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Strategic Plan for Loss Reduction and Risk Management:
University of California, Berkeley

Office of the Vice Provost and the
Disaster-Resistant University Steering Committee

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"The Economic Benefits of a Disaster Resistant University:
Earthquake Loss Estimation for UC Berkeley," by Mary C. Comerio, April 2000.

University of California at Berkeley
Institute of Urban and Regional Development

University of California, Berkeley

STRATEGIC PLAN FOR LOSS REDUCTION AND RISK MANAGEMENT

Office of the Vice Provost
&
The Disaster-Resistant University Steering Committee

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DISASTER-RESISTANT UNIVERSITY PROJECT

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EXECUTIVE SUMMARY

In the nearly three years since Chancellor Berdahl announced the creation of the Seismic Action plan for Facilities Enhancement and Renewal, the UC Berkeley campus has intensified its attention to seismic safety issues. SAFER Program initiatives have changed the organizational structure, altered the landscape, and increased our understanding of the complex operational needs of the campus. This ***Strategic Risk Management Plan*** grows out of the SAFER Program, and advances its twin goals of safety for the campus community and sustained operations in the event of a major earthquake.

This plan provides for increasing the ability of UC Berkeley to withstand future disasters without harm to people, excessive losses to property, or interruptions to our mission. Identified in the plan are actions that will contribute to prevention of life loss and injury from structural, nonstructural, or utility failures in an earthquake, flood or fire. Of nearly equal importance are the efforts that will support sustained operations following a disaster; in the plan are procedures for developing an institutional capacity to resume operations within 30 days of a damaging earthquake. The plan offers a blueprint for maintaining UC Berkeley as a pre-eminent university, even after a damaging earthquake.

The costs of strengthening the built environment are large, as the SAFER Program has shown, but the campus has responded to the challenges in creative ways, and its commitment will not waver over the 20 or 30 years necessary to improve our structures and infrastructure. Reducing nonstructural, or content, hazards will have some costs, but huge benefits. Ensuring the safety of contents will not only cut UC Berkeley's losses substantially, but will be critical to sustaining research, teaching and business operations in the wake of an earthquake. Small, incremental additions to normal operations and maintenance budgets will fund much of the nonstructural mitigation and planning activities called for in this plan.

The strategies put forward in this plan involve a change in organizational culture at UC Berkeley. Seismic safety is a top priority here, but there is a prevalent notion that achieving it remains the responsibility of a few people, scattered in obvious units around campus. In fact, SAFER Program goals and those of this plan can be met only by involving every control unit, every college, every department, and every Organized Research Unit. To increase UC Berkeley's safety and sustainability, the Chancellor and Vice Chancellors, deans and department chairs, and unit heads and office directors must do their part. Faculty, staff and students have roles as well. Enumerated herein are steps appropriate to every level.

To support these initiatives, the responsible parties must understand them. To that end, this plan calls for a comprehensive information and education program for both the campus community and for interested parties in the City of Berkeley, the greater Bay Area, and the State of California. We must inform them about the hazards UC Berkeley faces, our vulnerabilities, steps we are taking to decrease them, and how they can help us in our efforts. When we point out both our potential losses and the implications of those losses, a clearer vision will emerge: one in which we work together to preserve and enhance the foundations of UC Berkeley's excellence.

SECTION I. VISION AND GOALS

The UC Berkeley campus sits astride the Hayward fault on the slopes of the wooded East Bay hills, just where Strawberry Creek exits them. In this setting, it is vulnerable to earthquakes, urban-wildland fires, and flooding. In the 130 years since its founding, UCB has been fortunate with respect to disasters: the great fires of 1923 and 1991 missed the campus itself, but destroyed the homes of many faculty, staff and students; only the flood of 1962 did significant damage to the campus; and there have been no significant earthquakes on the Hayward fault.

However, the hazards remain and the risks increase. On a busy weekday, as many as 50,000 people can be on the campus. A major earthquake on the Hayward fault (for which seismologists offer a 32% chance over the next 30 years) could kill and injure students, faculty and staff. Damages to campus facilities may be extensive, perhaps enough to close numerous classrooms, offices and research facilities for a significant period of time. Such closures would compromise our mission as a great teaching and research institution. Beyond our campus perimeter, the communities in the Bay Area that rely on us for employment and business would be without our support.

Following the recommendations of this plan will enable the university to protect life safety, sustain its operations, avoid litigation and negative publicity, and contribute to the public good.

University Mission

It is the mission of UC Berkeley to teach, to conduct research, to contribute to the well being of the community, and to do all of the above as safely as possible. It is important to ensure that the mission will not be interrupted or compromised by foreseeable natural disasters. This plan provides direction and coordination for risk management activities at UCB: it articulates objectives, defines tasks, and outlines an implementation framework.

Vision

UC Berkeley is a pre-eminent public university and our intention is to maintain its high standing after a disaster. Our vision is a disaster-resistant university, one that is able to withstand the impacts of possible hazard events without harm to people, unacceptable losses to property, or interruptions to our mission. We have the following institutional objectives:

1. Safety—reduce the risk of death or injury to members of the campus community in a disaster.
2. Community safety—assure that the public will not be harmed by hazards associated with UCB.
3. Resiliency—continue our teaching and research activities with minimal disruption following a disaster.

Our primary intent is to prevent life loss and injury from structural, nonstructural, or utility failures in an earthquake, fire or flood. A related goal is to sustain operations after a disaster: to

develop the ability to resume instruction and research activities within 30 days of a large foreseeable disaster. Failure to open for business within that period of time constitutes a considerable threat to the viability of UC Berkeley (**see the note at the end of this section**).

To accomplish the primary goal, UCB must continue its aggressive program of strengthening vulnerable buildings, and increase its attention to nonstructural hazards in all buildings, regardless of their seismic rating. It must substantially upgrade its utility infrastructure, including voice and data communications. It must train personnel to respond appropriately to emergencies. Similarly, it must pursue prudent measures to reduce fire and flood hazards.

Achieving the second goal depends on UCB developing business continuity plans for teaching, research, business operations, and utilities, and beginning soon to implement the recommendations articulated in those plans. Furthermore, we must consider building or retrofitting some structures to levels above minimal building code requirements to ensure post-quake operability. Lastly, UC Berkeley should create a disaster recovery plan that will guide the complex repair and replacement decisions it will be called upon to make over many months, or years, following a disaster.

At the same time, UCB relies on the community and its ability to withstand disasters. To increase its disaster resistance, UCB will work with city governments and private organizations on projects that enhance its ability to respond to, and recover from a major disaster. The resilience of neighboring communities and businesses will have a bearing on UCB's ability to reopen and recover. Because the Bay Area uses UCB as a source of both employment and employees, and for other resources such as ideas, cultural events, and public service programs, its closing, even for a short period of time, will have extensive economic and social impacts on the region.

Policies

The aims above echo those of UC Berkeley's Seismic Action Plan for Facilities Enhancement and Renewal (SAFER) Program, adopted in 1997:

> To do all we can to improve the safety of the campus in the event of a major earthquake on the nearby Hayward fault. Our top priority is the protection of the life and safety of students, faculty and staff. We also want to ensure the sustained operation of the campus (10/30/1997).

They are, furthermore, in keeping with the policy of the University of California Office of the President:

> To the maximum extent feasible under present earthquake engineering practice, to acquire, build, maintain, and rehabilitate buildings and other facilities which provide an acceptable level of earthquake safety for students, employees, and the public who occupy those buildings and other facilities at all locations where University operations and activities occur (last revised 1/17/1995).

Strategies

The strategies below promote the development of disaster resistance at UCB. To achieve our objectives, we must accomplish the following:

1) **Understand the nature of our hazards**. Know and specify the risk that earthquakes, fires, floods and other events pose to our facilities, populations, and programs. UCB must update its institutional vulnerability assessment to reflect changes in scientific understanding of hazard agents or other pertinent social and economic forces.

2) **Develop or obtain the tools necessary to reduce our risk**. Define efficacious mitigation steps, find the resources to implement them, and ensure that our personnel have the capacity, the training, and the backing to do so. In addition to dedicating most of its capital budget to seismic concerns, UCB must use some of its operating budget and consider campus contingency funds. It should change its priorities for the next capital campaign to encourage private donors to contribute, directly or indirectly, to increased seismic safety.

3) **Eliminate known sources of harm**. The campus must pursue an active and aggressive program of earthquake risk mitigation in structures, utility systems, and nonstructural elements until the damage potential has been acceptably reduced. Concomitantly, UCB must apply prudent loss reduction and risk management practices to fire and flood hazards.

4) **Institutionalize risk reduction**. Create a policy structure and management process to address risk reduction over time. Beyond continuing the ten-point SAFER Program Plan of Action, we must incorporate emergency preparedness and risk management concepts into all departmental and college plans and programs. Finally, we must integrate our plans into larger city, county, and state networks.

5) **Formalize business resumption planning**. Offices and departments carrying out the university's ongoing instruction, research, and business activities will identify their vital functions, and develop a framework for prioritizing and restoring those functions following a disaster. As distinct from emergency response, business continuity planning has to do with the period from 72 hours to 30 days following a disaster, and addresses steps for resuming operations. UCB has a comprehensive emergency response plan and ongoing personnel training and exercising; however, business resumption plans are sketchy at best, and personnel are not prepared to handle reopening for business in post-disaster chaos.

6) **Educate and train university and community people**. Develop an ongoing information program about the risk here, and what is being done about it. Provide training for all members of the campus community so they are prepared for disaster response and apprised about loss reduction measures. Assure that they have taken necessary steps to back up computer records and to store them and other critical materials safely. Every college, department and administrative unit should designate staff members to plan for business resumption following a disaster.

7) **Provide incentives to faculty and staff** for reducing their potential losses at UCB, as well as in their homes. This may take the form of campus-funded grants for nonstructural retrofit in offices and labs, informational materials, or Sponsored Programs Office requirements that research data be backed up regularly. Furthermore, we should explore the options for offering loans or grants to faculty and staff for housing retrofit.

8) **Integrate disaster-resistance concepts into curricula in relevant disciplines at UCB**. Today's students are tomorrow's policy makers, voters, and alumni donors. What they learn here will inform their choices in the future.

9) **Cooperate and collaborate with neighboring communities** in preparedness, mitigation, education and training. We should be explicit with the City of Berkeley about our mutual expectations and responsibilities in emergency response, risk reduction, and recovery. Cooperative planning is necessary for post-disaster housing for students, faculty and staff. UCB will work with municipal and public utilities providers to reduce risk and assure rapid recovery.

