The further slippage in auto emission deadlines embodied by both bills is a source of distress to environmentalists, but the EPA, according to assistant administrator for air and waste management Roger Strelow, thinks the bills are moving too hastily. Administrator Russell Train proposed last year that there be a 3-year freeze on the 1977 standards followed by a 1-year move to the interim standards currently applicable in California before going to the statutory standards in 1982. The EPA has been more sympathetic than the writers of the bill to the industry's pleas for leniency in view of the energy crisis and the misadventures of the economy.

A selling point for the bills has been their emphasis on giving the states more responsibility for administering air laws and more discretion on how they choose to go about it. States, for example, get first crack at allowing extensions for stationary sources to meet compliance deadlines, and are given greater participation in decisions affecting federally owned areas. However, the major shifting of responsibility to states is in the area of transportation controls, such as levying parking taxes, establishing bus lanes, and other measures to reduce automobile traffic. EPA authority to impose such controls was curtailed by court action in 1973; now, says Strelow, the agency realizes that the political, economic, and social complications are so great that such measures are best left to the states. The bills under consideration only allow EPA to order states to make transportation control plans where primary air quality standards are being violated. Even then, controls may be delayed (up to two 5-year delays in attaining the primary standards would be allowed) if localities insist that controls would result in "serious adverse social and economic effects" (according to the Senate wording.)

Related to transportation controls is the problem of auto pollution from "indirect sources," that is, shopping centers and sports arenas that become hot spots for auto pollution. Business interests say that control of indirect sources, through such measures as denying construction permits, amounts to "land use," and strongly oppose it. EPA's concerns are therefore also limited to threats to the primary standard and if the agency wants to take action it must be through the courts.

Among other provisions contained in one or both bills are the following:

- A 2-year study to determine the effect of various substances, namely halocarbons, on the ozone layer, with EPA required to decide whether to issue new regulations at the end of that time.
- Worker protection provisions giving new avenues of redress to employees who think the costs of cleanup have been used as an excuse to fire them.
- A provision awarding court costs to the "prevailing party" (other than the government) in suits involving compliance to the Clean Air Act.
- Protection for independent manufacturers of auto parts by stipulating that purchase of replacement antipollution parts from other than the original dealer does not detract from the car buyer's warranty.

Environmentalists say, predictably, that the bills are too weak. They don't like the extensions for stationary sources or automobiles, and foresee endless delays in establishing transportation controls if the matter is left up to the states. They want the House to eliminate its class III category for nondegradation. They also want more mandatory class I areas. Despite the similarity of the bills, they fear that the nondegradation provisions will be gutted when the bills reach the floor because of the intense pressure from industry lobby groups. If that happens, says Rafe Pomerance of the National Clean Air Coalition, "they will destroy the national parks." The recently cancelled Kaiparowits power project in Utah, which environmentalists have been fighting tooth and claw for years, probably would not have stood a chance under the proposed legislation because of its proximity to national parks and wilderness. But Richard Ayres of the National Resources Defense Council predicts that the legislation would serve little to deter the blossoming of coal-fired power plants in the West, and he believes the environmentalists' nightmare of plumes of smoke hanging over the Grand Canyon still stands a good chance of coming true.

The Senate was scheduled to vote on its bill on 4 May; the House, shortly thereafter. Most vulnerable of the major provisions are those relating to nondegradation. Senator Frank Moss (D–Utah) is waiting to spring an amendment that would wipe out the whole section. Assuming the bills do not get snagged in conference—a lengthy delay is unlikely because the auto companies need to know very soon what to do about their 1978 models—the final bill should be ready for the presidential signature some time this summer.

