CHAPTER 1: HOW DO YOU WRITE A SCENARIO?

It has been 15 years since I thought the roof of that old building in Sacramento would fall on my head, since the image of the fallen Cypress Structure hooked me and injected the resolve to understand what had happened, and since I decided I must tell the citizens of our country of the danger of the worst natural disaster that would most likely strike our great country.

In that time I have done a great deal of study and research. I independently developed a scenario calculation method using data from the USGS, FEMA, and the USA population and economic census. Two novels in *The 7.9 Scenario* series have been published: *Memphis 7.9* and *Broken River*. Work on a third novel focused on the recovery effort is underway, and I am discussing my work and its results with the public, the scientists, and the governments and agencies in the affected regions.

It has always been my contention that my novels have fictional characters, but the earthquakes will become fact at some time in the future, and when they do, the impact on man-made structures, people in the affected areas, and the country's economy will be somewhat like the experiences of the characters described in my books. My hope has been that by letting people vicariously experience what it is like to be in an earthquake, they will become sensitized to the danger and take proactive action to protect themselves, their progeny, and their country.

This book is written for the more analytically minded, engineers like me who want more than the vicarious feeling of shaking. They want to know why I reached the conclusions I did, and how. They want to know the basis behind the figures. They want to judge for themselves if this is all a bunch of hot-air and pseudo-science, or if there is something to worry about. I will do my best to explain and accept the judgment of future generations.

I did not know as I began my research that I would be doing *The 7.9 Scenario*. Instead, I followed different topics I found of interest to some kind of conclusion, sometimes being diverted from one interesting channel into

another more exciting. The scenario evolved when I could not find some of the answers I needed or the information I wanted. My experience in engineering, physics and computer modeling helped me sort through some of the crap that is out there and go back to basics to calculate what I needed.

In retrospect, the research leading up to the writing of the novels of *The 7.9 Scenario* could have been organized into a series of questions, like the chapters of this book. I begin with questions about damage, mechanics, risk, and predictions. Then, I discuss the actual scenario models used for *The 7.9 Scenario*. Finally, what all this means to Memphis, the central United States, and our country is brought together in my conclusions of what has happened and my view of the future.

Chapter 3: What Is The History of The New Madrid Fault? History and comparisons w / California. Nuttli's estimates. Stewart's map. Stein's rebuttal. In 1811 Tecumseh predicted that the land would shake and all the teepees across the land would fall down. It happened. Five fractures, with magnitudes estimated to be in from 8.0 to 8.6 occurred between December and February. Aftershocks continued for five years. The death toll was small, in part because no one knew who was in the region. Since that time only two significant temblors have shaken the seismic zone, the latest a magnitude 6.8 over a hundred years ago.

Chapter 4: How: What Makes an Earthquake Dangerous? Earthquakes happen when the earth's crust fractures, transforming stored energy into shaking seismic waves that spread outward from the epicenter. Earthquakes are measured in terms of total energy released (magnitude) and the degree of local shaking (intensity). Most man-made structures are not designed to be shaken, so the extreme forces of an earthquake can break them.

Chapter 5: How Does an Earthquake Physically Do Damage? A fracture in the crust produces several different kinds of earthwaves. *P-waves* are high-volume, low-frequency sound. *S-waves* physically move rock and soil back and forth like a spring. *Love-waves* result from the interaction of the *P-* and *S-waves* with the surface and can produce horrendous slithering back and forth motions. *Rayleigh-waves* also occur along the surface and are much like breakers on the ocean beach with an up and down and around motion. Understanding how each of these waves affects different structures helps determine what kind of damage and consequential effects may occur.

Chapter 6: How Much Damage Can an Earthquake Do? FEMA and USGS numbers from David Stewart's book for estimated shaking intensity are used with the latest census data to sum up the projected damages and casualties by state and for the entire central and eastern United States. A magnitude 7.9 temblor serves as the baseline.

Chapter 7: What Makes an Earthquake Happen? Few have ever seen a fracture occur in the earth's crust, though the shaking from at a distance from these fractures has been observed since antiquity. But seismographs have enabled scientists to envision and analyze what happens over time. Fractures may occur on a slip strike fault or a thrust fault and may move in one or several directions. The time it takes to complete the fracture is all-important.

Chapter 8: What Is Earthquake Magnitude? The magnitude of an earthquake is a measure of the energy released. The amount of energy release is most strongly determined by the size of the fracture, with lesser dependency on the kind of fault and kind of material along the fault. A magnitude of 7.9 was chosen for the scenario because it is much more probable than something like an 8.6. The damage from such a temblor is sufficient to destroy much of the man-made structures in the area along the Mississippi River.

Chapter 9: What Is Shaking Intensity? When a fracture occurs, the effects will vary greatly, depending on local geology, distance from the fracture, and position relative to the direction of the fracture. Points along the trace of the fracture may experience a bow wave effect much like a sonic boom. The homogeneous crust in the central United States channels the energy like a wave guide and can increase the area of destruction by a factor of ten. Buildings on sand, mud, and rock will all experience different levels of shaking.

Chapter 10: What Difference Does Local Geology Make? The differences between interplate and intraplate seismic zones may affect the magnitude. But the local geology determines how the seismic waves will affect the local environment.

Chapter 11: What Difference Does Construction Make? Different structures react differently to the shaking. Some of the older buildings and bridge structures are in special danger. Newer standards will make or break a building.