10) **Develop support for UCB risk management activities from private organizations and individuals.** Enlist both the Development Office and Alumni Office in promoting life safety and loss reduction projects as worthy of financial and technical support by businesses, foundations, and other donors.

Reopening within Thirty Days

The committee recommends adopting the goal of reopening within 30 days for a number of reasons:

1) It is a planning tool, a desirable outcome toward which UCB will work.
2) "Open" does not mean that every building is occupied, every class is being taught, and research is humming along exactly as before, but it does indicate enough is operational that UCB is fulfilling its mission to teach, do research, and serve the public.
3) 30 days is the longest time any university has remained closed by a disaster (the University of Miami in 1992, Cal State Northridge in 1994, and the University of North Dakota in 1997). Each institution thought it important to reopen within that period of time.
4) After the "grace" period of 30 days, core classes must be taught and substantial numbers of research projects must be underway, or the university will begin to lose students, grad students, faculty, research funding, and public credibility.
5) If that happens, UCB may never regain its preëminent standing.

SECTION II. MAJOR RECOMMENDATIONS

In order to meet the institutional objectives articulated in the previous chapter, a number of goals must be achieved. The Chancellor and Vice Chancellors best deal with the first eight; five others are more appropriate for deans, department chairs, and unit heads. Unit heads and department chairs will be accountable to Vice Chancellors and Deans for carrying out the recommendations, and Vice Chancellors will report to the Chancellor.

For Chancellor and Vice Chancellors

1. Strengthen Buildings

As outlined in the SAFER Program, necessary resources will be devoted to strengthening UCB's most vulnerable buildings. Decisions on building strengthening should take into consideration our concern for both life safety and continuity of operations. Funds will come from capital budgets, federal and state mitigation programs, and private donors. The program will progress annually, with completion not expected until 2020 at the earliest (see Implementation Schedule at back).

The SAFER Program also commits us to nonstructural hazard mitigation, since the damaged contents of buildings can cause injury and death as well as lengthy business interruptions. UCB should make it a priority to reduce nonstructural hazards in any building that is being retrofit or remodeled. The extra costs of doing so during other structural work are relatively modest.

For existing spaces, the SAFER ***Classroom Seismic Recovery Plan*** recommends that nonstructural mitigation be carried out in all 244 general use classrooms. A project to improve the most vulnerable light fixture connections and AV equipment bracing in general use classrooms has begun and should be completed by September 1, 2001. But that is just the beginning. Funding should be appropriated at the Chancellor or Vice chancellor levels for projects to deal with additional nonstructural hazards in those classrooms. It is also recommended that similar projects be undertaken for departmentally controlled classrooms, and for high-use teaching labs and meeting rooms.

In addition, the Q-Brace program provides matching funds for the bracing of building contents; it is open to all university departments and units that can provide a match. Though all departments are perhaps unable to make the match, it is desirable to make the funds available to those that can. Administered by EH&S, with funds from VC for B&A Services, it was begun in FY 98-99, and funded again in FY 99-2000. It could be beneficially continued until at least 2005.

2. Strengthen Utility Systems

Also outlined in the SAFER Program is a commitment to replacing, retrofitting, or relocating our aging and vulnerable utility systems. Decisions about utilities strengthening will be informed by an understanding of systems interconnections and how they relate to continuity of operations.

The recommendations in the SAFER ***Utilities Infrastructure Seismic Response and Recovery Plan*** are in two categories--short-term and long-term--with the short-term having to do with emergency response capabilities: 1) fire prevention and control; 2) prevention of basement floods from broken water mains; 3) strengthening and making redundant the campus electrical systems; and 4) training of Physical Plant-Campus Services and IS&T staff members in their post-disaster roles. A timeline of 18 months was suggested for accomplishing those tasks.

In addition to those recommendations, this risk management plan strongly supports strengthening and making redundant the campus water supply system, both through work on-campus and with the East Bay Metropolitan Utilities District. This will increase capacity to fight fires and support post-event functionality.

3. Protect Voice and Data Communications

Foremost among the findings of the ***Utilities Infrastructure Seismic Response and Recovery Plan*** was the particular vulnerability of voice and data communications on the UCB campus. Located in the basement of Evans Hall, the hub is susceptible to earthquake shaking, building damage, and associated flooding. Should the hub be inoperable for even a short period of time, all computer- and phone-based activities would be interrupted. It would be difficult, if not impossible, to conduct university business in such a situation. Therefore, relocating the hub is a very high priority, and a plan for siting and financing should be in place by January 30, 2001.

4. Update Vulnerability Analysis for Structures, Infrastructure and Other Systems

As the SAFER Program updated the assessment of structural vulnerability first done in the late 1970s, so must the SAFER Program's 1997 structural assessment be reviewed and revised to incorporate new techniques and insights into an evaluation of our facilities. New information from the scientific community on earthquake hazard or structural vulnerability will be incorporated in the strengthening program as it becomes available. Earth scientists and building design professionals learn from damaging earthquakes in developed nations around the world. In the absence of any instructive earthquakes, they learn from models and experiments.

Analysis of UCB's vulnerability should be an ongoing activity, with a major update every four years. The Vice Chancellor of Capital Projects, the Seismic Advisory Committee, and other knowledgeable bodies share the responsibility to do so.

Such vulnerability assessments should be supported and coordinated throughout the entire UC System by the Office of the President.

5. Planning

a. Mitigation through the Master Plan--As the strategic facilities master plan--The New Century Plan--takes shape over the next year, seismic, fire, and flood safety considerations will be included in it. To guide decisions by the university about its land and facilities assets, and to maintain the university's ability to perform its academic mission in the aftermath of

foreseeable disasters, the New Century Plan must emphasize risk reduction. The plan will be complete by Spring semester, 2001.

b. Emergency preparedness--the University funds and staffs an Office of Emergency Preparedness which engages in comprehensive planning, training and exercising for all members of the university community. Maintenance of an up-to-date campus emergency response plan will remain within the purview of this office, as will regular training and exercising of campus personnel in emergency response. Campus-wide exercises will take place annually. This is an ongoing program.

c. Business resumption planning--all business and financial operations at UCB will develop and keep current plans for resumption of business within 30 days of a damaging natural disaster. The plans will specify actions necessary to reduce vulnerabilities that could militate against achieving the 30-day objective. Policies will be set, and practices noted, for paying faculty, staff and research assistants in the event of a closure. Guidelines and technical support should be provided for completing this task. This will be done by January 1, 2001.

d. Recovery planning--all units will develop procedures and priority rankings, necessary to guide decisions that will be needed in the wake of a disaster, regarding facility repairs, temporary facilities, class rescheduling, relocated research, and timetables for resumption of activities. This will be done by March 1, 2001

6. Educate and Inform Students, Faculty, Staff, and Community

The administration will begin to quantify the costs and benefits of many initiatives mentioned above, and will communicate that information to all units, colleges and departments. Beyond this, resources will be devoted to an annual program of information dissemination, education about possible hazards and how to reduce losses, and training in hazard mitigation and disaster response. All students working in labs will be trained in seismic safety as part of basic lab safety education.

In late 1999, special information was created for faculty and students, and emergency safety posters were developed for classrooms. This was done by a small committee with reps from the OR, OEP, and VPO. Dissemination will take place in early 2000. There is a need to create additional information materials for other sectors of the campus community, and to update and maintain the materials that exist. This job could be performed in concert with the Office of Emergency Preparedness by any other office with responsibility for the safety and well-being of a particular population within UCB. This should be an ongoing program.

7. Funding sources

Because the above initiatives will take time and money for a period of years, they should be considered a campus priority in the annual budget process. These expenditures--whether they come from the central administration or departmental budgets--are a part of strategic risk reduction over time. The funds may be obtained from the annual state grant, or raised from

federal sources or private donations. Most of the Capital Program budget should be devoted to structural retrofit or rebuilding. Contingency funds may also be used for this. Typical costs of nonstructural loss reduction and business continuity planning will be specified. A new line item for seismic safety projects can be added to the Operating Budget to accommodate such spending. UCB should continue to petition the legislature and UC Office of the President for money, aside from capital funding, to support the many loss reduction projects articulated above. It may be feasible to propose that a small portion of the funding stream for accommodating additional students be set aside for improving life safety and business continuity capacity.

The campus should develop a strategic plan to obtain seismic funds. The next capital campaign could have as one of its priority areas seismic loss reduction projects.

8. Community Outreach

Maintain the interest and support of the outside community--the city, private corporations, the Office of the President, the Board of Regents, the state legislature, the federal government--through informational campaigns and cooperative events, in order to cultivate financial and political assistance.

For Deans, Department Chairs, Unit Heads, and Office Directors

1. Nonstructural Mitigation

a. Classrooms and labs--Since nonstructural hazards can cause casualties and business interruption, deans and department chairs should inventory their classrooms, labs, and offices for potentially hazardous contents. Anchoring and strapping valuable and hard-to-replace laboratory equipment should have high priority, as should securing ongoing experiments. To some extent, this can be accomplished in labs by observing the OSHA requirements for managing hazardous wastes, but they do not govern all potential nonstructural hazards, and compliance with them is uneven across departments and ORUs. Each department or unit should develop a plan by March 1, 2001 for securing the contents by January 1, 2003.

b. Records, research data, collections, and specimen preservation--Each department or unit will assess the safety of valuable records, both electronic and paper, and take steps to duplicate, back-up, or otherwise secure them by January 1, 2001. Individual faculty members and graduate students will be encouraged to do the same. A convenient campus-wide vehicle for data backup should be provided. A back-up server should be established at a sister school such as UC Davis.

c. Animals--Researchers will assess the vulnerability of their research animals in light of the emergency response capability, and the post-disaster policies and practices, of the Office of Laboratory Animal Care. Researchers will take steps to reduce their potential losses, and factor them into their department's recovery plan. Animal contingency plans should be in place by March 1, 2001.

2. Business Resumption Planning

Each department, college, and administrative unit should develop a plan that will allow for a return to teaching, research, and all university business and financial support activities within one month of a damaging earthquake, fire or flood. A Faculty Senate ad hoc committee may aid them since the Senate can contribute to a consistent approach across campus. The plan should consider the most recent vulnerability analysis of pertinent buildings and utilities, set priorities, and specify procedures for resuming their principal activities within the specific setting of each unit or department. It is critical that all aspects of student life be included as well. The administration will provide guidelines and technical support for this task, making clear both the probable damages and the appropriate strategies for coping with them. Colleges and units are encouraged to give smaller departments and offices financial assistance. This should be complete by June 1, 2001.

