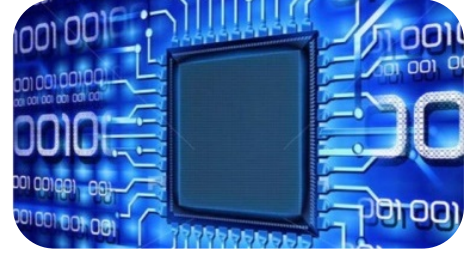
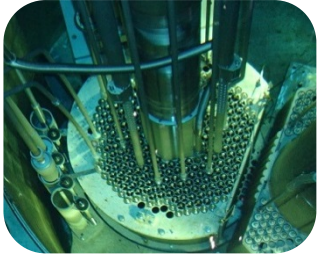


*Exceptional service in the national interest*



## Radiation Effects Science

### *Advancing the Frontiers of Science and Engineering*

#### Problem

The nation needs a strong Radiation Effects Science capability to evaluate performance of the nuclear deterrent and other national assets in radiation environments.

#### Why It Matters

Radiation environments can cause damage to components and prevent them from working as intended. These environments can be particularly stressing for electrical components. Sandia has significant expertise in designing, producing, and qualifying radiation-hardened components. The expertise required is unique and often takes years to acquire beyond traditional education. Further, the facilities to create relevant environments and computational codes to model the effects of radiation environments represent significant national challenges.

#### Sandia's Approach

Radiation effects research focuses on understanding the physics of radiation and other hostile effects on weapon systems, components, devices, and materials in order to improve the design and qualification for assured performance in radiation environments. The radiation environments include neutron, X-ray, gamma-ray, ion, and other forms of damaging electromagnetic radiation. This research field rests on three foundations: 1) the ability to design cost-effective technologies that increase margin for these environments, 2) experimental analysis of the radiation effects in relevant simulated environments, and 3) computational analyses of performance in simulated environments with extension to

other possible environments. Research informs technology options and trade-offs between these three facets for future systems, and research is utilized to understand and assess performance of currently fielded systems and components (prior designs). An important aspect of radiation effects research is consideration of the radiation survivability implications for emerging technologies and the uncertainty in future radiation environment specifications.

#### Research Accomplishments

Recent improvements in the radiation effects science capability at Sandia have achieved the following:

- Record gamma-ray outputs at HERMES enable qualification for Life Extension Programs (LEPs) and evaluation of electromagnetic pulse (EMP) effects on electric grid elements.
- Completed blind comparison for model validation of cavity system generated EMP in advanced computer simulations.
- For the first time, new diagnostics provide a high resolution photon energy spectrum on Z (Grand Challenge LDRD).
- ACRR completed record number of operations, two years in a row, to support design and qualification.
- Installed the nation's largest GHz electromagnetic test chamber for design and qualification.

#### Research Funding

NNSA/Engineering Campaign, NNSA/Advanced Simulation and Computing, Laboratory Directed Research and Development, and Other Government Agencies.



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