Managing Critical Safety Projects to Avoid "Entrenched Warfare"

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by

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"Entrenched warfare" often accompanies the process of siting, designing, and building critical facilities. It always leads to the expenditure of billions of dollars, benefiting only a select few. It is a waste of resources and a disservice to society. I propose that the solution to entrenched warfare is in the process.

I have chosen four case histories to illustrate this concept: the proposed Auburn Dam, the New Melones Dam, the Point Conception LNG facility, and the Diablo Canyon Power Plant. All four projects are located in California (Figure 1), and seismic safety became the driving issue.

Auburn and New Melones Dams

During the 1960s, feasibility studies were completed and sites for two of the largest dams in California were chosen. In the mid 1970s, Congress approved funding, and site preparation and construction began on both projects. On July 1, 1975, a moderate magnitude (5.7) earthquake struck 41 miles north of Auburn, near Oroville, California. This earthquake focused public attention and concern on a part of California not generally considered an area of active faults or of significant seismic hazard.

The Oroville earthquake was caused by slip along a short segment of the Foothills fault system, and that fault system traversed through or near both the Auburn and New Melones dam sites. The U. S. Bureau of Reclamation (Auburn) and the U. S. Corps of Engineers (New Melones) chose to have independent, objective, reexaminations of fault activity along the Foothills fault system to evaluate the seismic hazards pertinent to their projects. I was the project director for both of these seismic hazards studies.

Auburn Dam - The proposed Auburn Dam was to be a double-curvature, thin-arch dam 4150 feet long, 196 feet thick at its base, 40 feet thick at its crest, and 700 feet high.