3. Recovery Planning

Each department, college and administrative unit will develop the procedures and priority rankings necessary to guide decisions that will be needed in the wake of a disaster regarding facility repairs, temporary facilities, class rescheduling, relocated research, and timetables for resumption of activities. Residential and Student Service Programs should develop such a plan. Administration should provide guidelines and technical support for this task; smaller departments may receive financial assistance from their colleges. This should be done by September 1, 2001

4. Education and Training

The central administration will provide planning templates and guidelines, and it will make clear the earthquake damages that are considered likely and within which we must be prepared to operate. The dissemination of preparedness and mitigation information within schools and departments will be the responsibility of deans, department chairs and unit directors. Everyone should be instructed in ways to protect records, class notes, collections, and research.

Each department or unit should participate with the Office of Emergency Preparedness in emergency response training and drills. Each department or unit will designate a number of individuals to be highly trained in emergency response roles and to keep up the emergency plan. This is an ongoing program.

5. Funding Sources

Expenditures for the above high-priority initiatives should be appropriated through the annual budget process, over a number of years. Shared between the central administration and departments, the funds may come from yearly operating budgets or be obtained from other sources such as federal grants or private donations.

SECTION III. RISKS AT UC BERKELEY

The University of California was chartered in 1868, the very year the Hayward fault produced its last big earthquake. In 1870, the campus was sited in Berkeley, just where the East Bay hills slope up and over the Hayward fault, at the mouth of Strawberry Canyon. That location has tied the fate of UC Berkeley to the rhythms of the fault and the cycles of water and fire. UCB has been fortunate with respect to disasters in the 131 years since its founding. The large urban-wildland fires of 1923 and 1991 missed the campus itself (but destroyed the homes of many faculty, staff and students). Only the flood of 1962 did significant damage to the campus, although the El Nino storms of 1997 eroded hillsides and wreaked havoc with storm sewers. The epicenter of the 1989 Loma Prieta earthquake was too far away to shake the campus much, and thus far the Hayward fault has remained quiet.

Earthquake

A magnitude 7 quake on the Hayward fault will inflict extensive damage on UCB facilities, and potentially kill or injure students, faculty and staff. The surrounding communities will be seriously damaged as well. Given our proximity to the fault, there will be sufficient structural, nonstructural, and infrastructural damage on campus to close classrooms and research labs, and cripple communications. Aftershocks will complicate out damage assessment efforts. In the wider community, utilities will be cut off and transportation routes disrupted. Without either the internal or external resources needed for continuing operations, it will be necessary to close for some period of time. A long closure would compromise our mission as a great teaching and research institution.

1. Seismology

Seismologists offer a 1 in 3 chance for such an earthquake over the next 30 years. A new study of earthquake probabilities, released in October, 1999 by the U.S. Geological Survey, supports an increased probability for movement on the Hayward fault. On the basis of research conducted since the Loma Prieta quake, earth scientists now believe that there is a 32% chance that a major earthquake will strike on the Hayward/Rodgers Creek fault system before 2030. The quake could strike at any time--tomorrow, next year, or ten years from now. Earthquakes on other faults--most notably the peninsula segment of the San Andreas or the Calaveras--could also cause damage at UCB.

The effects of a Hayward fault earthquake on UCB will depend on the location of the epicenter and the direction in which the fault breaks. Although scientists cannot predict how the fault will rupture during the next earthquake, the northern segment of the fault (from San Pablo Bay south to San Leandro) has not slipped in historical time and may therefore be more likely to do so. Should the fault slip its entire length from San Pablo Bay to San Jose, the shaking will be very strong and long-lasting. The shaking intensity, and corresponding damage to the campus, may also be enhanced by proximity to the fault ("near-field fling"), the directivity of the seismic waves, and surface rupture on multiple strands.

2. Potential Losses

a. SAFER Building Survey

In October, 1997, the Seismic Action Plan for Facilities Enhancement and Renewal reported on the results of a survey of campus structures conducted by three reputable structural engineering firms. The question at hand was the capacity of the structures to withstand intense shaking sufficiently to avoid collapse. The survey indicated that 73% of the space on campus, including buildings with corrections underway, would perform adequately in a major earthquake. Adequate in this case means that the structures wouldn't collapse and endanger life, although there may still be sufficient damage to warrant closure for evaluation and repair. However, 27% of the space needs corrective work in order to meet life safety standards. All or parts of 57 buildings rated "poor" or "very poor," which indicates the likelihood for full or partial collapse, possibility of death or injury to inhabitants, and the need for lengthy repairs. Most, but not all, of the seismically deficient buildings were constructed before 1960, when more stringent building codes went into effect in California. The age of the campus's physical plant was also noted and its vulnerability highlighted.

Phase 2 of the engineering survey--for off-campus structures--was completed in April, 1998. That report added 38 more buildings to the "poor" or "very poor" structures identified earlier. The preliminary estimate for seismic retrofit costs has been set at $1.2 billion, in 1997 dollars, and the time frame for repairs placed at 20 to 30 years.

The current earthquake strengthening program is designed to minimize life safety risk; it is not primarily intended to reduce program disruption, although it will do so to some extent. Improving buildings to decrease program disruption will cost hundreds of million dollars more than the estimate above, but it should be a strategic priority to raise the additional funds for buildings that are essential to the resumption of our academic program.

b. Comerio Loss Estimation Study

In September, 1998, a research project at UCB called Economic Benefits of a Disaster-Resistant University began work on creating a loss-estimation model for three possible earthquakes on the Hayward fault (M6.5, M7, and M7.25). UCB architecture, structural engineering, and economics faculty have relied on engineering calculations and loss estimation techniques to develop a model appropriate to a campus setting.[1]

The researchers prepared a soils map of the campus depicting variables that affect the severity of ground shaking. They refined maps of campus infrastructure location and condition. They evaluated the structural and nonstructural characteristics of campus buildings, and described each building in terms of both how it was used (classrooms, labs, offices, libraries, special use, residential and parking) and the estimated average number of annual and peak-hour occupants. The campus data were then used to calculate the cost of repairs and possible downtime in the three earthquake scenarios. The downtime estimate comprises not only measures such as availability of materials and workers for repair work, but also considerations such as the time it

[1] Mary Comerio et al. ***The Economic Benefits of a Disaster-Resistant University***, Institute for Urban and Regional Development, UC Berkeley. 4/12//2000.

takes for engineering reviews and repair plans, and--perhaps most important--the slow process of negotiating with insurers and FEMA for repair funds. To a great extent, repair depends on the flow of money, and the flow of money after a disaster depends on politics. It is impossible to predict what the dynamics will be, but it is certain they will take time to play themselves out.

The study particularly emphasized the vulnerability of systems and space *uses* as related to the university's ability to keep functioning, or get back into business following a quake. Using various measures, the researchers calculated an earthquake's probable impact on various campus functions, and estimated building closures (see the table below). The study pointed out the vulnerability of UCB's research operations, as a significant portion of funded research goes on in either poor buildings or fair buildings that will suffer some structural and extensive nonstructural damage.

Note in Table 1 that even in an occasional (magnitude 6.5) earthquake on the Hayward fault, one with moderately severe ground motion, about 20% of the laboratory space on campus could be closed for repairs for nearly two years. In the magnitude 7 Hayward fault earthquake, 50% of the lab space and 40% of the classroom space may be closed for nearly two years.

Table 1. Campus Closures in Three Earthquake Scenarios

		OCCAS EQ (M6.5)	RARE EQ (M7.0)	VERY RARE EQ (M7.25)
USE	% OF CAMPUS	% of Space Needing ≥20 Months For Repairs		
Classroom	6%	5%	44%	78%
Laboratory	30%	19%	52%	66%
Office	30%	9%	50%	72%
Library	16%	4%	28%	38%
Telecom Hubs	<1%	2%	46%	50%
Special Other	18%	11%	36%	50%

Table 1 also shows that library space is comparatively resistant to closure. This is a result of the retrofits to Doe and a few smaller libraries, in buildings such as Valley Life Sciences and McCone, that have been completed in the last five years. This highlights the value of the SAFER program to strengthen buildings, and testifies to the need for an ongoing commitment to that program.

Table 2 on the next page shows the long-term effects of strengthening our vulnerable buildings. When we complete the work we have planned for the next 10-15 years, we will have significantly reduced downtimes in our buildings. That is one of the critical factors in sustaining or quickly resuming operations.

The costs of capital losses and downtime have been combined with data on capital flows (operating expenditures, salaries) in an economic impact evaluation. In addition to the

traditional review of impacts on the local area, economists have found noticeable impacts on significant research units and on UCB's human capital--faculty and students.

Table 2. Change Over Time in Percentage of Space Needing ≥ 20 Months for Repairs*

	Conditions in 1999①			Conditions in 2006②			Conditions in 2011③		
	Scenario			Scenario			Scenario		
Use	O	R	VR	O	R	VR	O	R	VR
Classroom:	5%	44%	78%	0%	26%	61%	0%	3%	38%
Laboratory:	19%	52%	66%	1%	26%	40%	0%	13%	26%
Office:	9%	50%	72%	5%	38%	59%	2%	15%	36%
Library:	4%	28%	38%	1%	23%	33%	0%	6%	16%
Telecom:	2%	46%	50%	1%	45%	49%	1%	11%	16%
Other:	11%	36%	50%	7%	31%	45%	0%	14%	29%

* Table 5 in Comerio et al., 4/12/2000.

1) Buildings under construction in 1999 were rated as if they were finished.
2) Based on projections that 10 additional main campus buildings will have completed seismic repairs by 2006.
3) Based on projections that 15 additional main campus buildings will have completed seismic repairs between 2006 and 2011.

Fire

1. Potential Losses

UCB has two areas of concern with respect to urban-wildland interface fires: 1) the central campus, and 2) the 900-acre Hill Area--in Strawberry and Claremont Canyons--which adjoins the central campus. Not only does the university have numerous research and recreational facilities in Strawberry Canyon, but also its wildlands are directly adjacent to private residential areas in Berkeley and Oakland. The neighborhood on Panoramic Hill is especially at risk to fires, floods, and landsliding. Furthermore, uncontrolled fires in the Hill Area are a threat to the central campus. Thus, to reduce the risk to its own facilities and address the liability of owning land next to private values at risk, the university has a comprehensive wildland fire prevention program. The Lawrence Berkeley National Laboratory is not a campus management unit and is not part of the university's plan; however, the LBNL and UCB do coordinate their fire management programs.

