Earthquakes in Kentucky?

When you think about earthquakes, do images of California, Turkey, or Japan come to mind? What about Kentucky? Did you know that earthquakes or damage resulting from earthquakes have been experienced in Columbus, Henderson, Hickman, Mayfield, Louisville, Middlesboro, Sharpsburg, Poole, Smith Mills, and Uniontown in the past 200 years? The most significant of these events were the catastrophic earthquakes at the town of New Madrid, Mo., during the winter of 1811–1812. Three of the most powerful earthquakes in U.S. history occurred—magnitude-8 earthquakes—followed by thousands of aftershocks. Witnesses reported seeing cracks open in the earth's surface and the ground literally rolling in waves. The effects of the New Madrid earthquakes and aftershocks were recorded thousands of miles away and damage was reported as far away as Charleston, S.C., and Washington, D.C. Chimneys were knocked down in many places in Kentucky, and one man in Louisville, Jarad Brooks, recorded 1,874 tremors from December 1811 through March 1812 (U.S. Geological Survey, 2000a).

Should I be concerned? In Kentucky, moderate earthquakes have shaken houses, cracked plaster, and shaken pictures from walls; bricks have shaken from chimneys; a bluff along the Mississippi River caved in; and landslides have occurred. The strongest earthquake in Kentucky was in 1980 near Sharpsburg, Bath County, in northeastern Kentucky. The effects of this earthquake were felt over all or parts of 15 states and in Ontario, Canada. Property damage was estimated at $1 million in Maysville in Mason County, where 27 commercial structures and 269 residences were damaged (USGS, 2000b). This earthquake was particularly interesting because it occurred in a region that had previously not been considered to be seismically active. A second earthquake of magnitude 4.6 occurred in the same area in 1988. This signaled an awareness that the risk of property damage was not limited to western Kentucky, which is adjacent to the New Madrid Seismic Zone, the most active seismic zone east of the Rockies.

Are geologists studying earthquakes in Kentucky? After the earthquake near Sharpsburg, the University of Kentucky established the Kentucky Seismic and Strong-Motion Network in late 1980. The network is jointly operated by the UK Department of Geological Sciences and the Kentucky Geological Survey. Since it began operation, the network has recorded data for more than 1,000 earthquakes.

The network has 20 stations—12 weak-motion stations and six strong-motion stations—that monitor seismic activity throughout the state and the surrounding region. Three new stations are planned for the future. Weak-motion stations record the location and magnitude of weak vibrations of the earth that result from small local earthquakes and from moderate to large earthquakes in distant areas. They are well suited for continuous monitoring of seismic activity over time. Strong-motion networks record large earthquakes with a magnitude greater than 4 or 5. Strong-motion networks provide data for designing buildings, construction projects, and building codes. Strong-motion station VSAO at Olmstead Lock and Dam, on the lower Ohio River, is operated cooperatively with the U.S. Army Corps of Engineers. Data from this station are used to study ground motion at the dam site, as well as for the study of seismic hazards from the Southern Illinois and Wabash Valley Seismic Zones. Strong-motion station RIDG in Ridgley, Tenn., is operated cooperatively with Lamont-Doherty Earth Observatory, a geologic research station affiliated with Columbia University in New York.

Regional cooperation in earthquake research. In 1983, Kentucky and six other states (Arkansas, Illinois, Indiana, Mississippi, Missouri, and Tennessee) formed the Central United States Earthquake Consortium (CUSEC). The consortium strives to improve earthquake awareness and education, coordinate multistate planning for earthquake preparedness, and encourage research in efforts to reduce hazards resulting from earthquakes. Assistant State Geologist John Kiefer recently began serving a term as chair of the CUSEC State Geologists, and