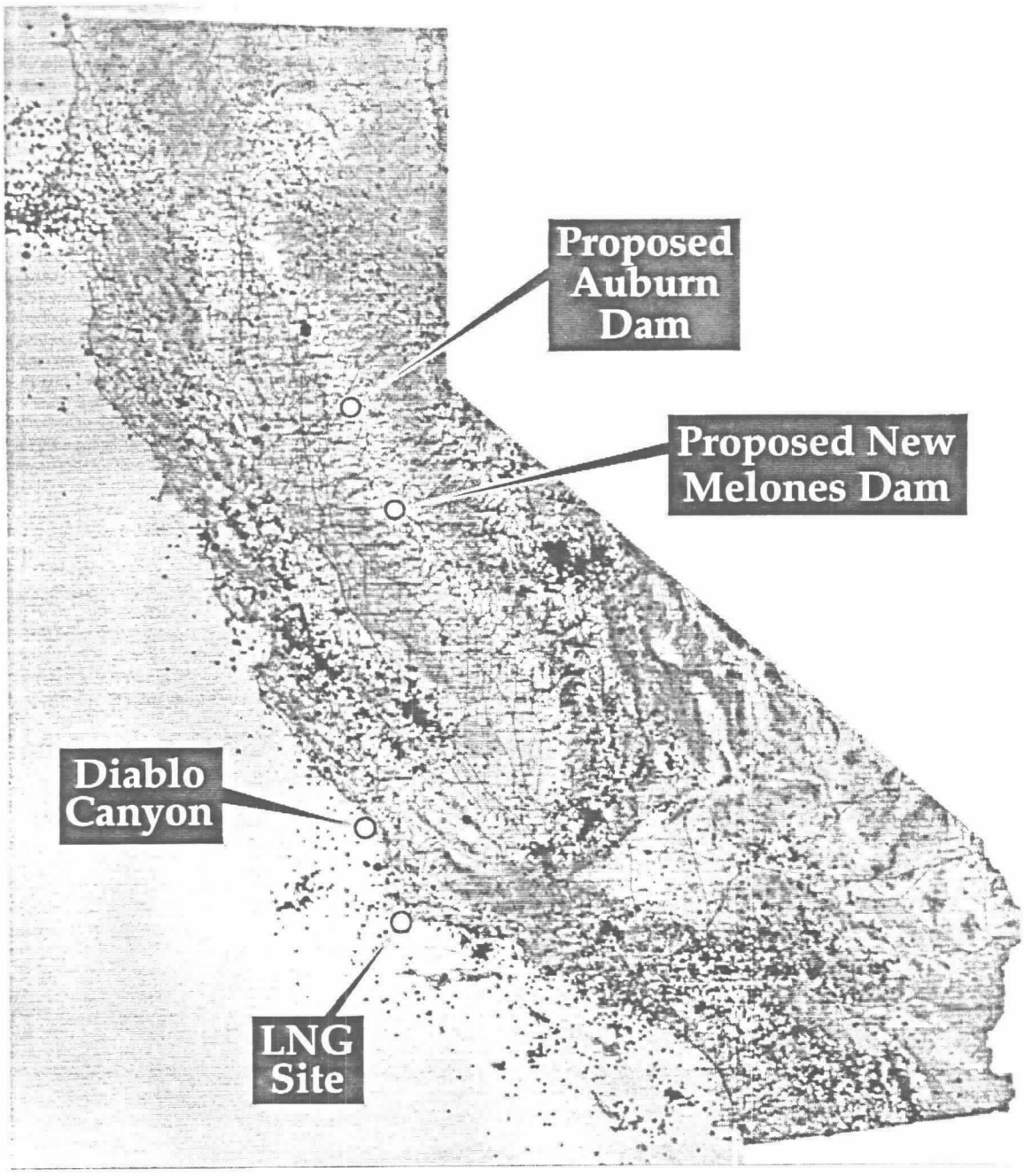


Figure 1. U. S. Geological Survey seismicity map of California, 1808-1987, showing locations of critical facility projects used as case histories.

It was to be built on the American River, near the town of Auburn, on the western margin of the Sierran foothills. In the site area, there were no young geologic deposits that could be used to conclusively assess the activity or inactivity of faults (USBR criteria) present in the foundation of the proposed dam.

The comprehensive regional reevaluation of faults along the Foothills fault system found conclusive evidence of a low degree of fault activity. It was concluded that there is a very low probability that active faults (USBR criteria) traverse the dam foundation. The maximum net slip during a single fault slip event was estimated during these studies to be 9 inches. The U. S. Geological Survey estimated net slip to be 3.3 feet, an estimate by a USBR consultant was less than 2 inches, down to the USBR estimate of zero.

The California Division of Dam Safety judged that a thin-arch dam could not accommodate more than 2 inches of fault displacement without failure. The Auburn Dam construction was terminated. The USBR did not change the dam design for many years, and the dam was never built.

New Melones Dam - The New Melones Dam was proposed to be built on the Stanislaus River near the town of Sonora, California. The dam is an earth- and rock-fill structure, 625 feet high, 2650 feet thick at its base, and 40 feet thick at its crest. The dam site is between two major components of the Foothills fault system: the Bear Mountains and the Melones fault zones.

The Bear Mountains and Melones fault zones contain numerous ancient shear zones and faults. Although it could be documented there has been no recent faulting along many of the fault segments, there were some segments where a low degree of fault activity was documented. The closest active fault (COE criteria) to the New Melones Dam was 2.6 miles away and had the potential for about 0.8 feet of surface rupture along an approximately 10-mile segment. The associated earthquake would not exceed magnitude 6 1/2 and the recurrence of this earthquake was estimated to be 10,000 to 30,000 years.

The New Melones Dam was judged by the California Division of Dam Safety to be safe under these seismic conditions. The dam was completed as designed.

LNG Project

In 1977, California passed the Liquefied Natural Gas Terminal Act, which required the California Coastal Commission to recommend to the California Public Utilities Commission potential LNG receiving terminal sites along the coast of California. The terminal was to receive LNG from both Indonesia and Alaska, to augment California's natural gas supplies to meet anticipated gas shortages projected to occur in 1982.

The geologic and seismic data required by the CPUC and submitted by the applicant concluded that, even though a proposed site at Little Cojo Bay near Point Conception was located within a region of significant potential seismic activity, no active faults traversed the site. In March 1978, the CPUC announced that Little Cojo Bay was the preferred site. In April 1978, a geologist hired by landowners opposed to the facility discovered active faults traversing the site. The CPUC then required additional geologic and seismic investigations and hearings on seismic safety matters before further considering the site.

Years of entrenched warfare on seismic safety issues ensued, during which the Commission conducted the most detailed scientific investigation in its history. After convening a panel of independent experts to assist in judging the adequacy of seismic safety, the CPUC issued its final decision on October 6, 1982. It found the Little Cojo Bay site to be seismically and geologically suitable for construction of California's LNG terminal. The Commission adopted most of the findings of its panel of experts, and concluded that the employment of a panel of experts was the appropriate basis for objective review and safety decision making. The Federal Energy Regulatory Commission affirmed the CPUC decision and concluded that the use of a panel of impartial experts to review technical issues set a legal precedent that proved efficient and provided a high level of confidence in the seismic safety decisions.

The LNG Seismic Review Panel allowed the review process to focus on the critical few scientific and engineering issues that had direct bearing on the seismic safety of the proposed facility. The stymied process only progressed to a satisfactory resolution after this innovative technique was introduced into the decision-making process. The warfare had lasted so long, however, that the economic climate had changed by 1982, and the facility was no longer needed and was never constructed.