The risk of fire is most common during the dry months of May-October. It is during this period that that warm, dry (Diablo) winds out of the north or northeast are more frequent, creating a situation conducive to rapidly moving, high-intensity fires. The Diablo wind conditions are the primary factor in creating extreme fire danger, temperature and relative humidity being the others. Fires can be ignited by broken power lines on windy days or by careless workers or smokers; however, it should be mentioned that such a conflagration could result from an

earthquake--when gas mains and water mains are broken--at any time of the year except, perhaps, the height of the rainy season. The 1991 Oakland Hills fire--the worst urban-wildland fire in California history--has been referred to by the California Division of Forestry as, "the fire of the future." When the Diablo winds are blowing hard, fires occurring in the densely vegetated and populated Hill Area will be impossible to stop, even with today's advanced fire-fighting equipment and well-trained forces.

2. Historic Fires

Since 1900, there have been 16 wildland fires in the Berkeley and Oakland hills, 14 since 1923 alone. They burned approximately 9000 acres and destroyed over 3500 structures. Over the past century, the fire risk has actually increased with population and vegetation growth in the hills. Three of the historic blazes--1905, 1923, and 1991--directly threatened the campus, but none of the fires actually burned any campus buildings. In each case, however, the fires destroyed the houses of faculty, staff, and students. The 1970 Oakland Hills fire (same starting location as the 1991 fire) did not burn much acreage, destroyed only 37 structures, and did not threaten the campus.

In October, 1905, a grass fire began in the morning near what is now Grizzly Peak and swept down the hill toward the trees around the Greek Theater. It was fought on many fronts for much of the day by 2,000 men--faculty members, many students, and even President Wheeler.[1] The fire spread across Strawberry Canyon and up Panoramic Hill, where it singed faculty homes. By nightfall it was checked, having done no direct damage to campus buildings.

The great fire of 1923 started on the early afternoon of September 17th, and moved down from Grizzly Peak toward the north side of campus, aided by 40 mph winds from the northeast and very low humidity. By the time the wind dropped in the evening, the fire had consumed 3,000 acres in north Berkeley, and destroyed 584 structures. A total of 5000 Berkeleyans were made homeless, among them about 60 professors, 50 instructors, 1000 students, and 50 staff. [2]

Campus buildings were unscathed yet again by the East Bay Hills fire of October 20, 1991, but faculty, staff and students were not so lucky. The fire burned 1700 acres in Berkeley and Oakland, much of it in densely developed residential areas, and destroyed over 3,000 structures. The fire raged from late morning to early evening, uncontrolled by anything firefighters could do, and died down only when the wind fortuitously changed its speed and direction. As had been the case previously, many faculty members and students lost homes, books, course notes, and collections. For the first time, however, they also lost computers and electronic data. The university opened up the student union as a shelter for displaced students and others.

3. Risk Reduction

[1] "The Fire on the Hills" from the 1907 ***Blue and Gold***, quoted in ***Chronicle of the University of California***, Volume 1, Number 1, Spring 1998, pp. 81-82.

[2] "The University suffered only minor material damage, but every department was necessarily affected to greater or lesser degree." Raymond T. Birge, quoted in "The University and Berkeley's Great Fire of 1923," In ***Chronicle of the University of California***, Volume 1, Number 1, Spring 1998, pp. 83-84.

Since 1991, the campus has allocated funds annually to a wildland fire prevention program; occasionally, the base budget is augmented to support additional fuel removal or other mitigation activities. The program is managed by Physical and Environmental Planning, and overseen by the Campus Hill Area Fire Prevention Committee. In 1997 the campus received, along with the East Bay Regional Park District, a FEMA Hazard Mitigation Grant that supports coordinated fuel removal through 2001. The FEMA funds are matched by UCB and EBRPD to support a program to create "defensible space" in critical areas and to improve Hill Area access for fire-fighting equipment and personnel. Furthermore, a Coordinated Resource Management Program for the Hill Area is currently in draft form that will guide comprehensive fire and erosion management there. The campus also works with LBNL, the City of Berkeley, and the East Bay Regional Park District fire departments to train personnel in best practice fire-fighting techniques[3]. All these practices should continue to receive funding into the indefinite future.

FARSIGHT, a computer program developed by the then UCB Department of Forestry in the early 90s, is currently used by university and LBNL professionals to model fire spread and plan for response and mitigation. With considerable data on vegetation, topography, meteorology, and precipitation levels, FARSIGHT can indicate probable direction and extent of fire spread given a specific ignition location, prevailing winds, temperature and relative humidity. Though the model has been used most extensively for blazes in the Hill Area, and lacks certain data for the central campus, it does indicate a distinct possibility that a large blaze could damage parts of the campus if the temperature, humidity, wind direction, and ignition location conduce to it.

Flood and Winter Storm

1. The Hazard

One of the Berkeley campus's signature features is Strawberry Creek and the redwood groves through which it flows. The creek poses a flood hazard for parts of the central campus, as well as for downtown Berkeley immediately west of Oxford Street. The creek's North and South forks enter the campus via culverts on the north and east sides of campus, and flow in predominantly open channels westward through campus. The confluence of the two forks is located in the Eucalyptus Grove on the west side of campus adjacent to Valley Life Sciences Building; the main branch of Strawberry Creek enters the city culvert at Oxford Street. Numerous storm sewers drain to both forks of the creek, on-campus and off and, thus, the creek serves as the storm drain system for the entire watershed.

The South Fork has its source in the hills surrounding Strawberry Canyon; it drains a largely natural area there, although increasing development (pavement) has added to the runoff in the basin. The North Fork emerges from the hills above Northside, its normal modest flow always increased by rainfall runoff from the extensively urbanized neighborhoods there. The North Fork, which drains both the LBNL and the streets of the city, is much more urbanized than the South Fork watershed. As a result, the hydrologic conditions are "flashy," which is to say that

[3] Dale Sanders, UCB PEP, 12/1999

flood peaks are much higher than they would be under natural conditions. The "lag time" (between rainfall and runoff) has been calculated at 15-18 minutes, as compared to the South Fork's 75 minutes.

2. Flood History

Strawberry Creek has a long history of flooding, with attendant mudflows and landslides. In its natural state--before undergrounding, channelizing, widening, and diverting--Strawberry Creek always flooded in heavy rainstorms before the turn of the century. In 1904, there was heavy damage in the Hearst & Euclid area as well as on Oxford Street downtown. At that time, the first of many subsequent flood control projects was undertaken. However, the engineers' attempts to direct the stream's flow did not keep up perfectly with the urbanization both on campus and surrounding it. Thus, runoff during rainstorms increased as naturally absorbent soils gave way to asphalt paving and buildings. In February, 1940, there was heavy flooding, mudflow and landslide damage in Strawberry Canyon, the Northside district, and to Gilman and Stephens halls. In 1958 and again in 1962, the creek overflowed its banks in heavy rains and damaged the developed campus.

On October 12, 1962, when 15 inches of rain had fallen over three days, a few hours of intense downpour turned both branches of the creek into muddy torrents. There was severe mud damage around LBNL. In Strawberry Canyon, mudslides and debris poured down and backed up at the bottom where the creek went underground beneath the stadium. This then flowed around both sides of the stadium and onto Gayley Road, which had to be closed. On campus, "The mud besieged low-lying Cowell Hospital (where the Haas School of Business now stands), and a river several inches deep flowed across the I[nternational] House ground floor and out the front door."[4] The creek left its banks at several places between its entrance near the Women's Faculty Club and the culvert at the western campus boundary. Mud was the dominant feature of the disaster all over campus: rivers of mud filled excavations for Barrows, Wurster and Etcheverry Halls, then under construction, and poured into the Student Union basement. Damage estimates were upwards of $200,000.

3. Flood Mitigation

Major creek channelization, dam-building, undergrounding, and other control efforts followed the 1962 flood. In the late 1960s a retention basin was constructed on the South Fork above the Botanical Garden at the entrance to the lower fire trail. This remains the only means available for controlling peak flows on the central campus. A flood hazard map prepared by FEMA and its consultants in 1978 locates two main areas on the western side of campus in the 100-year flood plain: on the North Fork the stretch between Mulford Hall and the confluence; and on the South Fork, the reach from south of Dwinelle Hall to the confluence. From the confluence to Oxford Street the floodwaters are anticipated to spread out because of the combined flow and because the trash rack on the culvert catches debris and the flow is backed up. Besides affecting a few facilities on campus, the waters become problematic for downtown Berkeley.

[4] Steven Finacom, "The Strawberry Creek Flood of 1962." ***Chronicle of the University of California***, Volume 1, Number 1, Spring 1998, pp. 107-108.

In addition to direct precipitation in a large winter storm, urban runoff is another variable in the flood control picture. That can best be handled by not increasing the amount of impervious surfaces, according to one expert. "Urbanization of the watershed [both forks] has had profound effects on Strawberry Creek. Continued development will create additional impervious surface that will increase runoff and peak flows into the creek drainage system. This could pose both a flooding and erosion hazard to the central campus."[5] Since 77% of the central campus is already made up of impervious surface, additional paving must be carefully controlled. New buildings on previously natural soil sites will also increase runoff.

In the Strawberry Creek drainage area, addition of impervious surfaces should also be controlled. More building or paving anywhere in Strawberry Canyon or at LBNL will increase runoff. Furthermore, fire management in the Hill Area could, "reduce woody vegetation and organic material that intercept rainfall. The overall effects will generally be to increase rainfall energy at the surface, resulting in increased surface runoff."[6] Vegetation management must be conducted with an eye to the flood hazard as well as the fire hazard.

During periods of copious rainfall, campus personnel must carefully monitor precipitation levels, soil saturation, stream flows and water elevations in order to take the necessary steps to manage floodwaters to the extent permitted by its flood control devices. Beyond that, it all depends on how much water falls where.

Over time, UCB must respect the 100-year flood plain, maintain setbacks, and attend to storm water management. Best management practices (BMPs) for stormwater management should be implemented. New university construction on undeveloped lands within the watershed should seek to maintain (not increase) existing peak runoff conditions and/or limit the amount of impervious surfaces allowed. These goals will help mitigate the adverse hydologic and water quality impacts of additional development in the watershed, and not further exacerbate existing flood hazards.[7]

[5] Robert Charbonneau, ***Strawberry Creek Management Plan***, UC Berkeley, 1988, p. 31.
[6] Charbonneau, p. 107.
[7] Charbonneau, UCOP, personal communication, 1/2000

SECTION IV. RESOURCES FOR REDUCING THE RISK

Money

1. State

a. Buildings

UCB devotes a significant portion of its annual capital budget to seismic safety now and will continue to do so. At the current time, the state contributes roughly $20 million/year to UCB for its capital budget. A similar amount is raised from private sources for the overall capital improvement program. Overall state appropriations to the UC system have gone up a small amount for this year and next, but there is no reason to anticipate that UCB's annual capital budget allocation will increase dramatically.

