SCIENCE NEWS of the week

A Meltdown But No Melt-Through

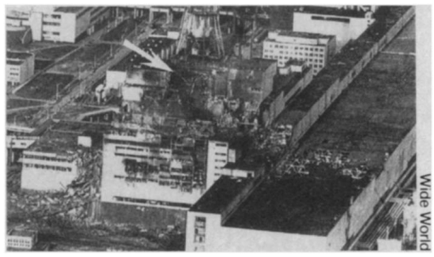
Reports out of Moscow this week indicate that by drilling holes beneath the Chernobyl reactor to create a "cooling zone" for its white-hot reactor core, the Soviets averted a "China syndrome" – a runaway melting of nuclear fuel out of the bottom of the reactor, down through the concrete mat below, and on deep into the earth. "As for the assault on the reactor, we're working not only beside it, but under it. Our task is to fully neutralize it, to 'bury' it," said Yevgeny Velikhov, a vice-president of the Soviet Academy of Sciences, in an interview published May 8 in Pravda, the Communist Party paper. The ultimate goal is to entomb the Chernobyl facility's #4 reactor in concrete until its nuclear contamination decays to manageable levels. Soviet officials say the decay process could take several hundred years.

While the meltdown crisis may be stabilized, "it would be difficult for me to say the crisis is over," said Morris Rosen, the U.S. member of the International Atomic Energy Agency team that met with the Soviets last week. In a radio interview Monday, Rosen said that if the Soviets don't provide adequate cooling, heat being generated by the radioactive decay of reactor fuel could again bring that fuel to the melting point. "The eventual worry," he said, "is that if the melting starts again [the fuel could] work its way through the concrete block below the reactor core and eventually reach the ground."

Ironically, during the 1970s a China syndrome was commonly held to be the worst possible reactor accident. But one lesson of the Chernobyl event may be to dispel that assumption. Radioactive contamination of the environment might have been less widespread, and perhaps more manageable, some scientists now believe, if the Ukrainian reactor damaged in an explosion and fire three weeks ago *had* melted down in the classic China syndrome scenario instead of flinging its contamination primarily into the atmosphere.

"Anytime you've got radioactive material going up into the atmosphere, you have a much worse situation than when releases contaminate the ground and [water]," says Susan Niemczyk, a Washington, D.C.-based reactor safety analyst. While officials can cordon off contaminated soil and prohibit the drinking of contaminated water, they can't ask people not to breathe, she points out.

That's not to suggest that managing a melt-through would be easy. Niemczyk says that although she and other U.S. scientists have probably studied the melt-through problem as thoroughly as any, it has not been thoroughly enough. A 1980 study she conducted while working at Sandia National Laboratories in Albuquerque, N.M., concluded that neither the Nuclear Regulatory Commission (NRC) nor the national laboratories have the skills to contain core materials that have melted through the bottom of a reactor's concrete base mat, preventing them from contaminating groundwater and migrating through soil. Unless the needed expertise is developed, she half-facetiously recommended in a report to NRC, officials might consider "declaring such a site a national monument" and keeping people away from it – perhaps for hundreds of years.



Arrow points to the severe structural damage sustained during an explosion at Chernobyl's #4 reactor.

In fact, several factors make Chernobyl-style plants more resistant to melt-through and more likely to vent contaminants into the atmosphere than their Western counterparts, according to discussions at an NRC briefing in Washington, D.C., last week. For example, though the Chernobyl reactor produced power comparable to large U.S. plants, its fuel-holding core is more than 10-fold larger in cross section – 1,600 square feet instead of somewhat less than 144 square feet, according to Victor Stello, NRC's executive director for operations. As a result, Chernobyl's concrete mat beneath the reactor is also comparably larger, he says. The ability of the Chernobyl fuel to spread out and dissipate heat over a much larger concrete mat reduces the chance of a melt-through, noted Harold Lewis, a member of NRC's Advisory Committee on Reactor Safeguards.

Moreover, Stello said, while the Soviet reactor has been designed with some capacity for "containment" of potential accident emissions, "it isn't like any Western containment that you would see." Instead of surrounding within a reinforced structure all of the pipes carrying reactor-core coolant, a portion of each of the 1,700 tubes carrying coolant from the Chernobyl reactor core extends beyond the limited "containment" area. If any of these pipes ruptured outside of containment, radioactive materials would spew into the environment.

Robert Avery, a reactor scientist at Argonne (Ill.) National Laboratory, believes the *initiation* of the Chernobyl accident might also be attributable to "poor design. We're beginning to look at that now." In particular, he considers that the use of so many independent, pressurized pipes and valves not only is "overly complicated" but also increases the chances that one of them will fail.

– J. Raloff

Will U.S. be first to tax Nobel Prize?

To journalists it's known as the "Pulitzer Prize rule," to scientists it's the "Nobel Prize rule." It's a provision in the U.S. tax code that excludes from taxable income certain cash awards recognizing achievement in fields such as charity, the arts and science. But a little-noted provision of the proposed tax reform legislation now wending its way through Congress would drop that exclusion and tax as income all money from prizes and awards other than scholarships or academic fellowship grants.

U.S. tax law already treats most monetary prizes and awards as income. However, winnings are not taxed when the award is for special achievements, was not applied for by the recipient and will not require that the winner "render substantial services as a condition of receiving it." Among awards that fall into this special exemption category are the Nobel Prize, the Pulitzer Prize, the MacArthur Foundation Fellowship Award, the Lasker Award and the General Motors' Kettering, Mott and Sloan cancer-research prizes.

The proposed elimination of exemptions for certain awards has already brought sharp criticism from the Stockholm-based Nobel Foundation. "The tax reform bill would make the United States the first and only country in the world to tax Nobel Prizes," notes Nancy Abramowitz of Arnold & Porter in Washington, D.C., a firm representing the Nobel Foundation in the United States. A statement by her firm, outlining the Nobel Foundation's position, charges that the proposed tax change could set a disturbing precedent: "U.S. taxation of Nobel Prizes could be used as an excuse by certain foreign governments to tax away the prizes, or otherwise punish dissident laureates."

Says John Corbally, president of the