Diablo Canyon Power Plant

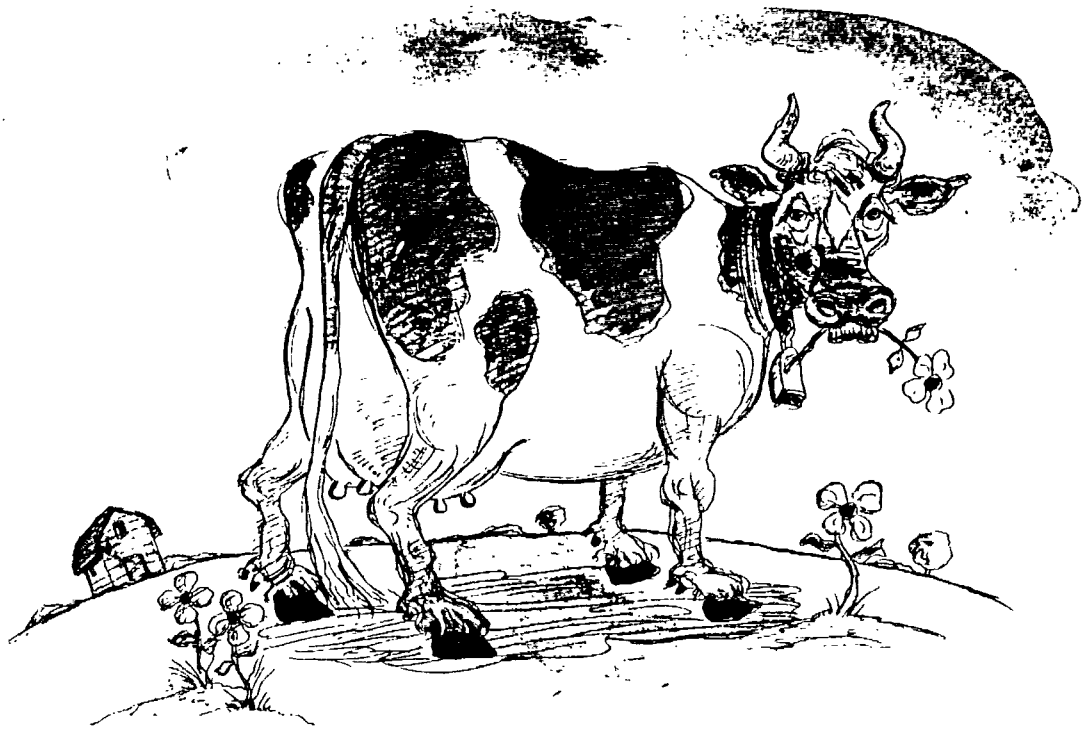
After having several proposed nuclear power plant sites rejected during the issue-charged regulatory review process, Pacific Gas and Electric Company received a license from the Nuclear Regulatory Commission for full-power operation of its Diablo Canyon Power Plant, a plant started in the 1960s, on November 2, 1984. This license, however, was conditional, requiring PG&E to complete a reevaluation of the seismic safety of the facility. The evaluation of the seismic design basis used for the plant was called the Diablo Canyon Long Term Seismic Program, and was to consider all the relevant new information that had become available since 1978, when the seismic design of the plant had been approved. A comprehensive interdisciplinary study was undertaken and completed in July 1988.

The NRC review process included independent studies in all the critical areas of concern. One of the independent reviewers, the U. S. Geological Survey, stated in their concluding report,

This brief summary of the LTSP only hints at the large amount of data acquired, and the number of new discoveries. The LTSP was planned and implemented to address a set of pre-defined geologic issues, but considerable flexibility was demonstrated in responding to new and unexpected findings. The broad range of earth science methods used, the areal extent of the study, and the depth to which critical issues were probed marks this as an unusually comprehensive site study of earthquake hazards. Much of the credit for this effort belongs to the able and highly professional team assembled by PG&E management.

The NRC and its consultants completed their review of the final report in June 1991. The NRC concluded that the license condition had been met. They summarized their approval of the Long Term Seismic Program stating,