The question of whether to retrofit or replace a building must be carefully justified with the state. UCB can spend state funds to improve only a building's life safety--no other improvements are currently being funded. Retrofitting is generally cheaper than replacement, but it doesn't necessarily yield a more useful building. UCB finds that it is sometimes more cost-effective to spend additional money on a new building that actually meets the programmatic needs of the departments that occupy it. In two building replacement cases, UCB has asked the state for funds equivalent to the seismic renovation costs and incurred the obligation to raise the additional monies from other sources.

The Chancellor's discretionary monies, which can be used for either capital projects or operating expenses, may be a source of funds in certain retrofit cases.

The Board of Regents requires that when UCB leases or buys buildings rated "poor" or "very poor," they must be upgraded to the seismic performance rating of "good." The requirement is a risk reduction measure, but it does put large front-end costs on UCB. Financial assistance in funding that mandate would be useful.

Efforts to obtain additional special capital funds for UCB's particular seismic vulnerabilities should continue with the Office of the President, the Board of Regents, and the state legislature.

b. Deferred maintenance

UCB has, at last calculation, at least a $150 million deferred maintenance backlog, significant amounts of it representing high seismic loss potential. Deferred maintenance projects can not be funded from capital budgets since the state doesn't recognize such projects as capital renewal, so a separate source of funds must be found. In the last two years some funds for deferred maintenance have been generated by the sale of bonds by the UC system, but that funding will not last more than 5 years total.

Some years of regular funding at $16-20 million/year would allow UCB to make significant progress on its deferred maintenance backlog. A change in allowable expenditures on capital renewal would facilitate the process. The overall goal of increasing seismic safety on this

campus, and others, would be well served by such a change.

c. Other risk reduction

Other high-priority loss reduction or risk management projects should be funded as part of the annual budget process, with costs shared between the central administration and departments or units. For example, many of the recommended nonstructural hazard mitigation projects can be supported by appropriations from various vice chancellor budgets, or with fund matches between central administration and departments or units. One area at special risk--labs--should be dealt with by special cooperative projects.

The business resumption planning initiatives can be supported, at first, with staff time. Little extra money is needed. Implementing some of the suggestions that result from the process will require one-time expenditures from appropriate vice chancellor and department budgets. Their priorities will have to be assigned when they are made.

2. Federal

UCB has benefited from a FEMA Hazard Mitigation grant. The $42 million matching fund grant will cover the upgrading of four important campus buildings. Additionally, FEMA funded both the loss estimation study, ***The Economic Benefits of a Disaster-Resistant University***, and the Disaster-Resistant University planning effort that developed this plan. The campus should continue to seek more federal funding not only from FEMA, but also from other federal agencies with a large investment in research or the human capital on the campus. The administration should work with FEMA to increase the understanding and consequent support of major federal research funding agencies.

3. Private

The fundraisers in University Relations are extremely able at obtaining money from the private sector. Although seismic safety and risk reduction, per se, are not terribly popular with donors, they can be inserted into projects and major donations in a way that would make some of the funds available for actual risk reduction. For example, the Haas Pavilion was motivated in part by a need to improve the seismic safety of Harmon Gym, but the pavilion project was developed in a way that the major donors were satisfied and seismic safety was included in the package. Such opportunities should be pursued in the future. We should consider mechanisms for adding increased seismic safety appropriately in the next capital campaign.

The Alumni Association can be engaged in the campaign for risk reduction support as well.

Personnel

1. Capacity and Know-How

The campus has high-quality professionals in every department and unit. The professionals are familiar with state of the art practices in every field related to loss reduction and risk

management. Some standard risk management practices are not followed here--business resumption planning, for example--that would contribute to smooth operations following a disaster. Personnel could be beneficially educated about, and trained in loss reduction techniques such as nonstructural hazard mitigation, and expected to implement them. UCB is capable of doing everything necessary, but it must assign responsibility for specific tasks and then assess performance. It must maintain this capability during periods of budget shortages, or when concern for loss reduction drops for one reason or another, by developing and adopting pertinent policies; and ensuring managerial backing

2. Dedicated Staff

Comparatively few FTEs are devoted solely to loss reduction or risk management. The long-term success of the SAFER Program, and risk management in general, depends on staff being dedicated to those activities, not trying to perform them in addition to other responsibilities. In order to pursue the strategies specified in Section I, especially Strategies 3-7, it may be necessary to increase the number of personnel available to provide planning and technical assistance. The recommendations in Section II will require that vice chancellors, deans and department heads, and unit leaders undertake certain risk reduction responsibilities, and specify who should do what. Personnel should be authorized to spend time on loss reduction activities, and appropriate job descriptions created to permit that.

Technical Assistance

1. From within the University

Internationally recognized specialists in various disciplines germane to loss reduction and risk management are on the faculty here at UCB. They can be called on for everything from short-term advice to long-term involvement in preparedness, mitigation, response and recovery initiatives.

2. Outside Consultants

When intramural assistance is not available or sufficient, the campus should engage qualified consultants from the private sector. Such was the case with the Strategic Facilities Master Planners, among others.

Community

The campus is dependent on the surrounding community for student, faculty and staff housing; fire protection; utility services; transportation; commercial services, health services, and student part-time jobs. Campus and city interests are united in shared emergency response capacity, business resumption capability, housing provision, and long-term recovery plans and pace. An assessment of the probable consequences of an earthquake or fire could serve as the basis for a set of policies (multi-family apartment retrofit), plans (sheltering and temporary housing), programs and projects (Berkeley Alliance), cooperative exercises (response and recovery), and

outreach efforts to housing owners, commercial material suppliers, and the state legislature and federal congress.

Businesses in the community are dependent on the continued viability of the campus. UCB would benefit from working with campus-serving businesses (landlords, food outlets, copy centers, bookstores, clothing stores) as well as businesses that look to the university for their work force. UCB should explore arrangements with Bayer and other scientific firms for cooperation in pre-disaster planning, and post-disaster recovery.

Businesses beyond Berkeley are also part of the equation. Some are dependent on sustained UC Berkeley operations; others are critical to the campus and its departments. Innumerable industries use UC-developed knowledge, materials, and graduates, and the continued availability of these resources depends on the campus's viability.

The alumni represent a large resource to assist the university in developing and implementing parts of this plan. Alumni live in the community, own and work in businesses there, and many care about UCB's well-being. In addition, alumni across the state exercise considerable political power and they could be enlisted to use some of it to promote UCB's risk management efforts.

SECTION V. BUILDINGS AND USES

Classrooms

In February, 1998, the Classroom Seismic Recovery Committee published its review of the potential for classroom loss in an earthquake and the campus's capacity to recover classroom space sufficient to resume teaching with minimal interruption. As part of the SAFER Program, the committee had been asked to identify central issues for classroom use post-earthquake and develop a plan for immediately improving the campus's preparation for classroom recovery. The committee faced two significant facts:

- Only a handful of campus buildings--none of which houses a significant number of general assignment or departmentally controlled classrooms--were rated by the SAFER engineers as likely to remain functional after a major earthquake.
- Nonstructural hazards such as unsecured bookcases and cabinets and improperly mounted light fixtures can threaten life safety or render a classroom unusable. Replacing broken equipment will take time and contribute to extending classrooms unusability.

Classrooms occupy only 6% of total campus building floor space, but that space is of the utmost importance to the UCB teaching mission. The committee recommended that the campus move forward with a program to identify potential nonstructural hazards in classroom buildings, and that it fund a high-priority mitigation program for them. Two initiatives identified by the committee were undertaken in 1999-2000, but much remains to be done.

In what is essentially a business resumption plan, the committee specified procedures to follow and laid out various decision sets for choosing which classes to teach in light of post-earthquake space limitations. It also recommended the adoption of policies that will enable the swift recovery and/or production of classroom space following an earthquake. To illustrate the scope of the response and recovery effort which will be required after an earthquake, the committee offered a description of the potential disruption, the likely displacement of instructional activities, and the forces driving the recovery strategies described elsewhere in this plan.[8]

The challenge for the campus is to consider what steps must be taken to recover and house the curriculum after an earthquake. Under normal circumstances, the campus houses roughly 75-80% of its courses in 239 general assignment classrooms in 33 buildings. Any significant loss of classrooms will amplify existing scheduling problems and create additional challenges that will require modification or suspension of regular classroom scheduling policies and practices.

Any loss of departmentally controlled classroom space will increase the campus-wide need for classroom space regardless of the pre-quake "owner." The closure of a given building will severely affect each department that offers most or all of its classes in it.

[8] Extracted from ***Classroom Seismic Recovery Plan***, Susanna Castillo-Robson and Tom Koster, Co-Chairs, UC Berkeley Classroom Seismic Recovery Committee, February, 1998.

1. Moderate Inventory Replacement

Approximately 50-60 general assignment classrooms, or about 25% of the campus total, would be lost if an earthquake closed a central classroom building like Dwinelle Hall, or if both Barrows Hall and Wheeler Hall were unavailable for use. Important gateway classes such as Math 1A, Sociology 1, and Statistics 2 would need to relocate out of Dwinelle. Wheeler Auditorium would be unavailable for the lectures of Psychology 1, Economics 1, and Anthropology 1.

A loss in classroom stock that does not exceed 25% could be dealt with by extending the academic day to include evenings and weekends, by acquiring temporary classroom space in trailers, and by instituting scheduling policies to reduce classroom demand. However, the number of classrooms lost is not the only measure of impact; it depends also upon which classrooms become unavailable. For example, it would be more difficult to find suitable substitutes for a large lecture hall such as Wheeler Auditorium (which seats 700) or for the instructional laboratories in the Valley Life Sciences building.

2. Large Inventory Replacement

If a major earthquake rendered 75% of the general assignment classrooms unusable, the campus would be unable to re-house its entire regular curriculum, even after displacing evening, weekend, and summertime classroom space users. A loss of this magnitude can best be illustrated by a situation in which Dwinelle Hall is the ONLY classroom building available for the entire campus. In such a circumstance, the courses for most faculty and students would need to be relocated.

