

Format for Proposals

The following subsections discuss the content of the proposal.

Title Page. The title page presents your proposal title, your name, your affiliation, the date, and a summary not to exceed 200 words. The title is the single most important phrase in the proposal; it identifies the area of your study and your perspective on that area.

**A Proposal to Review Whether the Engineers of Pittston Coal Company
Acted Ethically in the Events Leading to the Buffalo Creek Disaster**

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Summary

On February 26, 1972, after heavy rains had soaked a remote mining area of West Virginia, a series of three dams failed, creating a flood in which 125 people perished. One of the worst floods in United States, the Buffalo Creek disaster destroyed the communities of the narrow valley along Buffalo Creek. This flood was not without warning. For months, engineers at Pittston Coal Company, which had constructed the three dams, had issued flood warnings and requests for evacuations to the residents. On this day, though, no such warnings came. The question arises whether engineers acted ethically in their construction of these dams and in their monitoring of the dam's stability. This document proposes a research project to address those two questions. Included in this proposal are our methods for assessing these questions, a schedule for completing the review, and our qualifications.

Proposal Text. There are four major sections of the proposal: "Statement of the Problem," "Objectives," "Plan of Action," and "Management Plan."

Statement of the Problem

The "Statement of the Problem" presents the justification for the research. In a sense, this section is a preliminary literature review of the problem or need. This section does two things: (1) makes the proposal reviewers aware of the technical, financial, ethical, or public-relations crisis, and (2) persuades the proposal reviewers that a gap exists as to whether the engineers acted in an ethical manner. Consider an example:

Statement of Problem

On the morning of April 18, 1906, the population of San Francisco was awakened by violent shaking and by the roar caused by the writhing and collapsing of buildings [Hodgson, 1964]. The ground appeared to be thrown into waves which twisted railways and broke the pavement into great cracks. Many buildings collapsed, while others were severely damaged. The earthquake caused fires in fifty or more points throughout the city. Fire stations were destroyed, alarms were put out of commission, and water mains were broken. As a result, the fires quickly spread throughout the city and continued for three days. The fires destroyed a 5 square-mile section at the heart of the city [Mileti and Fitzpatrick, 1993]. Even more disastrous was the Kwanto earthquake in Japan, which devastated the cities of Yokohama and Tokyo on September 1, 1923 [Hodgson, 1993]. In Yokohama, over 50 percent of the buildings were destroyed [Bolt, 1993], and as many as 208 fires broke out and spread through the city [Hodgson, 1964]. When the disaster was over, 33,000 people were dead [Bolt, 1993]. In Tokyo, the damage from the earthquake was less, but the resulting fires were more

devastating. The fires lasted three days and destroyed 40 percent of the city [Hodgson, 1964]. After the fire, 68,000 people were dead and 1 million people were homeless [Bolt, 1993].

The 1906 San Francisco earthquake and the Kwanto earthquake were two of the most famous and devastating earthquakes of this century. These earthquakes struck without warning and with disastrous results. If earthquakes could be predicted, people would be able to evacuate from buildings, bridges, and overpasses, where most deaths occur.

Some earthquakes have been successfully predicted. One of the most famous predictions was the Haicheng Prediction in China. In 1970, Chinese scientists targeted the Liaoning Province as a site with potential for a large earthquake. These scientists felt that an earthquake would occur there in 1974 or 1975. On December 20, 1974, an earthquake warning was issued. Two days later, a magnitude 4.8 earthquake struck the Liaoning Province; however, further monitoring suggested a larger earthquake was imminent [Mileti and others, 1981]. On February 4, 1975, the Chinese issued a warning that an earthquake would strike Haicheng within 24 hours [Bolt, 1993]. The people in Haicheng were evacuated, and about 5.5 hours later, a magnitude 7.3 earthquake shook the city of Haicheng. If the people hadn't been evacuated, the death toll could have exceeded 100,000.

Using geophysical precursors, the Chinese have predicted more than ten earthquakes with magnitudes greater than 5.0 [Meyer, 1977]. For example, the Chinese predicted a pair of earthquakes of magnitude 6.9 that occurred 97 minutes apart in Yunnan on May 19, 1976 [Bolt, 1993]. Despite these successes, the Chinese failed to predict the earthquake that struck the city of Tangshan on July 27, 1976; this earthquake killed 250,000 people and injured 500,000 more [Bolt, 1988]. This earthquake wasn't completely unexpected, but the Chinese believed it to be a few years away. Other earthquakes have been predicted, but the predictions didn't have enough precision for warnings to be issued. For example, in 1983, a young geophysicist predicted that an earthquake of magnitude 8 would strike Mexico City within four years [Deshpande, 1987]. Two years later, an earthquake of magnitude 8 did strike Mexico City. Because the prediction was not more precise, no warning was issued and the earthquake took the population of Mexico City by surprise. Other predictions have turned out to be false warnings. For example, an earthquake warning was issued in August 1976 near Hong Kong [Bolt, 1988]. During the earthquake alert, people slept outdoors for two months. No earthquake occurred.