—CONSTANCE HOLDEN

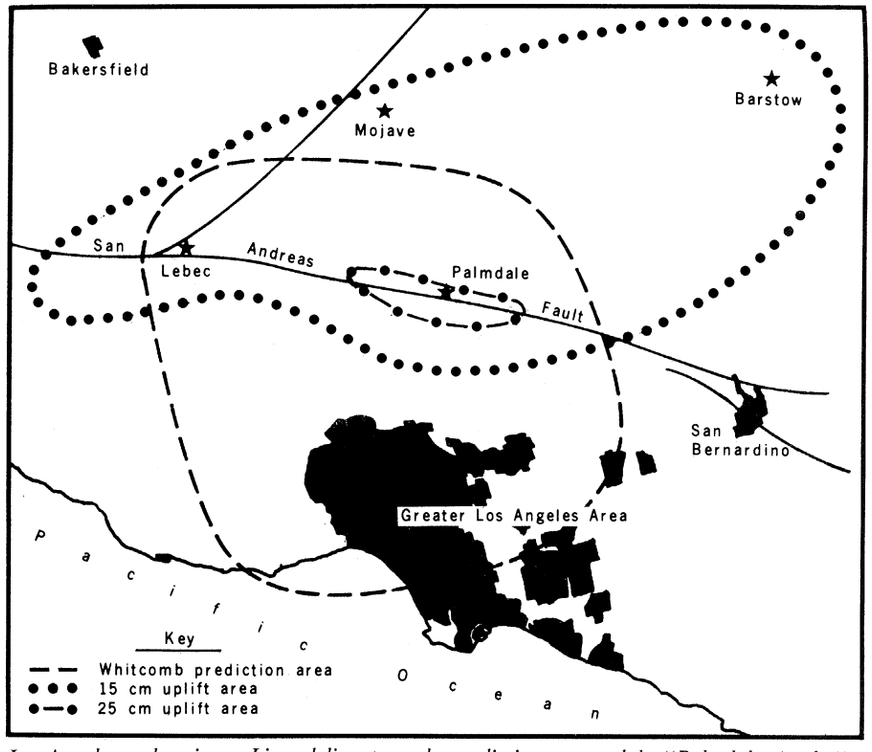
Earthquakes: Los Angeles Prediction Suggests Faults in Federal Policy

In recent weeks several people, from radio preachers to distinguished scientists, have been warning that a severe earthquake could strike the Los Angeles region, including portions of the city itself, possibly within a year. A quake of Richter magnitude 5.5 to 6.5, which would be comparable to the 1971 San Fernando quake which caused property damage of $550 million, was predicted in a scientific paper given on 15 April in Washington, D.C., by a California Institute of Technology seismologist, James H. Whitcomb. The prediction, a rare event of itself in seismology, was based on seismic wave measurements and followed on the heels of other reports of a geologically sudden 1-foot uplift along the same part of the San Andreas fault, and extending over a 4500-square-mile area centered around the little town of Palmdale.

So far the two findings are not known to be related to each other. But both are being taken seriously by scientists and officials who feel they could be signs that a quake of major proportions could be imminent.

Earthquake prediction this week is the subject of complementary stories, this one and one in Research News (page 538) reporting on successful quake prediction in China.

All this caused Doug Clark, a Los Angeles radio evangelist, to devote a special, 1-hour program to earthquakes, the "Jupiter effect," and the Book of Revelations, while offering his own tome on earthquakes to listeners in return



Los Angeles and environs. Lines delineate quake prediction area and the "Palmdale pimple."

for cash contributions. It also caused a stir among Los Angeles politicians; after word of the Whitcomb announcement broke, there was talk in the city council of suing Whitcomb, and anyone else who made earthquake predictions, for any resulting drop in real estate values.

In Washington, the excitement over the prediction followed many months of behind-the-scenes work by scientific advisers and Administration officials—including President Ford—who had inside word of the Palmdale uplift and were trying to get an adequate array of seismic instruments set up along the little-monitored portion of the fault. But officials and advisers have also become concerned that neither the scientific community nor the federal, state, or local authorities know exactly what to do next. "Right now," says one adviser, "we're in a very awkward situation where no one really knows who should take the ball and run with it."

Several scientists, including Whitcomb, hasten to say that earthquake prediction is barely an art—let alone a science. There is no way of assigning a numerical probability to the chance that Whitcomb's prediction is correct. Furthermore, ground uplifts like the Palmdale "pimple" have sometimes—but not always—preceded major earthquakes. And offhand predictions of a major California quake, of Richter magnitude 7 or 8, have been made for years by everyone from soothsayers to scientists—but so far nothing of the sort has happened.

New, however, are data suggesting some ominous activity along the fault. Says Vincent E. McKelvey, Director of the U.S. Geological Survey (USGS), the federal official with most responsibility for earthquake prediction and warning, "The difference between what we knew before and what we know now is the evidence of accumulating strain along the San Andreas fault. Obviously, something is going on. What we have now is an element of imminence for which we had no basis previously."