Most gateway courses would be jeopardized, and the campus would be reliant on leased trailer space to house courses. Even with many leased trailers, it would be necessary to break down large-enrollment classes into smaller sections to fit them into the remaining available space. That would be a scheduling nightmare in itself, and made all the more difficult if voice and data communications systems are not operating at 100% capacity. Over 230 temporary trailers would be needed to make up for lost classrooms; siting them on campus would be very difficult, if not impossible, and conflict with the need for space to stage repair equipment and materials.

Research Facilities

Approximately 70% of the $400 million in 1998-99 research funds flow to projects on the central campus. And roughly 75% of the $400 million goes to research that relies on sophisticated laboratories. The largest financial losses to the university in an earthquake will result from damage to research facilities. UCB must take steps now to protect the research and the investment.

The power outage at Columbia University in the summer of 1999 illustrates the deleterious effects disasters can have on research. Due to excessive electricity consumption in New York City during a heat wave, power was interrupted and then went out totally for two or three days.

In the intervening time, researchers at Columbia's College of Physicians and Surgeons lost research materials--human tissue, enzymes and cells--because there were not sufficient functioning back-up generators to keep freezers or incubators working. Damages were calculated at many millions of dollars, and research projects were set back or ruined.

Laboratories occupy 30% of the total space on the UCB campus. As indicated above in the section on the DRU Economic Impacts Study, disturbingly high percentages of UCB's research laboratories may be closed for extensive periods following a damaging quake on the Hayward fault. The labs on the UCB campus are vulnerable in three major ways:

- Some of them are in poor and very poor buildings; when the structures sustain damage, the labs may cease to function, or not be accessible. Even fair buildings can be damaged beyond immediate safe use and need repair.
- All buildings, regardless of seismic performance rating, are at risk to expensive and paralyzing nonstructural damages and utility failures: research material, expensive equipment, computers, and valuable data can all be damaged or destroyed.
- One category of nonstructural damages results from hazardous materials. Wet labs are full of liquids and solids that can be released by quake damage, become hazardous on their own or in combination with other agents, and close down labs and buildings for weeks while clean-up is done.

Research in the social sciences and humanities is less dependent on laboratories, but it is similarly vulnerable to structural and nonstructural damages. Researchers may be unable to re-enter damaged buildings. Individual computers that have been broken, local networks that aren't working, and--most importantly--a nonfunctioning central campus computer hub will also make ongoing research difficult for some period of time.

Seismic retrofit projects are beginning on some particularly vulnerable buildings, but--as pointed out by the Comerio loss estimate--high expected losses can be seen in even good buildings because of nonstructural vulnerabilities there.

The Research Administration Advisory Board, which was been charged to develop a seismic assessment and recovery report as part of the SAFER Program, completed its task in March, 2000. The plan[9] was reviewed by the Academic Senate Committee on Research, and their comments incorporated into the final plan for reducing research vulnerability now and recovering quickly after a quake.

Among the recommendations of the ***Research Seismic Recovery Report*** are the following:

- To protect life safety and secure valuable data, materials, equipment and books, the campus should develop and promote a program to help colleges, departments and ORUs identify potential nonstructural hazards in offices and labs, **and ensure that steps are immediately taken to reduce them.**

[9] ***UC Berkeley Research Seismic Recovery Report***, prepared by the Research Administration Advisory Board, 3/7/00.

- A **funding stream** should be established to **support ongoing nonstructural hazard mitigation.**
- The campus should conduct an assessment of the security of, and recovery requirements for **computer and utility systems that support research projects.**
- Deans, ORU directors, and department chairs should **now develop plans for coping with limited research space** following a quake, and **explore the availability of alternate spaces elsewhere.**
- The campus should **determine now the criteria** that will be used to set priorities for activity restoration in limited space with limited support.
- The campus should ascertain the safety of, and recovery requirements for **libraries**--both main collections and departmental ones.
- The campus should establish a **Disaster Recovery Task Force.**

Offices

Offices occupy another 30% of the space on campus, and are variously vulnerable to damage and closure after an earthquake. A magnitude 7 quake on the Hayward fault could make 50% of them unusable for around two years. The loss of access will result from a mixture of structural failure, nonstructural damages, and hazardous materials releases in some buildings. This is similar to the situation that obtained on the campus of California State University, Northridge following the 1994 earthquake there. Most administrators, faculty, and staff had no access to their offices because they were in dangerous buildings or had been contaminated with hazardous materials. The business of reopening the university and then running it for months was done in tents on common areas, temporary buildings, and kitchen tables in homes. Beyond the obvious priority to reduce nonstructural hazards in most offices and to back up data and works in progress, it is clear that a business operations seismic recovery plan is needed for UCB to allow us to anticipate the dislocations and plan to work around them.

Libraries

Libraries occupy 16% of campus building floor space. They are in reasonable good shape overall because of individual library retrofits and the new Doe stacks. However, there will be damage and closures in a number of college and program libraries in poor or very poor buildings. In all libraries, nonstructural damages can make books and papers unusable for a period of time, and may damage them beyond repair if swift intervention and salvage is not performed. Sprinkler systems behave badly in earthquakes and may pour water on collections if they are not detected early and turned off. Nonstructural damages will also certainly interrupt electronic data access. The functionality of the campus communications hub is of critical importance to ongoing library work.

Special Uses

Special uses occupy 18% of the total floor space at UCB, and are divided among convocation spaces and living and dining spaces.

1. Convocation Spaces

Some convocation spaces are rated good, others have recently been retrofit, and still others are rated poor. The new Haas Pavilion has obviated the danger posed by the old Harmon Gym. Zellerbach Hall is rated good. Memorial Stadium is a dangerous structure and plans are in process to determine how best to retrofit it and how to fund that retrofit. The UC Berkeley Art Museum and Pacific Film Archive Theatre are, appropriately, in the process of being retrofit. Some smaller convocation spaces such as the Dance Hall have been retrofit, but others have not. Priorities should be assigned according to occupancy and frequency of use.

2. Residence Halls

Residence Hall Units 1, 2, and 3 have been retrofit to a life safety standard, but there is no reason to believe they will be usable for students or for sheltering community members after an earthquake. Dining areas may also not be usable for food service or for sheltering. Since these closures will come at a time when other housing in the community will be damaged and even more difficult to find, Residential and Student Services Programs will be under some pressure to provide food and lodging. A business resumption plan should augment the emergency plan, and consideration should be given to building new dining facilities above code to ensure that they will be functional after and earthquake.

It is well known that housing after a Hayward fault earthquake will be desperately insufficient. Much of the UCB student population lives in vulnerable older apartments and other private housing types. Co-ops, fraternities and sororities are generally in older buildings and are run with little extra capital for retrofit or upgrading. Many private multi-unit residential properties are old, vulnerable, and have not been retrofit for various reasons. Given that the residence halls may also be closed, a huge percentage of the student population could be displaced from housing.

Childcare services will also be seriously affected by damage to facilities. The business resumption plan should review the merits of providing them in temporary facilities, or perhaps suspending them for a time.

SECTION VI. UTILITY SYSTEMS

In June, 1998, the Utilities Infrastructure Seismic Response and Recovery Committee released a report on its assessment of the campus utilities systems. As part of the SAFER Program, the committee had been asked to analyze the performance of the infrastructure in an earthquake, and to assist in developing a plan for rapid recovery after a quake. Among its findings, three were very troublesome:

- Earthquake-damaged utilities can hamper emergency response, trigger additional damage that can kill or injure more people, and extend the time required to restore the campus to full operation.
- A single utility damaged by a major earthquake event will affect many or all campus buildings, potentially rendering them unusable until that utility is fully repaired.
- The hub for voice and data communication in the basement of Evans Hall is dangerously vulnerable and should be relocated or made more resistant to damage.

The committee concluded that meeting current standards for earthquake-resistant design should be at least as high a priority for campus utilities as it is for campus buildings. It recommended a number of upgrade projects be undertaken in the near future to defend against infrastructure "meltdown" in an earthquake on the Hayward fault.

The committee urged priority be given to components of campus utilities systems essential to both life safety and the successful recovery and resumption of teaching and research. It asked whether plans to upgrade campus utilities could be expanded beyond their current scope.

Background

The campus's utility infrastructure consists of 85 miles of underground pipe and conduits of various ages, materials, and conditions. Campus-owned utility conduit crosses the Hayward fault in **eight locations** to deliver service to buildings in the central and east campus. Regional utility providers' supply lines cross the Hayward fault in **six locations** to connect with campus utilities. Fault displacement will render these useless for days or weeks.

There are seven major campus utilities: water (drinking, fire, industrial); sanitary sewer; storm sewer; natural gas; steam; electricity; communications (voice and data). Because utilities are underground: 1) they are inherently at risk of damage from shaking, compression, subsidence, fault displacement and landslides during seismic events; 2) they are difficult to access for repair or replacement (and the campus does not have the staff or equipment to repair or replace most utilities); and 3) they receive less attention, are more difficult to fund, and have lower priority than the buildings that depend on them for service.

The age and outmoded materials in many of the campus utilities dramatically increase their vulnerability to serious damage during an earthquake.

Post-Earthquake Problems[10]

A major earthquake on the Hayward fault will wreak havoc with many utilities, both on-campus and off. Below are detailed the impacts on utility systems observed in past earthquakes.

1. Water

It is likely that water supply will be lost, due both to breaks in EBMUD aqueducts and to individual breaks in campus water lines. Campus maps for the water and wastewater systems, and all underground utilities, are incomplete and it will take time to find broken pipes, not to mention repair them. Rest rooms will not be open because the sanitary sewer lines will be severely damaged. The water supply may not return to pre-earthquake levels for weeks or months. Bottled water will need to be trucked in each day if the campus is partially open. Temporary toilet facilities will be needed as well.

2. Steam tunnels

The campus heating system, which relies on the steam tunnels, will be interrupted. Damages will include ruptured steam lines, collapsed walls, and asbestos releases.

3. Electricity

The campus will be without electricity for a period of days, due both to damages at PG&E supply facilities and to damages on to the campus distribution system. To speed up recovery of the service, it may be necessary to install temporary poles all over campus to carry electricity to campus buildings.

4. Communications

Voice and data communications are extremely vulnerable, and will be interrupted for extended periods. The safety of data depends, in part, on the computer hub in the basement of Evans Hall. The central computer systems there can be disrupted by structural and nonstructural damages, which could destroy the building's electrical system, mechanical systems, and the Internet connections for the campus, the Office of the President, and other northern University of California campuses. The unbraced, raised floor in the Evans Hall Computer and Communications Facility may collapse. A steam line runs next to the main electrical transformer and the campus connection to the Internet. Also problematic are the segments of data network that could be lost to collapsed steam tunnels.

