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).

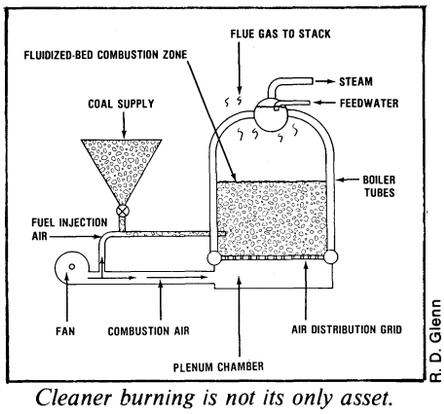
Before each of the three tremblers—usually a day or several hours before—a public warning was issued. The careful preparations that were precipitated by the initial prediction enabled the Chinese people to respond in an organized fashion, including the systematic evacuation of hazardous buildings. According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

the distribution of ions associated with it.

Changing ion concentrations is probably part of the natural control of cell division. In his early experiments Cone found that at least two types of cells have a higher internal sodium concentration while they are actively reproducing on a laboratory dish and a lower concentration after they cover the available surface and stop dividing. Cone demonstrated that changing intracellular ion concentrations by several methods could reversibly stimulate cells to proliferate or block their division.

"The process thus opens up an entirely new direction of therapeutical research possibilities for cancer treatment," Cone says. "Among its implications, it puts the focus of malignant aberrations at the cell surface with the inability to partition ions adequately. What's really wrong is a fundamental change of the cell surface."

Cone's current work with Charlotte M. Cone and Max Tongier Jr. centers on provoking nerve cells to divide. "Initial application of the process to induce cell divisions in spinal cord neurons in cultures have been excitingly successful," Cone says.

The investigators find that the drug ouabain, which increases intracellular sodium concentration, intitiates mitosis in chick nerve cells growing in the laboratory. The nuclei of the nerve cells obviously replicate, because cells with two nuclei appear. However, the cytoplasm of those cells never divides. Various experiments have convinced the researchers that the binucleate cells are the result of normal nuclear division: The DNA content of each nucleus is the same as that of the parent nucleus, radioactivity incorporated into the parent nucleus is equally distributed between the sister nuclei, and nuclear division is blocked by an inhibitor of normal mitosis.

For the process to be medically useful, it is not enough that the nucleus divides. Normal nerve cells with single nuclei must result. Cone's most recent work provides evidence that many neurons are actually dividing completely, although the resulting cells are more difficult to recognize than the binucleate neurons. Cone has compared the number of cells that begin cell division, identified by a characteristic pattern of chromosomes marked with a DNA-specific stain, to the ultimate number of binucleate cells. The results are encouraging. As many as 70 percent of the neurons that begin mitosis may complete normal cell division. These results, Cone concludes, support the possibility that nerve cells from the adult central nervous system may be induced to divide by appropriate treatment.

Why patent a rather general, although important, concept? Cone explains that NASA did it to prevent having to pay royalties on further research and medical applications if a drug company later undertakes the same development and patents it. □

# Bulb to brighten lighting costs

A new reflective coating, when applied to the inside of light bulbs, could cut their electricity consumption by 60 percent. The coating, a sandwich of silver between layers of titanium dioxide, was developed by the Massachusetts Institute of Technology for use in solar-energy applications. It serves as a window to visible light while reflecting back infrared radiation. In a conventional 100 watt incandescent light bulb, about 90 percent of the wattage is lost as heat, 80 watts in the infrared alone. The MIT coating focuses that infrared radiation back to a centrally located filament, reducing the electricity needed to keep it at its most efficient operating temperature.

Duro-Test Corp. of North Bergen, N.J., bought an exclusive patent for the coating from MIT's Lincoln Laboratories and hopes to begin marketing the new bulbs in a line from 40 watts to 500 watts by early 1979.

Duro-Test, the so-called Cadillac of light-bulb manufacturers, already makes a line of watt-saving incandescent lights at a price of almost $2.50 per bulb. Because the bulbs last twice as long—roughly 2,500 hours—as conventional ones, they are already economical for commercial and industrial applications. There the cost of changing a light bulb runs an estimated $10 to $12 per bulb.

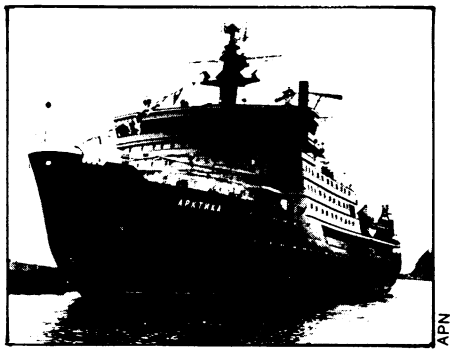
For homeowners, doubling the lifetime at four times the cost isn't good economics. Although Duro-Test expects its new line to cost even more—$3.50 to $4 for a 100-watt bulb with a 2,500 hour lifetime—its cost savings in electricity over the life of the bulb will more than pick up the difference in its cost over conventional incandescent versions. Good news for everyone.

Professor James D. Felske of MIT says that the film has been applied only to flat-plate glass substrates, so the bulb doesn't exist yet. He and others at MIT will design and run tests for adhering the coating to curved glass.

The adhering process, called sputtering, involves colliding excited argon atoms with titanium dioxide molecules. Silver will be applied the same way. Luke Thorington, Duro-Test's vice president of engineering, says that the process requires an absolutely clean environment and must be performed in a vacuum chamber.

While MIT works on the coating, Duro-Test engineers will work on mounting the filament. Current production techniques are fairly sloppy, Thorington says, and for the process to work properly, the filament must be centered precisely and a mirror applied to the bottom so that all infrared is reflected to the filament. □

# Soviet surface ship is first to North Pole




APN

*Icebreaker Arktika in Murmansk harbor.*

Peary traveled overland—or rather "over-ice"—reaching the North Pole in 1909. Byrd and Bennett, 17 years later, flew over it. In 1959, the U.S. submarine *Skate* surfaced there, but only after making the journey beneath the foreboding ice. Now, according to Soviet news sources, a nuclear icebreaker named the *Arktika* has become the first surface vessel to reach the pole by bulling its way *through* the ice.

The 140-meter, 25,000-ton vessel reached the pole at 9 p.m., EDT, on Aug. 16, reports the Soviet news agency, Tass. The crew, commanded by its regular captain, Yuri S. Kuchiev, reportedly erected a Soviet flag on a pole bearing a capsule containing their names and a draft copy of the new Soviet constitution. The ship had sailed on Aug. 9 from Murmansk, at about 69° N, and is said to have reached the North Pole a week ahead of schedule despite ice that was sometimes as much as four meters thick. The *Arktika* is the second Soviet nuclear icebreaker; a third may begin operations Dec. 15.

The voyage, timed to commemorate the 60th anniversary of the Russian revolution, is also important as a part of Soviet efforts to conquer the rugged conditions that beset the important Arctic shipping lanes. (The New York Times reports that the greater power of the nuclear icebreakers has already enabled the Soviet Union to extend its Arctic shipping season from three or four summer months to six months or longer along the Murmansk run.)

"The huge hull of the ship is shuddering from time to time when hitting upon chaotic piles of ice hummocks," wrote a Tass correspondent who went along. "The ship creeps onto them and sends high a cloud of splashes and fragments of ice, then punches through white and blue ice barriers. At times, the customary idea of a voyage by sea almost completely disappears. It seems it is not a ship, but a fantastic, self-propelled platform, which is traveling over ice." □