Objectives

The "Objectives" section accomplishes two things. First, it states the proposed solution (or goals) and expected benefits from that solution. In other words, you make the promises in this section that you intend to fulfill in your research. Second, this section presents the scope and limitations of the solution. The "Objectives" section explains what your literature review will cover and what it will not cover. Because you are writing about something that you intend to do rather than something you have already done, this section is perhaps the most difficult section of the proposal to write.

Objectives

I propose to review the available literature on how geophysical precursors can be used for short-term predictions of earthquakes. In this review, I will achieve the following three goals:

1. explain three commonly monitored geophysical precursors: ground uplift and tilt, increases in radon emissions, and changes in the electrical resistivity of rocks;
2. show what happens to each of these precursors during the five stages of an earthquake; and
3. discuss how each of these precursors is used for short-term earthquake predictions.

Geophysical precursors are changes in the physical state of the earth that are precursory to earthquakes. In addition to monitoring geophysical precursors, there are other strategies for predicting earthquakes-in particular, analyzing statistical data on prior earthquakes. Analyzing statistical data on prior earthquakes, however, is solely a long-term prediction technique [Bolt, 1993]. For that reason, I will not consider it.

In my review, I will discuss three common geophysical precursors: ground uplift and tilt, increases in radon emissions, and changes in the electrical resistivity of rocks. Earthquakes occur in five stages as there is a build up of elastic strain within faults in the earth, followed by the development of cracks in the rocks, then the influx of water into those cracks. The fourth stage is the actual rupture of the fault and the release of seismic waves. The fifth stage is the sudden drop in stress in the fault. In this stage, aftershocks occur.

During these five stages, the geophysical precursors follow distinct patterns. For instance, the ground uplift and tilt increases during the second stage as the volume of rock increases. In my review, I will relate how the three geophysical precursors relate to the five stages of an earthquake and how well this relation can be used to predict the oncoming fault rupture.

Plan of Action

Following the "Objectives" section is the "Plan of Action" section. This section explains how you will do the literature review. For instance, if your research involves an evaluation of techniques, this subsection explains how the techniques will be compared. What are the criteria? How will the criteria be weighed? This section also discusses any assessment that you have intended for measuring the proposed outcomes. Finally, this section justifies why you have chosen the sources you have already gathered to do your review and identifies your primary and secondary audiences for the literature review.

Plan of Action

This section presents my plan for obtaining the objectives discussed in the previous section. Because of the recent earthquakes in California and Japan, there has arisen a strong interest to predict earthquakes precisely. As a consequence of that strong interest, many books and journals have been written on earthquakes and earthquake prediction. I have gathered five books and several articles on the subject. In addition, there are dozens of books and articles available in the library. These books and articles should provide sufficient information for me to write my review. The following paragraphs discuss how I will use these sources in my research.

The first goal of my research is to explain the physical principles behind monitoring geophysical precursors. For example, why does the electrical resistivity of rocks decrease before an oncoming earthquake? Or, what does a sudden increase in radon emissions reveal about the future likelihood of a massive earthquake? The second goal of my research is to show what happens to each of these precursors during the five stages of an earthquake. To achieve these two goals, I will rely on three books that give an overview to earthquake prediction: *Earthquakes* [Bolt, 1988], *Earthquakes and Geological Discovery* [Bolt, 1993], and *Earthquakes and Earth Structure* [Hodgson, 1964].

A third primary goal of the literature review is to cover the accuracy of monitoring each precursor. By accuracy, I mean how well does the method work in predicting the time, place, and size of earthquakes. This discussion will not include many statistics on the predictions of earthquakes, because at present there just haven't been enough successful predictions to validate these types of statistics. Instead, I intend to evaluate the potential accuracy of monitoring each precursor based on the opinions of experts and preliminary data. To achieve this goal, I will rely on two of my most recent sources: *The Great Earthquake Experiment* [Mileti and Fitzpatrick, 1993] and *Earthquakes and Geological Discovery* [Bolt, 1993].

Should I require additional sources other than the ones I have, I will search for them in the library system at the University of Wisconsin. Should I not be able to find that information, I will modify the scope of my research accordingly.

Because the primary readers for my proposed literature review are engineering students who are probably not familiar with the theories behind earthquakes, I will have to provide selected background information from my sources. These engineering students already know that earthquakes are devastating. They also know that if earthquakes could be predicted, people would be able to prepare for them and lives would be saved. However, they may not know the different methods of predicting earthquakes. My intent is to inform these students of three methods of predicting earthquakes.

A secondary audience for the review would be non-technical readers who either live in earthquake-prone areas or are affected financially when earthquakes occur. My proposed literature review will provide this group with an unbiased discussion of three methods for earthquake prediction. This discussion, drawing much from overview chapters in *Earthquakes, Animals and Man* [Deshpande, 1987] and *California Quake* [Meyer, 1977], will put into perspective how accurate, or inaccurate, the named methods are and what hurdles face engineers who try to predict earthquakes.