Other vulnerabilities in the data system occur in every unbraced computer in every department and office, every local area network in a department or building, and every connection from home computers to the UCB system.

[10] Based in part on an assessment by Martha Fateman, Chair, UC Berkeley Utilities Infrastructure Seismic Response and Recovery Committee, June, 1999.

Data communications also depend on electrical power availability from PG&E, which may be out for days.

Voice communications are dependent on vulnerable systems on campus, as well uninterrupted service from phone companies. Indications are that both conventional phone service and cellular phone service will be interrupted for hours or days.

Effects of Utility Systems Failures

1. Students

Residence halls may be closed by structural damages or utilities interruptions. Food preparation will be hampered when the water, electricity and steam system fails. Students may return to their homes and remain there because there is no place here to live. Besides the older residence halls, a large number of private rental apartments were damaged or destroyed. Many students with part-time jobs will be without a source of income since a large number of businesses are closed for repairs. Some students may want to apply to other schools for Spring Semester, but be unable to get transcripts from the slowly restored campus student database.

2. Faculty

Faculty will lose research materials if back-up generators are not in place to maintain incubators and refrigerators. Lack of water will become a threat to some research projects within a day or two. Some faculty may be able to work at home using books and papers they had there, or were able to salvage shortly after the quake. Other faculty may resume their work using private Internet services and computer time donated by other universities. Data retrieval from campus hard-drives or servers will be impossible or exceedingly difficult. Faculty whose research is in damaged and closed facilities, and those that can not use their space due to the lack of electricity, water, and communications, will need to find temporary and permanent locations in which to continue their work.

3. Administration and Staff

Business will not be usual and all the operations of the university will be impaired by the damages noted above. Accounts payable and receivable may be required to operate with pencil and paper. The Chancellor, his cabinet and staff will be busy working with the Regents, the state legislature, and federal agencies on: 1) emergency funding to restore the campus; 2) continued funding for research; and 3) paying salaries for faculty, staff and grad students who are not working. Communicating with students, parents, suppliers and contractors will be difficult.

College and departmental staff will be consumed with the exigencies of operating under such severe circumstances. Without contingency plans for operating in such a situation, much time will be spent initially trying to figure out how to do so.

Implications

The above observations are entirely feasible outcomes of a Hayward fault earthquake, especially when considered in light of the breaks in water lines, sewer lines and steam pipes, and the frequent electrical outages that we experience routinely without earthquakes. Damaged utilities are a serious threat to both life safety and property. Because a single failed utility can render many or all buildings unusable, we should strive for redundancy in our electrical, water and communications systems.

The campus cannot resume operations without 1) a working electrical system, 2) a safe supply of water for drinking, 3) a working sanitary sewer system, and 4) operational voice and data communications. We can resume business with temporary buildings served by utilities. Obviously, we need to establish mutual aid agreements with local utility providers such as PG&E and EBMUD, as well as with out-of-area campuses and contractors, if rapid recovery is to be possible.

CHAPTER VII. NONSTRUCTURAL MITIGATION

In many campus buildings the great earthquake risk is not structural failure, but rather damage to contents. Poorly mounted light fixtures, ceilings, and unsecured bookcases and metal storage cabinets can injure and kill people during the shaking. Unsecured electronic and scientific equipment can be smashed, and the time and costs associated with repair and replacement can be excessive. Computers that fly off desks can be lethal, don't bounce well, and will bring the work of the university to a halt once broken.

Laboratories, classrooms, offices, libraries and residence halls are all vulnerable to nonstructural damage, although the equipment in most laboratories is both especially fragile and very expensive to replace. An interdepartmental Nonstructural Seismic Safety Mitigation Work Group was established in 1997 as part of the SAFER Program. In 1998-99, a multi-departmental effort administered by the Office of Environment Health and Safety created a new nonstructural hazard mitigation program. ***"Q-Brace"*** provided $100,000 in matching funds to induce earthquake mitigation efforts throughout the campus. Academic and administrative departments alike were encouraged to assess their vulnerability to nonstructural seismic damage, and apply these funds to make necessary improvements. Applications for ***Q-Brace*** exceeded funding by nearly 300%, indicating the wide interest and concern. The program has been funded again for 1999-2000, at the same monetary level. It should be continued at that funding rate for a number of years.

A comprehensive program to secure the most obvious nonstructural hazards in general assignment classrooms was started in September, 1999, with funding from the Executive Vice Chancellor's budget. The Office of the Registrar and the Office of Emergency Preparedness are coordinating an effort to secure or remove pendent light fixtures and to anchor audiovisual equipment in the classrooms. A survey of the 244 general assignment rooms indicated that about 60 of them had hazardous light fixtures and 40 of them needed AV equipment anchoring. The initial investment of about $120,000 will take care of those problems, but there are additional nonstructural hazards such as suspended ceilings and inadequate glazing that remain to be dealt with.

Departmental classrooms--which total over 250--have similar nonstructural hazards and pertinent departments should begin to survey their rooms and determine their highest risks. As a high-priority part of UCB's overall seismic safety program, vice chancellors, deans, and department chairs should develop programs for securing contents within their purview in the next few years. Chemical and biological materials that may become hazardous when released should be of particular concern, since they are not only threats to life safety but sufficient cause for long-term building closure.

It is recommended by this committee that colleges and departments carry out similar projects in high-use meeting rooms.

Of particular concern is the vulnerability of teaching labs and research labs. Unsecured contents

that break will have a number of deleterious effects: 1) they may kill or injure people; 2) they will destroy research projects in medias res; 3) they may destroy expensive equipment; and 4) they may release biological and chemical materials that will become hazardous incidents requiring extensive clean-up, which is both expensive and time-consuming.

Prudence dictates that ORUs and responsible colleges and departments spend some time and money securing UCB's very valuable and very vulnerable research investment.

CHAPTER VIII. EMERGENCY RESPONSE

The mission of the UC Office of Emergency Preparedness (OEP), is to prepare the campus community to respond to, and recover from, a disaster. A unit of the UC Police Department, OEP serves the Berkeley campus community by implementing programs for disaster planning and training, hazard mitigation, and emergency response and recovery. Relationships with local, county, state government and other universities have been established to assist in response.

OEP leads the development and implementation of the Campus Disaster Response Plan, which serves as the organizational framework for an effective response during times of major emergencies. The campus Disaster Response Plan is up-to-date and complies with the State of California requirement to use the Standardized Emergency Management System. The plan is used to train personnel from across campus, and various parts of it have been exercised in the past two years. The Office of Emergency Preparedness has a comprehensive program of educating and training campus personnel in emergency response, and at least once a year there is a large exercise.

Over the past several years, the campus has implemented several progressive training and exercise programs, ***"QUAKE 98"*** and ***"QUAKE 99"***. These projects targeted the executive leadership, emergency operations center (EOC) staff, and management personnel from essential service departments across the campus. Each exercise involved the activation of the campus emergency operations center to manage a simulated earthquake scenario. After each exercise, needed improvements in the campus plan and infrastructure are identified and corrective measures taken. "***Quake 2000***," which took place May 25, 2000, was the largest disaster response exercise ever held at a university in California. It involved all building coordinators on campus as well as the activation, in two of the emergency management areas, of building inspection, first aid, and canine search and rescue teams.

Many infrastructure improvements have been installed for use during emergencies. Examples of these include an outdoor public address system, an Emergency Operations Center (EOC) and alternate EOC, new "code-blue" campus emergency phones, 800 MHz radios, and an emergency generator for the campus radio station (KALX). OEP collaborates with the Campus Fire Prevention committee in developing and managing wildland fire mitigation projects on campus properties. The Berkeley campus is now administering a FEMA hazard mitigation grant for wildland fire mitigation

OEP provides training and informational courses on a wide range of topics relating to emergency preparedness. In 1999, the Office of Emergency Preparedness launched ***"The HOME Team"*** disaster training program. The program recruits volunteers from among students, faculty and staff, and offers free emergency responder training courses. Types of training include Light Search and Rescue (SAR), First Aid and Triage, Shelter Operations, and Communications support. An ongoing campus K9 SAR program is currently training six volunteers and their dogs toward FEMA certification. All HOME Team participants are registered as State Disaster

Service Workers, ensuring they will be provided with health and liability coverage during any activation. In its first year, the HOME Team recruited and trained nearly 450 volunteers

When disaster strikes, HOME Team volunteers are instructed to report to specific departments for management and deployment (e.g., Police for search and rescue, University Health Services for first aid.) The equipment and materiel necessary to support these volunteer teams is stored within the respective managing departments. Subsequent campus wide drills will engage our volunteers in field level disaster exercises.

OEP manages the Campus Building Coordinator program and sponsors special events such as the annual Emergency Preparedness Fair; CPR Saturday, regular CPR and first aid classes; and offers presentations to student, staff and faculty groups of six or more on emergency preparedness for home or work.

The OEP should update the emergency plan and procedures on a periodic basis to reflect changing conditions, expectations, and campus capacity. This program should continue with ample annual funding on an annual basis. Cooperative/collaborative programs in the community to prepare, mitigate, and respond should be continued and funded.

CHAPTER IX. BUSINESS CONTINUITY PLANNING

Business continuity planning is an integral part of risk management and, increasingly, a regular part of business operations in large organizations in California. UC Berkeley is in serious need of such planning.

Conventional continuity planning has two major elements: 1) business analysis to identify all vital business functions and systems within an organization, and 2) operational impact analysis to evaluate the losses from the disruption of each function, and categorize the time frames needed for the recovery of each function. These analyses can reveal the consequences of disruption in terms of financial and operational losses, and help determine the maximum time period the organization can tolerate loss of functions or even closure. With that information in hand, the organization can set priorities for getting systems and functions up and running again.

The campus can not function without any of the three components of campus operations: 1) faculty/researchers, students, essential personnel, other staff; 2) physical plant (access, buildings, infrastructure); and 3) financial/IT/data processing systems. The campus impact analysis should identify mission-critical processes and administrative functions for business resumption in central administration and departments. This will include contingency planning for alternate or backup computer information systems and vital records management, for backup power and water supplies, and for swift restoration of infrastructure.

Post-Earthquake Constraints

Following a serious earthquake on the Hayward fault, the situation on campus will vary according to the magnitude and location of the quake. However, certain structures and systems will be damaged in any major quake, and alternate modes of operation will be required if the campus is to get up and running within the 30-day period proposed earlier in this Strategic Risk Management Plan. Below are realistic statements of the conditions under which UCB will be forced to operate. It is desirable to consider now which courses of action will be preferable, and to put into place the policies necessary to carry them out.