Among the first to feel this sense of imminence, it seems, was Frank Press of the Massachusetts Institute of Technology, who is perhaps the doyen of the earth science community. Press first saw the Palmdale data during a routine advisory meeting last December in California, and, because he sits on several high-level government committees, he was in a prime position to sound the tocsins in Washington.

The evidence, according to USGS scientist Robert O. Castle and his colleagues (and published in *Science*, 16 April, page 251), was that a 100-mile portion of the fault, which had remained locked for 40 years while other portions moved, began to rise rapidly after 1960. "Frank got very excited about this," recalls one scientist who was there. Afterward, USGS's Office of Earthquake Studies set up a special, ad hoc group to review the data to make sure there was not some fluke.

As it turned out, the Palmdale finding was not a fluke at all, and, in mid-January, Press used the occasion of a meeting of one of the new presidential science committees, which Vice President Rockefeller attended, to explain the situation. Press also talked to the Vice President's longtime scientific confidante, Edward Teller, who apparently also spoke to Rockefeller. In interviews with the media, Press has been cautious in his characterization of what the Palmdale data bode for Los Angeles. But a letter he wrote to Rockefeller on 21 January, which the Vice President then showed to the President, gives some sense of his concern.

> The discovery, which will soon be released publicly, is most disturbing because such uplifts in the past have preceded earthquakes of great destructive power. . . .
>
> The effect on Los Angeles of an earthquake in the region of the uplift would be quite disastrous. A structural engineer at U.C.L.A., Professor Martin Duke, has estimated that as many as 40,000 buildings would suffer collapse or serious damage.
>
> There is no question that the uplift must be taken very seriously even though geophysicists have, as yet, no clear understanding of its origin or significance. . . .
>
> The region of the uplift should now be subjected to a most intense scrutiny. . . . In Japan, a geophysical anomaly of this magnitude would trigger an intensive study or a public alert.

He then discussed the $2 million needed to study the uplift and the importance of more funds for earthquake research. He mentioned the success of the Chinese in predicting a quake in 1975.

> Having visited China, I can attest to their technical proficiency in this field of science, and express my own concern that because of insufficient resources a similar achievement may not be possible in this country.

According to a Rockefeller spokesman, President Ford asked for more information, which resulted in three memos from the Vice President on the subject. Ford decided that something should be done: McKelvey, science adviser H. Guyford Stever, and the Office of Management and Budget became involved. The upshot was that $2.1 million in reprogrammed 1976 geological research funds was given to USGS to monitor the fault.

The story of Press's actions and the White House response would seem to show that the government is well equipped to snap into action when scientists find evidence of a possible hazard developing in a fault zone. On the contrary, some officials and advisers say that the government is in many ways totally unprepared to follow through after specific predictions. They say it lacks policies for certifying predictions, issuing warnings, and offering "prequake" aid to communities which could be affected.

Following passage of the Federal Disaster Relief Act of 1974, the President gave the job of warning against geologic disasters to the Secretary of Housing and Urban Development (HUD). But because HUD's Federal Disaster Assistance Administration, the agency that aids communities after a disaster occurs, "wouldn't go near the job with a pole" according to one insider, the Secretary of HUD shifted the job to the Secretary of the Interior. He in turn shifted it to the director of the USGS. As a result, current federal policy gives this relatively low-ranking official, whose main job is research administration and cartography, sweeping national responsibility, in the language of the act, to be "prepared to issue warnings" and to "provide technical assistance to state and local governments to see that timely and effective disaster warning is provided." At present, USGS has no funds to perform this task.

As for screening predictions of scientists, soothsayers, and charlatans, McKelvey is now establishing a scientific advisory committee that would review any predictions submitted to it. This is the job that was performed by the ad hoc group on the Palmdale data, and the job yet to be performed on the Whitcomb findings. McKelvey admits, however, that the formal authority of the committee would extend only to the work of USGS scientists. Critics of the arrangement note that the successful earthquake predictions so far have been made by university scientists—not USGS staff. Needless to say, soothsayers and charlatans would not be obliged to report to McKelvey's committee.

Moreover, says Ralph H. Turner, of the University of California at Los Angeles, who recently headed a National Academy of Sciences study of earthquake policy,* a USGS-linked committee may have a conflict of interest in passing on the findings of USGS scientists. "Our recommendation was that a body should be set up to screen predictions that was not directly under the thumb of those who also sponsor the research." Whitcomb has proposed that earth scientists send their predictions to the Center for Short-Lived Phenomena, in Cambridge, Massachusetts.

