Debris thrown up by force of the Chernobyl explosion litters roof of adjacent building. A large chunk at right, in front of a length of 6" pipe, appears to be half of a graphite block, with indentation left by cylindrical cooling channel. (Photo from Soviet tv, provided by Ed Purvis.)

Helen ApSimon and her colleagues at Imperial College, London, presented some initial findings to a World Health Organization conference last June in the Netherlands. They simulated the transport of 21 MCi of iodine and 1.5 MCi of cesium from the reactor across Europe, accounting for both winds and rainfall in the days after the accident. They estimate that the 500 million Europeans outside the USSR might have a collective dose from both ground-deposited and ingested cesium of 24 million person-rems.

Other simulations have been run by a collaboration in the Netherlands (the National Institute of Public Health and Environmental Hygiene and the Royal Netherlands Meteorological Institute) and by a team at Lawrence Livermore National Lab.[2] In these models the source terms have been adjusted to agree with surface-air concentrations measured at many places in eastern and western Europe as well as some points in the Middle East and Asia. Marvin Dickerson of the Livermore Lab says there is a need to work with the Soviets to arrive at a better estimate of the overall radionuclide release.

These simulations can only predict depositions averaged over very large regions. Chris Hohenemser (Clark University) points out, however, that Europeans have measured many "hot spots," such as places in southern Germany where rainfall produced dose levels up to 40 times those in places with no precipitation.

Studies under way. The implications of the Chernobyl accident are just beginning to unfold. Groups in many countries have already issued assessments of the radiological impact. Other institutions have assessments now in progress. UNSCEAR, with the cooperation of IAEA and the World Health Organization, will try to determine the overall radiological consequences. The US Department of Energy has established a task group under William Bair (Battelle Pacific Northwest Lab) in the Office of Health and Environmental Research. One of the group's four committees, under the leadership of Goldman, was scheduled to report at the end of October on its estimates of the radiological consequences. Another committee in the task group is assessing the opportunities presented by Chernobyl to validate existing models. A third committee is studying what the US might learn from the Soviet experience to improve emergency response preparedness.

Brian Sheron of the Nuclear Regulatory Commission told us that an interagency group in the US was preparing a factual report on the accident, from which each agency is to draw implications for its particular area of responsibility. Sheron is participating in a committee under the aegis of the Organization for Economic Cooperation and Development that is evaluating the implications of the accident for OECD member countries.

By the end of this year DOE was scheduled to receive six separate consultants' reports about the safety of the N-Reactor, a plutonium production reactor in Hanford, Washington. In late July, the National Research Council asked a panel of experts under Richard Meserve (Covington and Burling, Washington, DC) to report in nine months on the safety of plutonium production reactors and another nine months on US research reactors.

—BARBARA GOSS LEVI

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2. P. Gudiksen, R. Lange, Nature, to be published.

Ozone hole attributed to solar maximum

In the 20 September issue of the *Journal of Geophysical Research*, Linwood Callis (NASA) and Murali Natarajan (SASC Technologies) suggest[1] that the recently hyperactive Sun, rather than manmade pollution, bears primary responsibility for the mysterious and troubling "ozone hole" that has for several years been appearing every October over the South Pole. They point out that 1979–80 witnessed one of the most intense solar maxima in centuries. This, they argue, would account for the striking increase in the level of "odd-nitrogen compounds"—various oxides of nitrogen—observed in the stratosphere between 1979 and 1984. Produced in an atmospheric layer above the stratosphere with the aid of sunlight and solar wind, these molecules can participate catalytically in the destruction of ozone.

Ozone resides primarily in the stratosphere. Callis and Natarajan suggest that these odd-nitrogen gases are drawn down into the Antarctic stratosphere during the winter by polar vortex winds. Once there, they begin attacking the ozone when the Sun reappears in September. The ozone hole thus created is eventually dissipated by the vortex in the polar summer.

The ozone holes have persisted beyond the solar-maximum year, Callis and Natarajan argue, because odd-nitrogen molecules survive in the stratosphere for about four years. If it is indeed this effect, rather than chlorofluorocarbon pollution, that is chiefly responsible for the polar ozone hole, this disturbing breach in our protection against the Sun's ultraviolet should be going away as the recent extraordinary solar maximum recedes into the past. And indeed, Callis told us, preliminary data indicate that the 1986 south-polar hole was significantly less pronounced than last year's, and that mid-latitude ozone levels are recovering from recent depletion.

A special issue of *Geophysical Research Letters*, scheduled for mailing at the end of November, contains 46 observational and theoretical papers dealing with the ozone hole.

—BERTRAM SCHWARZSCHILD

Reference

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