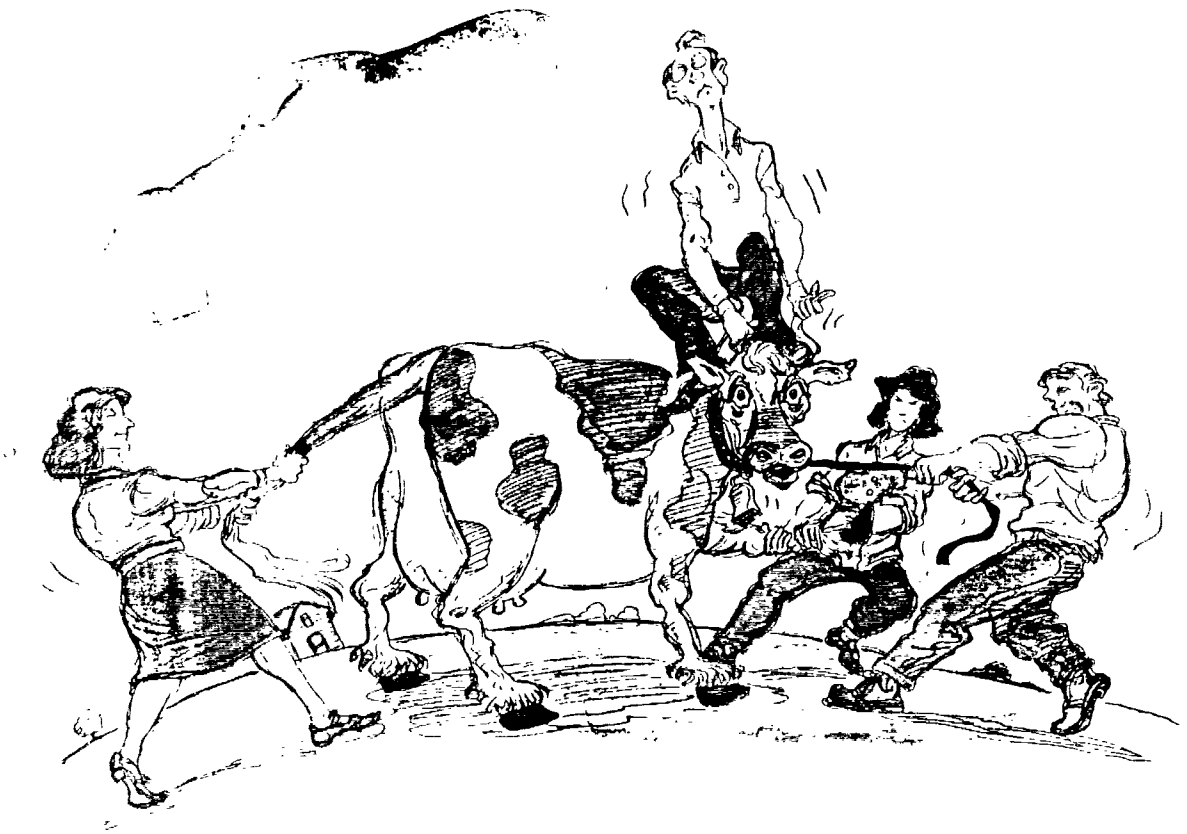
The NRC staff finds that the geological, seismological, and geophysical investigations and analyses conducted by PG&E and its consultants for the LTSP are the most extensive, thorough, and complete ever conducted for a nuclear facility in the United States, and have advanced the state of knowledge in these disciplines significantly....the PG&E soil/structure interaction analyses were comprehensive, thorough, and acceptable....The LTSP has served as a useful check on the adequacy of the seismic margins and has confirmed that the margins are acceptable.



Avoiding Entrenched Warfare

These projects were all plagued by inept handling of the seismic issues by the applicant, the regulators, and their consultants. The conflicting agenda of the scientists and engineers provided an opportunity for "social reformers" to get involved and compound the problems. To avoid entrenched warfare, the process of managing the siting, design, and construction of critical facilities must plan for:

- Egos and emotions out of control
- Surprise earthquakes and the discovery of new faults or other data
- Vested interests and jealous competition
- Technical issues that are emphasized without considering social ones
- Arrogance of experts, management, regulators
- Adversarial environment imposed by legal precedent
- Attempts to "stonewall" the process
- Addition of extra conservatism in every step of the process
- Hidden agenda
- Ignoring the facts and focusing on the desired outcome
- Provincial attitude that does not allow independent review and oversight



Entrenched warfare is extremely time consuming and expensive. Billions have been spent defending positions that may not even have a direct influence on the solution. The atmosphere of controversy provides an opportunity for entrepreneurial enhancement of the controversy. Lawyers, consultants, agencies, and regulators all have been known to "milk" the situation.

To avoid entrenched warfare, projects need

- Mutual respect and trust based on competence and integrity
- An open seeking of the facts
- A multidisciplinary team effort involving the best talent
- Appropriate identification of the problems and issues that truly make a difference
- Appropriate scope of work, using a simple logic tree approach to assist in identifying the tasks necessary to address the issues
- Teamwork based on objectivity
- Anticipation of regulatory evolution
- A plan to manage social conflicts and political bombshells
- Flexibility and a vision of the range of options
- Workshops, field trips, briefings, and publications to keep all interested parties informed
- Independent panel of experts to assist in decision making

Managing critical safety projects with an open, positive, and cooperative attitude results in a projects in which safety is properly addressed, regulatory approval is achieved, the owner's investment is secure, social issues are adequately addressed, and appropriate facilities get built.