hallway would be a congested area in an emergency, and thus offers considerable risk to those delayed in exiting the area.

The library stack area is prone to many of the same problems as the other libraries on campus. Books falling off shelves may block passage ways and cause injury. Study cubicles in the stacks provide little cover. Card catalogs may slide out and spill over. Microfilm equipment may fall off bench tops and be damaged. Many display cases line the exit way. The glass could shatter and cause injury to those exiting.

Many tools and equipment are repaired or made in the machine shop in the lower level. This area is filled with heavy equipment on floors, benches and table tops. The mass of these machines is expected to hold each one down in an earthquake. This may not necessarily be the case, as was found when a two ton machine came off its supports at UCSB. Some are suspended

from the ceiling, and could cause the ceiling to cave in because of the weight of the equipment and the large distance between supporting columns. It is hoped that the ceiling is well enough engineered to handle the weight. Here, and throughout the rest of the building, exposed gas lines and lighting fixtures present many of the same problems already discussed in the introduction to this section. Metal shelving units, card files, files with nails, screws and other hardware items may slide open and fall. Attempts have been made temporarily to secure shelving units by tilting them back. Fire extinguishers and first-aid kits were present.

Classrooms appear relatively safe. Falling light fixtures, wall cabinets and shattering windows are the only things that could do damage here. The student laboratories also have the usual light fixtures and wall cabinets found throughout the building. They also have boxes and chemicals on shelves and in cabinets, and equipment on benches. These rooms are generally uncluttered and relatively safe. A few rooms have suspended electrical cables that could be very hazardous. Most of the rooms in Life Sciences have only one exit into the corridor, with no emergency exits.

The stock room poses numerous hazards. Rows of tall shelving units that house chemicals, glassware and equipment are not secured to the floor or ceiling and may fall during an earthquake. This may result in passageways cluttered by broken glass and spilled chemicals. It was noticed that heavy objects, bottles and jars were stored low and seismic strips were installed in attempts to minimize possible damage. Work has also begun to secure units to each other and eventually these will be secured to the floor or ceiling. Some gas cylinders were still found to be secured with weak chains. In some cases the chains were so loose that their purpose had been lost.

The animal room on the fifth floor houses a stock of mice, rats, and rabbits. The cages are on roller racks and can easily slide off during an earthquake. Some cages which are without lids may fall and allow animals to escape. Since these animals are not sick or diseased, no danger of epidemic exists. An emergency door is present but is blocked by a cart. Snakes are housed in a small stock room in cages. These may also get loose and will require special care in returning them to their cages.

Most offices are poorly arranged. Unsecured shelves and cabinets are located near work areas, desks or exits. These have been known to fall over and cause injury or obstruct exits. File drawers can open and fall over. Hanging plants, picture frames, clocks and other office knick-knacks that are not properly secured may fall. Desks have also been found near windows that may shatter. Cluttered faculty offices present a major hazard to their occupants in the event of an earthquake. It appears that the clutter in an office was proportional to the length of time that each office has been occupied by the same person. Older faculty tended to have the worst clutter, and thus run the highest risk. Many younger faculty appeared to be taking steps to reduce this problem in their offices. Such efforts on the part of the older faculty were not

noticed. Perhaps each department could look into this matter.

Overall, the Zoology department has done much to reduce risk of hazards in the event of an earthquake. The hallways are generally uncluttered. Suspended lighting fixtures and sprinklers are found throughout the corridors. Congestion and blocked doors are liable to be the main source of problems. Plaster and ceramic tile on walls and ceilings often fall during an earthquake, causing injury to those below. These tiles are used in laboratories, offices and hallways.

Most of the possible hazards can easily be remedied and thus minimize the risk of earthquake damage. Heavy equipment shifting, falling objects, shattering glass and ruptured gas, steam and electric lines, and fire are serious potential hazards. Fallen objects not only may cause injury but may also obstruct exit ways. All heavy equipment and permanent furniture should be bolted down. All drawers should be latched to prevent them from accidentally sliding open. Wherever possible, seismic strips and tilt-back shelves should be installed to keep objects in place. Rooms should be arranged for maximum safety. Glass display cases and large glass windows should be of tempered glass or glass with wire running through it as reinforcement.

Because of the hazardous nature of the hollow tile walls, mounted cabinets and shelves are not very secure. The stairwells ought to have battery-operated emergency lighting that is secured to the walls of the stairwell.

The faculty members of the Zoology department have been made aware of hazards that may occur during an earthquake. Twenty members of the department are currently enrolled in first-aid and C.P.R. courses. A contingency plan has been developed and all the faculty members have agreed to meet at Edwards Field after the earthquake.[16]

The Life Sciences Building has a sturdy structure and was rated "fair" in a recent structural survey of campus buildings.[6] The floors and exterior walls are not very likely to fall in.[13] The main hazards in Life Sciences are debris and fire or gas leakage.

In the event of an earthquake, one should behave as follows: Hide in a "safe area" until the earthquake has stopped. Ordinarily a doorway is a good "safe area," but most of the doors in Life Sciences have glass panels in them. These could shatter and cause injury. In finding a safe place great care must be taken to avoid broken gas, steam or electric lines. Other than sturdy tables and benches, a room corner away from windows and other hazards, or near one of the solid structural columns may also be a good "safe area" in the Life Sciences Building. Try to leave the building and help any injured person. Attempts to stay and repair damage should not be made, since large tremors have been known to follow the first jolt. Once out of the building, get as far away from windows, power lines and other hazards as possible. The outdoor campus police telephones should be used for emergencies, such as reporting a fire or a trapped or seriously injured person. If it is necessary to leave the campus, inform another faculty member. With forethought and proper planning an earthquake need not be as hazardous as they have been in the past.