1. Conditions

After a major quake, the campus will be closed for a period of time due to structural damages to some buildings, nonstructural damages to others, breakages in on-campus electrical transmission lines, as well as water and sewer mains, damages to the computer hub, and hazardous materials clean-up. This plan has set a goal to make necessary repairs to the infrastructure and reopen campus within 30 days with reduced space and minimal computing capacity. In such circumstances, decisions must be made about the uses to which the limited space and resources should be put; other decisions have to do with restoring business operations when typical data and computing, and personnel resources are in short supply. Academic questions comprise one set of choices, and business questions comprise another. A third set involves questions related to the utility systems. They have been posed in Section VI and need not be enumerated again here

beyond noting that without electricity, water and sewer, and telecommunications, conducting business will be challenging. But it won't be impossible, especially if contingency plans are made now.

2. Academic Choices

a) If only half of all classrooms will be available for use, which classes would be taught in the classrooms? Which classes could be taught in trailers? Could some class be taught in space off campus?

b) If damage is so severe that only 1/4 of all classrooms will be usable, which classes should be taught in those rooms?

c) If computing will be unavailable for students for half a semester, how would we change course and examination requirements in the face of no computing capacity?

d) If the campus were closed one week before mid-terms, what would we do about the exams? How would courses be restructured?

e) If the campus has been closed one week before finals, would final exams be cancelled? How would students be graded on their courses?

f) The plan is to reopen in 30 days, but even then only half of all campus space will be available for use. What priorities should administrators assign to activities in that space? Should teaching be resumed in 30 days, and research put on hold for 90 days, vice versa, or some other equation?

g) After 30 days, campus will reopen, but many research facilities will not be usable. If researchers had access to borrowed research facilities an hour away, for how long would such a commute and other constraints be acceptable?

h) While research activities are interrupted, should graduate students and other support technicians be paid? With what funds?

3. Business Administration Choices

a) If California Hall is closed down for repairs, where will the Chancellor's office be located?

b) If University Hall is closed down for repairs, where will the administrative jobs usually performed there be done?

c) If the computer hub in Evans is damaged and shut down, as expected, how will all computer-dependent payroll, purchasing and disbursements be done?

d) How long will it take to get the BFS functioning again if it's shut down?

e) Do we have back-up systems for critical purchases during the emergency period?

f) How will we handle loans and receivables? Financial aid awards?

g) How will recharge departments operate?

h) If employees can't get in to work for various reasons, how will be handle the need for extra personnel?

Need for Plan

The SAFER Business Operations Seismic Recovery Committee began in March to develop a business resumption plan. This will take some months to perform comprehensively, and will be completed in December of 2000 and ready for implementation on 1/1/2001. The process will result in not only a plan for central business operations, but also templates that will allow colleges and departments to undertake their own business resumption planning efforts. Those plans will be complete by 6/1/20001/

This is a very high priority. To sustain the operations of a complex institution like UCB, it is imperative for all operational units to undertake business resumption planning.

CHAPTER X. RECOVERY PLANNING

UC Berkeley has engaged in no systematic recovery planning. Neither emergency response planning nor business resumption planning addresses some of the issues covered by recovery planning. .

After business is resumed at some level, repair and replacement of damaged buildings and systems goes on for years. Repair is a long and complicated process of many steps (some of them backwards): applications for state and federal assistance funds; negotiating with FEMA, California OES, and the legislature; hiring engineers; debating the merits of functional and seismic upgrades during the repairs; raising funds for projects that don't qualify; setting priorities for use of limited funds. Inherent in the process is much extra work and many delays; all too quickly the people in charge of recovery are overwhelmed and lose their sense of priorities. Even if some provisional level of business operation is established within 30 days, a semblance of normalcy will not be achieved for months or years. This could be almost as damaging to the university as the disaster itself.

The central administration should establish recovery priorities. For example, the goal of resuming 75% of classes within 30 days of an occasional earthquake would help in the analysis of what policies, plans, and pre-existing agreements will be needed to enable UCB to do that. Based on that, we could set repair priorities.

It would be wise to educate administrators in the post-disaster assistance process. Change laws that will be unduly burdensome, if necessary. Set up private funding mechanisms (insurance, Cat Bonds, donor appeals, loans) that will help overcome some of the inevitable problems.

CHAPTER XI. EDUCATION AND TRAINING

On Campus

Review of the current level of education and training available at UCB shows a number of good initiatives from the Office of Emergency Preparedness. Some printed information about emergency safety is available, and is distributed to various audiences in certain circumstances. However, a comprehensive education program is necessary to inform all members of the campus community. Ideally, materials would address what to do BEFORE an earthquake to reduce losses, how to behave during a quake to reduce death and injury, and what is expected from each person after a quake--informed coping that will minimize disruption and confusion.

Loss potential has been explained by some of the SAFER information, but such an effort should be more frequent and ongoing. Explain the vulnerabilities of buildings, contents, and systems. Discuss the implications of damages for the sustainability of university operations following an earthquake. Describe behaviors that will reduce the risk of death and injury. Give directions for actions that will reduce losses to materials, data and systems highly valued by members of the campus community.

In September of 1999, an initiative was funded by the Vice Chancellor for Business Operations to produce three kinds of informational materials: 1) classroom posters advising on what to do in a number of emergency situations including earthquakes, 2) brochures for faculty members on steps they can take to reduce their losses in an earthquake, and 3) pamphlets for students on earthquake safety and loss reduction in dorms and apartments. Under the direction of the Office of Emergency Preparedness, and with the assistance of the Office of the Registrar and the Disaster-Resistant University project, the materials will be completed by December and disseminated in early, 2000. Simultaneous with distribution of materials, there will be articles in the ***Daily Californian*** and the ***Berkeleyan*** to call attention to the materials, and explain the reasons for them.

Due to turnover in the student body, faculty, staff and administrators, information and education programs should be delivered every semester. Ongoing information and assistance should be offered for faculty and staff that wish to undertake planning or nonstructural hazard mitigation.

It has been suggested that students at this institution would benefit from learning about hazard assessment and loss reduction in their studies. Could the principles of risk management be integrated into the curricula of pertinent disciplines?

Off-Campus

Develop a comprehensive outreach effort to the community: the city, landlords, parents, and campus suppliers of food and materials. Inform them of the preparedness and mitigation measures underway on campus, but give them an idea of the response and recovery needs anticipated following a large earthquake or fire. Make the community aware of potential losses--

to housing, transportation and utilities--and engage everyone in planning for emergency response support and recovery assistance.

A separate component of off-campus education should be devoted to producing informational materials for the legislature, the regents, alumni, and donors. The better they understand the needs, and the efforts to meet them, the more supportive they will be in both financial and political terms.

CHAPTER XI. PLAN MAINTENANCE

Implementation and Accountability

As stressed throughout this plan, Vice Chancellors, Deans, and Department Chairs are responsible for preparedness and mitigation within their purview. Technical support is available from on and off-campus, but implementation must take place in every unit, college and department. The schedule for implementation is a prudent one. Every year the Chancellor should review the schedule for an appreciation of how projects are progressing on all fronts.

Review will involve 1) who is in charge of each element, 2) what period of time was prescribed for implementation, 3) measurement of performance; and 4) task revision, if necessary.

Sustaining Interest and Support

To maintain the interest and support of the campus community, informational materials should be made available and events should be regularly scheduled.

To maintain the interest and support of outside parties such as the legislature, the Board of Regents, public utilities, involve them in some aspect of the annual emergency response exercise, or develop a recovery tabletop exercise to engage their thinking on the complex issues that will be confronted. With the SAFER and DRU loss estimates, the city's loss estimates, and the SAFER accomplishments, there is plenty of material to use for outreach to build understanding and support among the Office of the President, the Board of Regents, and state and federal representatives and departments. Alumni and the donor community can also be brought into the information web.

Continue to work with private sector businesses and other helpful organizations. Review the progress and level of support annually.

SCHEDULE FOR IMPLEMENTATION

Comp By	Task	Who	Cost	Source of $$
ongoing	Emergency prep plan	Emer. Prep. Ofc	$150,000/yr	VC B&A Svcs
12/1/1999	Loss reduction info for faculty (from Provost)	OR/EPO/VPO	$45,000 (99-00)*	VC B&A Svcs
12/1/1999	Safety info for students	OR/EPO/VPO	*part of above	
2/30/2000	Post-disaster signs for classrooms	OR/EPO/VP	*part of above	
2/30/2000	Loss reduction info for faculty (through depts)	Deans & Chairs		
3/30/2000	Seismic recovery plan--Research	VC Res		
5/30/2000	Emergency response exercise	Emer. Prep. Ofc.	$25,000	VC B&A Svcs
9/1/2000	Begin classroom nonstructural survey (departmental)	Deans & Chairs		
1/1/2001	Records back-up and security	VCs, Deans & Chairs		
1/1/2001	Business resumption plan (central bus ops)	VC B&A Svcs		
1/30/2001	Plan for relocating Evans Hall hub	VC		
3/1/2001	Campus recovery plan (central)	VC		
3/1/2001	Nonstructural reduction plans	Deans and Chairs		
3/1/2001	Animal contingency plans	Deans and Chairs		

Comp By	Task	Who	Cost	Source of $$
5/1/2001	Seismic safety element in Strat Fac Mas Plan	VC Cap Proj	$1 million	Chancellor
6/1/2001	Utilities systems strengthening	Vice Chancellor		
6/1/2001	Business resumption plan (colls and depts)	Deans & Chairs		
9/1/2001	Classroom nonstructural (gen'l assign)	Vice Chancellor	$123,550 (99-00)	Ex VC
9/1/2001	Recovery plan (colls and depts)	Deans and Chairs		
1/1/2003	Classrooms and labs nonstructural (departmental)	Deans & Chairs		
6/1/2003	Redundant water supply	VC Cap Proj		
12/30/05	Q-Brace program for contents	EH&S	$100,000/year	VC B&A Svcs
12/30/2006	Ten additional (beyond 1999) main campus bldgs retrofit	VC Cap Proj		
12/1/2010	Complete upgrade of campus utility infrastructure	VC Cap Proj		
12/30/2011	Fifteen addtl. (beyond 1999) main campus bldgs rtrft	VC Cap Proj		
1/1/2030	Complete strengthening of vulnerable bldgs critical to post-EQ sustainability of UCB	VC Cap Proj	$1.2 billion est.	