successes at a Paris meeting that convened to plan a worldwide conference on all aspects of earthquake prediction, social and scientific. The meeting was sponsored by the United Nations Educational, Scientific and Cultural Organization.

The three quakes were each near magnitude 7 (about one-tenth the intensity of the 1906, magnitude 8.3, San Francisco quake). They occurred on May 29 in Yunnan province, on Aug. 16 in Szechuan province and on Nov. 7 in a Szechuan-Yunnan border region—all three confined to southern and south-central China. In each case, a medium or long-range forecast was made privately. Although the public wasn't informed directly, each prediction was followed by extensive planning, preparation and public education.

The preliminary prophecies followed measurements of significant departures from ordinary patterns of earthquake activity and various other observations of the earth's surface contour and magnetic field. In general, and a key element in China's successful predictions, says Wesson, "is a 'grass roots' effort, [whereby] tens of thousands of amateurs assist in the observational activities, which include the monitoring of water levels in wells, recording variations in ground tilt and electric currents in the ground on instruments in villages, and even the reporting of animal behavior." Wesson's description is consistent with other accounts previously made public (SN: 5/1/76, p. 277).

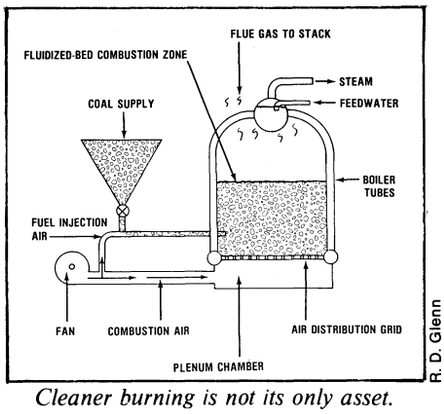
Before each of the three tremblers—usually a day or several hours before—a public warning was issued. The careful preparations that were precipitated by the initial prediction enabled the Chinese people to respond in an organized fashion, including the systematic evacuation of hazardous buildings. According to the Chinese scientists, thousands of lives were saved as a result.

Although there has never been any official U.S. government earthquake prediction, there have been a number made—with some successes—by individual scientists, usually of minor tremblers. A critical aspect of earthquake (like weather) forecasting, concerns societal reaction to false alarms. A few years ago, a California seismologist who openly ventured a calculated prediction incurred the wrath of many citizens who charged him with risking a public panic. When asked about the Chinese attitude toward the several admitted false alarms that were issued them last year, Ting Kuo Yu of the State Seismological Bureau in Peking replied that some people complained, but that on the whole, the Chinese people would rather respond to many false alarms than suffer the consequences of an unpredicted earthquake. □

Fluid-bed combustion: A sleeper awakes

Fluidized-bed coal combustion is a lackluster, albeit advanced energy technology that might still be asleep were it not for the Clean Air Act and its threat of crippling Ohio's coal mining industry. Last year, the U.S. Environmental Protection Agency told Ohio officials that because they had been delinquent in meeting sulfur dioxide standards, EPA would do it for them. A resulting dictum—use stack-gas scrubbers or burn low sulfur coal—tolled an ominous message to the 14,000 people who mine Ohio's coal; an estimated half would lose their jobs with a statewide shift to low sulfur coal. Since scrubbers have a notoriously bad reliability and cleanup record with Ohio's particularly dirty coal, state officials offered an alternative: demonstration of fluidized-bed combustion, beginning with four commercial boilers, the first due to begin operation late next year.

The fluidized-bed concept exploits the fact that air blowing through a perforated plate will agitate particles above the plate, making them behave much like a fluid. This permits burning coal of any type—lignite to anthracite—perhaps with as much as a 4 percent increase in thermal efficiency. Because burning occurs at a lower temperature than in normal boilers, nitrous-oxide emissions are reduced to well below EPA standards. And sulfur can be eliminated by mixing a ratio of four parts coal to one part limestone; sulfur combines with inert limestone instead of going up the stack. The limestone can be removed for use as a soil nutrient—as Ohio plans—or to regenerate clean limestone and salable sulfur.



Cleaner burning is not its only asset.

Eric Johnson, energy specialist for Ohio's energy agency said that this is the only way to burn Ohio coal and meet federal air-pollution standards. He says Ohio's governor, James Rhodes, is already talking about an eventual 600 or more fluidized-bed boilers for that state.

Although fluidized-bed research in this country is almost two decades old, the technology has attracted little attention, mostly due to its unglamorous appeal. And the wealth of cheap energy alternatives—now dwindling rapidly—put no heat under the burner to expedite its progress. Therefore, when Ohio decided fluidized-bed was the way to go, it had to go far—literally across the ocean to England—to find the experience, capability and commercial guarantees that fluidized-bed boilers would perform as well as conventional ones.

Where is fluidized-bed research in this country? On Aug. 26, the first commercial-scale plant will be dedicated in ceremonies at its Rivesville, W. Va., site. The plant began operation last December but its design is still one to three years from commercialization, depending on how quickly problems in coal-handling equipment can be overcome. Walt Saunders, of the Energy Research and Development Administration's coal combustion and utilization branch, explains that a fine powder shakes off coal particles and settles to the bottom of the conveyor feeding the combustor. Accumulation of powder softens the vibrations that send coal moving, impeding the rate at which it moves; eventually, the whole system can get plugged up.

Another type of fluidized-bed combustion involves burning coal in a high pressure—six to ten atmosphere—environment for much better thermal efficiency. That process is significantly more complicated and lags several years behind the nonpressurized version in overcoming engineering obstacles. Its overriding advantage is that it would permit combined-cycle generation of both steam and electricity, making it ideal for use by large electric utilities. □

NASA patents cell control method

A pharmaceutical dial to turn up or down the rate of human cell division would be a powerful tool for medical scientists. They could then stop the rampant proliferation of cancerous cells and coax mature, nonreplicating nerve cells to reproduce to make up for loss from injury or senility.

The National Aeronautics and Space Administration has now received a patent on a process that appears to control cell division. Experiments in their laboratories have indicated that various methods of changing ion concentrations inside a cell alter the rates of replication.

Clarence D. Cone Jr., now at the Veterans Administration Hospital Center in Hampton, Va., first proposed this process while studying effects of space radiation on living cells. He noticed that cells with large electrical gradients across their membranes, such as nerve and muscle, seldom if ever divide, while cells with small electrical gradients divide rapidly. Subsequent experiments demonstrated that the controlling factor was not the electrical gradient itself, but rather