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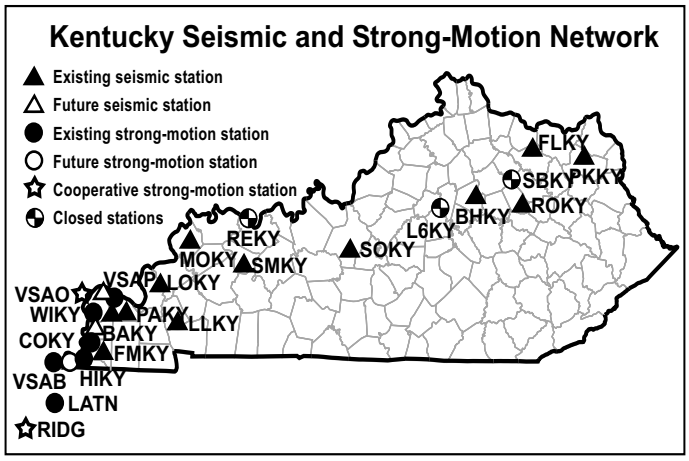

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in this capacity he is also an ex-officio member of the Board of Directors of CUSEC. John Kiefer and Steve Cordiviola have been active in the development of seismic-hazard maps for the central United States and the creation of the Central United States Partnership, which is a coalition of national organizations and agencies promoting efforts to reduce damages associated with natural hazards.

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Research on earthquake hazards. Ed Woolery of KGS and Ron Street of the UK Department of Geological Sciences are conducting research on ways to minimize damage from potential earthquakes in Kentucky. A grant for $112,816 from the National Earthquake Hazards Reduction Program of the U.S. Geological Survey is supporting research to define the properties of thick soils in the Mississippi Valley in order to identify areas that are vulnerable to earthquake damage. Another grant, $5,500 from the Kentucky Transportation Center (KTC), at the University of Kentucky is supporting research to study previous earthquake activities over a 250-year period to assess the potential for damage in each county of Kentucky, should an earthquake occur in the future. The latter study is being conducted in cooperation with Issam Harik of the KTC.

State-of-the-art equipment recently purchased through grants received by KGS and the Department of Geological Sciences will enable KGS to study earthquake movements in the deep subsurface and build two-dimensional and three-dimensional models of ground motion on a large regional scale. This equipment is unique in the central and eastern United States, and places the University of Kentucky among the Nation's leaders in the direct measurement of the properties of deep sediment, which is necessary to reduce seismic hazards and design structures that are resistant to earthquake-related damage. As this research at KGS comes to fruition, it will provide an important public service to Kentucky. Geologists at KGS will be able to identify areas that are vulnerable to earthquake damage, and this information in turn can be used by engineers to design new buildings that can withstand the stress of earthquake activities and minimize the loss of life and property damage in the event of future earthquakes.

How do I get more information? John Kiefer or Ed Woolery, two geological engineers at KGS, can help you. They can be contacted at (859) 257-5500 or through e-mail at kiefer@kgs.mm.uky.edu and ewoolery@kgs.mm.uky.edu. Additional information is also available at these Web sites:

- www.uky.edu/KGS/education/earthquakes.html
- quake.wr.usgs.gov/

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Ground-water quality

New KGS investigations

Approximately 90 percent of the population in rural Kentucky who supply their own water depend on ground water for domestic water supplies. It is important to study the quality of ground water in order to establish baseline conditions and assess the impact of pollutants. Jim Dinger and Steve Fisher have been awarded two grants to study the quality of ground water in Kentucky. An award of $95,345, of which $56,980 is from the U.S. Environmental Protection Agency, will be used to assess the quality of water in wells and springs in drainage basins of the Upper and Lower Cumberland River, Lower Tennessee River, and tributaries of the Ohio and Mississippi Rivers in the Jackson Purchase. An award of $100,945, of which $60,000 is from the U.S. Environmental Protection Agency, will be used to map the concentrations of naturally occurring solutes, pesticides, and nutrients in ground water from the Tennessee, Mississippi, Upper and Lower Cumberland, Tradewater, and Green River Basins, and statistically summarize data on the quality of the ground water. Peter Goodmann of the Kentucky Division of Water will be collaborating with Fisher and Dinger on both projects. ❖