Chapter 12: Can Anyone Predict Earthquakes? The number of successful predictions of earthquakes is miniscule. The number of failed attempts at prediction is large. But seismologists continue to work on the problem, and there are some signs they may be able to do it in the future. But what good will it do?

Chapter 13: Do You Understand Risk and Probability? Scientists predict the probability that a particular size earthquake will occur within some length of time, indifferent to structures in the surrounding area. Insurance companies are concerned about the risk of damage that may result, using the probability calculations of the scientists and the value of what is at risk of damage. Insurance companies depend upon enough people paying premiums long enough to cover the cost of the damage when it happens, leaving them with a tidy sum for profit. But is that the proper way to view risk when playing Russian roulette?

Chapter 14: What Are Your Local Risks? Memphis is the major population center most at risk, though it will not be the one that suffers the most casualties. With one million residents in Shelby county, the projected death toll will approach 9,000. Larger population centers may suffer more. Damage to the land, building, infrastructure, transportation, communication, pipelines, shipping, and so on will be awesome. It is difficult to pick which is the most major.

Chapter 15: What Are The Risks To The USA? 32 million residents in CUS, the projected death toll could approach 80,000. Larger population centers may suffer more. The river is at risk. Damage to the land, building, infrastructure, transportation, communication, pipelines, shipping, and so on will be awesome. The economic impact will be worse.

Chapter 16: What is the 7.9 scenario? The parameters for the 7.9 scenario include the size of the earthquake and the US population and economic census. Next I considered the consequential damage that might result and took the worst case: flooding and losing a primary dam on the Tennessee River.

Chapter 17: How To Build A Shaking Model. Shaking depends upon distance from the fracture and soil conditions. For large earthquakes the long

length of the fracture and the time it takes to break makes a difference. Reflections become important.

Chapter 18: How To Do A Casualty Model. Determine the shaking in each county across the land. Use a simplified assumption of casualties as a function of population and cross multiply. Sum over all the counties for gross figures.

Chapter 19: How To Build An Economic Model. Use the economic census to build a county by county measure of the industry, warehousing, and shipping of the areas. Cross multiply with the shaking map to determine the degree of damage and loss of capacity. Consider the shipping traffic that may be lost between states because of broken rail lines, pipelines, and bridges.

Chapter 20: How To Model The Impact Of An Earthquake. My greatest concern is our country. It is simply not prepared for a disaster of this magnitude. People on the west coast feel what happens in the middle has no effect. How wrong can they be. When you look at what happened to our land as a result of 9-11 and after the power outage of 2003 you see how insecure we really are. We are dependent upon advanced technology that leaves us without recourse when there is a failure in some strategic system. And when all systems fail the result is chaos. My initial SWAG (scientific wild-ass guess) is that a 7.9 magnitude earthquake on the New Madrid will result in a loss of 25% of our Gross Domestic Product. Whole industries will be wiped out. Over a third of the population will leave the affected areas. We will enter a major depression. What can we do as a country, as a culture, as a society? There is no way to stop a giant earthquake from happening. But we can plan a course of action; we can prepare.

Chapter 21: How Should We Personally Respond? First it is important to remember that smaller earthquakes are more likely to happen. With that in mind you should prepare your home for small shakes and check your insurance. Prepare for the most probable. One the other hand, the chance for a catastrophic event are high enough to consider taking extreme action, including leaving the area. Consider survival training as an alternative.

Chapter 22: How Should Businesses and Governments Respond? Governmental agencies are designed and equipped to handle the lower level events. There appears to be no planning that anticipates what to do if a truly

major event happens on the New Madrid. It is the same as when no one planned for the 9/11 attacks. Such events are beyond the realm of reality, but in the case of a catastrophic earthquake everyone should realize that it WILL happen. Your government should take that into consideration in their planning; tell them to do so.

Chapter 23: How Do We Recover From The 7.9 Scenario? We recover by starting to plan and prepare now.

Chapter 24: What Does The Future Hold? Ian Browning predicted an earthquake in 1990 but he was laughed out of town when it did not happen. People throughout the whole area have become complacent, unwilling to admit to themselves that they sit atop one of the most dangerous regions in the United States. People in the areas more remote from the NMSZ don't even know it exists. One thing everyone should be sure of: a major earthquake will occur – next week, next month, next year, or several hundred years from now. Everyone should be aware of how bad such an event can be. It is not a matter of IF, it is a matter of WHEN, for it will happen.

Chapter 25: What Conclusions Have I Reached. What If I Am Right – Or Wrong? And what can be done about it: lessons in preparedness and planning, getting the message out, understanding risks in the twenty-first century, pseudo-science, biased-science, bloated-science. As an added bonus I am included some remarks on the publishing industry, especially as it addresses unpopular subjects. One thing everyone should be sure of: a major earthquake will occur – next week, next month, next year, or several hundred years from now. Everyone should be aware of how bad such an event can be. It is not a matter of IF, it is a matter of WHEN, for it will happen.

Epitath. ***The 7.9 Scenario*** is an estimation of reality, it is not reality itself. It attempts to forecast what effects a giant crack in the earth's'crust on the New Madrid might have. It is not fact; it may never become fact. But looking at what might happen does tell us something about what we should plan for. What we do if or when such a seismic event does occur depends upon each us. The better prepared we are, the better off we will be. Time will tell.