RADIATION SHIELDING

Putting Safety First

In the 1930s Eugene Wigner devised a formula indicating that some materials are more effective than others in absorbing, or slowing down, neutron radiation. This work established the basis for radiation-shielding studies.

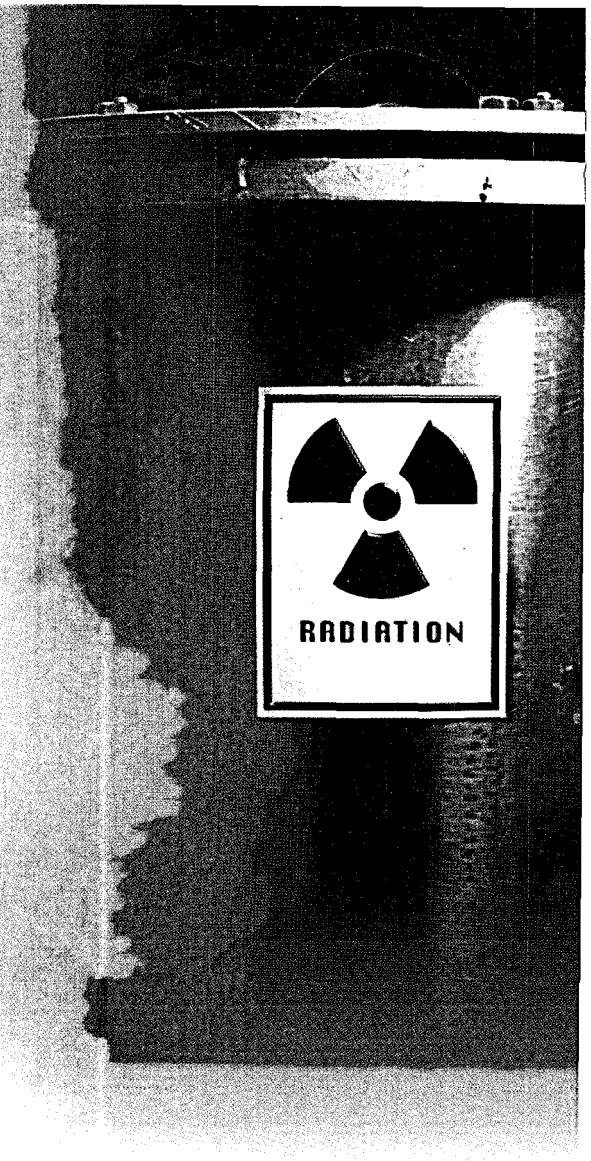
By 1951, under Everitt Blizard's guidance, ORNL became a world leader in performing calculations to determine the thicknesses and configurations of lead, steel, and concrete shielding necessary to protect people and equipment from exposure to hazardous radiation levels. For the later-aborted nuclear aircraft project, ORNL researchers worked to identify lightweight shielding materials that would protect the crew of an airplane powered by a small nuclear reactor from radiation. To provide data for this effort, the ORNL Bulk Shielding Reactor and Tower Shielding Facility were built in the 1950s.

In 1958 ORNL researchers developed a neutron transport code and photon transport code to predict which shielding configurations best protect humans from neutrons and gamma rays. In 1959 they evaluated the effectiveness of reactor shielding proposed for the *Savannah*, the nation's first and only nuclear-powered civilian ship.

In 1966 the Oak Ridge Electron Linear Accelerator began providing data for shielding-code developers on how radiation interacts with individual atoms within the shield material. The accelerator helps scientists answer questions such as "How much neutron radiation is captured by or scattered off the atom's nucleus?" and "How much causes the atom to fission?"

In 1967 ORNL developed a computational simulation code still used today to evaluate the effectiveness of radiation shielding. In 1986 the Oak Ridge Transport model was released; this first openly available radiation transport simulation code enables the solution of extremely large, complex, three-dimensional shielding problems.

ORNL shielding research is being applied to the design of the Spallation Neutron Source's target, medical radiation therapy, and homeland security projects. ORNL researchers also respond to requests for advice on difficult shielding issues.



Containers for radioactive material are designed to protect those working nearby from hazardous radiation.

INFORMATION CENTERS

Sharing Scientific Data

Forty years ago, then ORNL Director Alvin Weinberg headed a presidential panel to study the problem of handling rapidly growing amounts of data. The panel recommended the creation of specialized information centers to review, analyze, condense, and interpret scientific literature for the scientific community.

In response to the Weinberg report, *Science, Government, and Information*, the Radiation Shielding Information Center was established in 1963. In 1996 it morphed into the Radiation Safety Information Computational Center to reflect the scope of technical coverage and keep up with changing computational technology. For scientists and educators in 73 countries, the center has collected, tested, packaged, and disseminated 1600 computational tools used in radiation shielding, transport, and protection.

Since its founding in 1963, the Controlled Fusion Atomic Data Center has made available atomic, molecular, and particle-solid collision data of interest to fusion energy and plasma research. The center has provided valuable data from ORNL's electron-cyclotron-resonance ion source to national fusion research centers at ORNL, Princeton Plasma Physics Laboratory, and General Atomics and has participated in the International Atomic Energy Agency's Data Center Network.

Since the early 1960s, numerous other ORNL information centers have come and gone. They have covered ecological sciences, health and environmental effects of toxic chemicals, nuclear data, nuclear safety, and remedial action programs.

The Carbon Dioxide Information Analysis Center (CDIAC), established in 1982 at ORNL, is the Department of Energy's primary center for global-change data. CDIAC's accurate, impartial data are used by a diverse group of clients. The center's greatest moment of international impact came in the run-up to the 1997 Kyoto conference, when countries negotiated reductions in greenhouse gas emissions. CDIAC provided its unique database of country-by-country, year-by-year emissions of carbon dioxide from fossil-fuel combustion to representatives of many countries, as well as to the news media and a variety of nongovernmental organizations.

Modified nickel aluminide alloys developed; used in commercial production of steel & auto parts

Superconducting electromagnets successfully tested by fusion energy researchers at Large Coil Test Facility

Carbon Dioxide Information Analysis Center established; world-renowned repository of global-change data

1983

Martin Marietta becomes ORNL managing contractor, succeeding Union Carbide

1984

Experiments started to produce hydrogen from water using photosynthesis in spinach and algae