Earth Sciences

Joanne Silberner reports from the Seismological Society of America meeting in Santa Barbara, Calif.

Housing loss upped

A magnitude 8 earthquake on the San Andreas fault in southern California — considered a distinct possibility — would leave 250,000 to 400,000 homes uninhabitable, according to Northridge, Calif.-based Rachel M. Gulliver, an earthquake-hazard consultant. The number represents an increase over her 1980 estimate of 135,000 houses made uninhabitable by structural failure or loss of utilities, calculated while she was with the Federal Emergency Management Agency. The initial estimate was based on the assumption that areas where the water table is low — such as the urbanized valleys in and around Los Angeles — would suffer less shaking than areas with high water tables. But other scientists' measurements of seismic events led Gulliver to up the estimated intensity of an earthquake wave in areas with a low water table.

In Canada: Strong acceleration . . .

An earthquake in a remote area of Canada was responsible for the highest acceleration — a measurement of one aspect of the power of an earthquake — yet observed. The magnitude 6.8 earthquake occurred along the east side of the Canadian Rockies in December 1985.

Acceleration is a way to quantify the force and strength with which an object moves, in comparison to the force and strength that gravity has upon it. Gravity's acceleration is equivalent to 1 g. Most earthquakes have vertical accelerations in the 0 to 1 g range; the Canadian earthquake had a vertical acceleration of more than 2 g, making it capable of tossing objects not bolted to the ground into the air.

The accelerometer that recorded the event was put in place (and bolted to the ground) after a strong quake in September 1985. It was not designed to measure more than 1 g, notes Peter W. Basham of the Geological Survey of Canada in Ottawa, who headed the staff that installed the instruments. "So we're a little uncertain of the exact measurement." Nevertheless, he and others say, it was the highest yet recorded.

Basham has no explanation for why the earthquake caused such an unusually high acceleration, but notes that because of similarities between the quake area and parts of the eastern United States, such accelerations could conceivably occur there as well. Like the quake area, the East has highly "competent," solid rocks that could transmit the force in a similar manner. The East also has thrust faults where one part of the earth's crust shoves up over another, which is the type of faulting that caused the Canadian quake. And the same rock type that underlies the Canadian earthquake is under most of the eastern United States.

. . . and mysterious objects

At 4:20 a.m. last Sept. 19, a resident of Yellowknife in the Northwest Territories watched a point of light flash across the sky. He called the local office of the Geological Survey of Canada to see if they had noticed anything on their seismic measuring devices.

Analysis of that morning's readings showed that something had traveled over the devices at a height of 45 kilometers and a speed of 12 kilometers a second, with no evidence of having hit the earth. Frank M. Anglin and his colleagues at the Survey concluded the object was a meteor that produced a strong sonic wave. While seismometers have picked up the crashing of meteors into the earth, the Sept. 19 observation is apparently the first time they have detected an aerial event, says Anglin.

The Yellowknife instruments are intended to pick up seismic signals from underground nuclear testing; knowing that a meteor can show up on the reading will help in seismic verification of nuclear test blasts, Anglin says. "You don't like mysterious signals lying around," he says.

Environment

The hazards of leadshot in soil

In many industrialized countries, the major source of environmental lead outdoors is the exhaust from cars fueled with leaded grades of gasoline. But in some countries, such as Denmark, spent shotgun ammunition accounts for three times more environmental lead (800 tons annually) than does automobile exhaust. A new analysis of the fate of this toxic pollutant in soil is reported in the most recent AMBIO (Vol. 16, No. 1). It shows that lead gunshot pellets "are rapidly tranformed" into compounds that can be taken up by plants and grazing animals or leached into streams and groundwater — and thereby moved up the food chain.

According to Søren Storgaard Jørgensen and Marta Willems, chemists at the Veterinary and Agricultural University in Frederiksberg, Denmark, one-third of Denmark's leadshot is distributed rather uniformly over its rural areas; the remainder is concentrated on shooting ranges. The researchers picked three shooting ranges at which to study the decomposition of shot in soil. Their laboratory data show that crusty corrosion products found covering most lead-pellet surfaces should dissolve rapidly in acidic soils. Samples of the shooting-range soil showed that the average residence time for pellets in soil was 13 years in the acid loam at one site, and just six years in the neutral and acid soils at the other sites. The loamy soil accumulated two to three times more of the available lead, and most of the lead decomposition products there, unlike those at the other sites, were in an extractable (largely unbound) form. Soil cultivation was among the factors that appeared to speed leadshot decomposition.

Nuclear war? Head for the basement

If nuclear war rained devastation and fallout upon the United States, how would the surviving population fare? Potentially better than most might have been led to expect, according to a new analysis in the March HEALTH PHYSICS. It found that "except for the heaviest fallout regions, the sheltering provided by an unprepared basement [and an initial, continuous] shelter time of no more than three weeks will suffice" to protect survivors from a lethal dose of radiation. Since about half of all U.S. residences have basements, and since many multi-story apartment and office buildings offer about as much radiological protection as an unprepared basement, most survivors would have access to adequate protection, report physicists Robert Ehrlich of George Mason University in Fairfax, Va., and James Ring of Hamilton College in Clinton, N.Y.

The pair used fallout patterns and calculations computed by others for an "all-out attack against urban-industrial areas as well as missile silos." This attack involved 1,444 weapons (6,559 megatons), most detonated at ground level to maximize fallout. Together with what had been published on the protection offered by buildings — including basements — Ehrlich and Ring computed combinations of initial continuous confinement and subsequent periods of daily outdoor excursions necessary to protect sheltered survivors from acute radiation injury.

They note that since outdoor exposures represent the biggest radiation contribution (and outdoor levels decay with time), the period of continuous shelter before venturing out becomes much more important than how radiologically protective a shelter is. For 75 percent of the United States, 9 days of initial confinement and 85-minute daily excursions thereafter would probably offer about the same, sufficient protection — an 84 percent reduction in dose (in comparison with someone having remained unsheltered all along) — as 21-day confinement and subsequent 7-hour daily trips outside. For most, this reduction would eliminate the need for acute radiation-related medical treatment. Most survivors would still face some long-term increased risk of cancer.