Management Plan

The next section of the proposal is the Management Plan. It presents the schedule (with time-line figure), budget, and your qualifications for doing the literature review.

Management Plan

This section presents my schedule, costs, and qualifications for performing the proposed research. The proposed research project culminates in a formal report that will be completed by December 6, 1995. To reach this goal, I will follow the schedule presented in Figure 1. Because I already possess several books and articles on earthquake prediction, most of my time will be spent sifting through the information, finding the key results, and presenting those results to the audience.

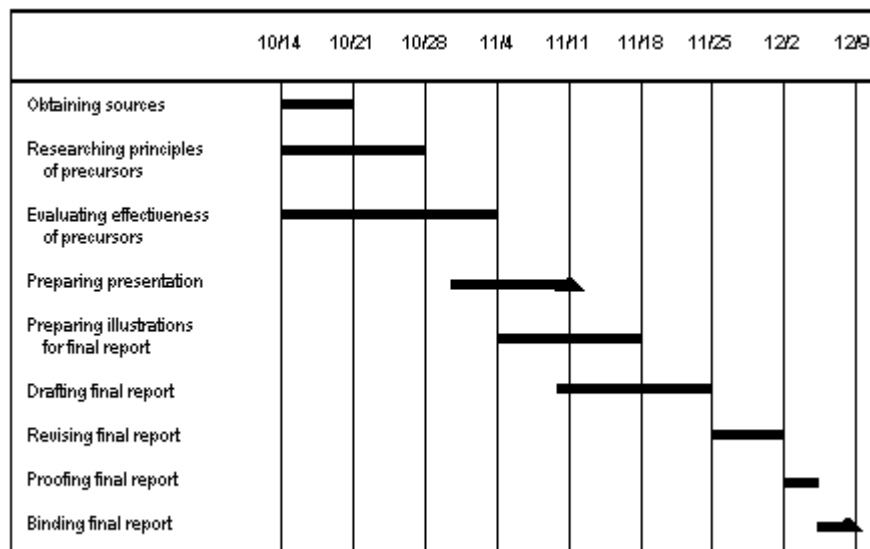


Figure 1. Schedule for completion of literature review. The two triangles represent milestones for the project, the first being the formal presentation on November 11, 1996, and the second being the formal report on December 6, 1996.

Given that I can obtain all my sources for the literature review from the library, there is no appreciable cost associated with performing this literature review. The only costs, which will be minor, are for copying articles, printing the review, and spiral binding the review. I estimate that I can do these tasks for under \$10.

I am a senior in the Geological Engineering Department at the University of Wisconsin at Madison. In my undergraduate courses I have taken rock mechanics, soil mechanics, geophysics, and stratigraphy, all of which have included the principles of seismology and stress-strain relationships. In addition, I have taken field courses on structural geology that have introduced me to subsurface behaviors. I believe that these courses and my hands-on experience will aid me in assimilating the proposed literature review. For further information about my qualifications, see the attached resume (*not attached on this web site*).

References

At the end of the proposal is a "References" section, which lists all sources that have been cited either as a paraphrase, quotation, or image in the proposal. The references are listed in alphabetical order. The reference section immediately follows the "Management Plan." Note that some instructors might require a "Conclusion" section to follow the "Management Plan" and precede the "References." Such a section would summarize the proposal and present a call for action, which is a reason that the proposal request should be acted upon.

References

Bolt, Bruce A., *Earthquakes* (New York: W. H. Freeman and Company, 1988).

Bolt, Bruce A., *Earthquakes and Geological Discovery* (New York: Scientific American Library, 1993).

Deshpande, Prof. B. G., *Earthquakes, Animals and Man* (Pune, India: The Maharashtra Association for the Cultivation of Science, 1987).

Hodgson, John H., *Earthquakes and Earth Structure* (Englewood Cliffs, NJ: Prentice-Hall, 1964).

Meyer, Larry L., *California Quake* (Nashville: Sherbourne Press, 1977).

Mileti, Dennis S., and Colleen Fitzpatrick, *The Great Earthquake Experiment* (Boulder, Colorado: Westview Press, 1993).

Pages 1-5 were adapted from writing.engr.psu.edu/workbooks/proposal.request.html#request

Criteria for Proposal Evaluation

Proposals will be evaluated in two ways: *from a management perspective* and *from a technical perspective*. The management evaluation will consider the following questions:

- Is the proposed project feasible?
- Is the management plan realistic? Can the project be completed on time?
- Will the proposed toy sell better than others?

The technical evaluation will consider the following questions:

- Can the proposed toy be constructed as suggested?
- Does the proposed toy remain within the boundaries of being a toy or is it far too complicated?
- Is there something unique about the proposed toy and its mechanism?