There is also the question of warnings. McKelvey interprets the 1974 act as giving the job of warning, that is, telling the public what to do, to state and local officials. But the law's language is ambiguous, and local officials, reluctant to alarm the public and local businesses, could argue that this is still a federal responsibility. The net result is that it is still unclear how—and whether—the public will be officially warned of a possible impending quake.

Table 1. National seismic monitoring program.

Danger area	Cost ($ millions)
Southern Alaska	10
California	5
Seattle	2
Salt Lake City	2
Wyoming–Idaho (Yellowstone region)	2
Reno	2
Hawaii	2
St. Louis	2
Total	27

Under current policy, "pre-quake" assistance and preparation is to be carried out by state and local governments. And, while California is regarded as a national leader, some California officials sound less than confident that very much "pre-quake" preparation can be done.

For example, R. J. Williams, chief of the city of Los Angeles' Building and Safety Division, told *Science* that a resolution which would have brought 45 old theaters up to current codes has been stalled in the city council for a year. Williams considers such buildings "high life hazards" likely to collapse in a medium-sized quake. (In fact, in the 1971 San Fernando quake, theaters within a 14-mile radius of the epicenter crumbled and had to be destroyed.) But the city's powerful theater industry has opposed the provision, on the grounds that bringing the buildings up to code would cost 85 percent of the price of new theaters. As one official said, "They just wanted to stay open and keep on making money.

"There ought to be some legislation at least at the state level on this," says the official. "But the state always backs away from it because it would cost so much." According to one estimate, bringing old buildings in earthquake-prone regions of California up to standards would cost $10 to $12 billion.

Charles Thiel of the National Science Foundation, which sponsors research on earthquake hazard reduction, says a whole array of state and federal policies are lacking, and calls the USGS plan "a starting point. . . . There exists tremendous federal machinery to protect victims after a disaster occurs. But should we wait until after the event to give people aid and succor?

"When an earthquake is predicted for a region, its tax base starts to collapse. This takes place at a time when the community needs its tax base most." Thiel claims that if a community were confident of receiving money to strengthen highway overpasses, drain dams, and take other safety measures, the erosion of business confidence after a quake prediction would be lessened.

A final problem is insurance. The federal government now subsidizes privately offered flood insurance, in order to keep premiums within reach of people living in flood-prone areas. But there is no comparable federal policy to protect the public and the business community against exorbitantly high rates for earthquake insurance. One city official in Los Angeles estimates that in that region, only 200,000, or 4 percent of all structures, are insured against earthquakes.

Those who have been concerned with the Los Angeles situation cite as the first priority the need for more funds to monitor likely earthquake sites. And, indeed, thanks to the efforts of Press, Rockefeller, McKelvey and company, an added $2.1 million will be spent immediately on instrumentation of the suspect region.

Yet this amount is almost equal to half of the total government effort in earthquake prediction, which previously amounted to some $5 million. And USGS officials note that it is still a long way from a comprehensive program for monitoring not only Los Angeles, but the rest of California, the six other major cities which sit on active faults, and southern Alaska, which, in 1964, experienced one of the strongest shocks ever recorded of Richter magnitude 8.4. Figures, which officials say are "very rough," for the annual cost of monitoring nationwide are shown in Table 1.

But whatever significance the Los Angeles situation has for public policy, earth scientists are becoming more confident about making predictions. Previously, they say, they were reluctant to do this, partly because their science was in its infancy and partly for fear of acting like so many Chicken Littles, running around and squawking when the sky—or rather the earth—may not fall in after all.

But Press, for one, is said by colleagues to feel earth scientists should start living up to their public responsibilities. "Frank has often said that he feels that the talent in the community is being underutilized," says one colleague. "But he also feels a moral obligation about this thing. He feels that if earth scientists did not come forward, and something disastrous did happen, they would have the same guilt that the atomic scientists felt after the dropping of the bomb."

—DEBORAH SHAPLEY

*"Earthquake Prediction and Public Policy," report of the Panel on the Public Policy Implications of Earthquake Prediction of the Advisory Committee on Emergency Planning, Commission on Sociotechnical Systems, National Research Council (National Academy of Sciences, Washington, D.C., 1975).