

Containment Integrity Research

Sandia National Laboratories applies its extensive experience in nuclear reactor containment integrity research to reduce uncertainty and develop the technical basis for risk-informed, performance based regulations.

Investigating Containment Integrity

Sandia is a nationally and internationally recognized leader in Nuclear Reactor containment research, supporting operations, lifetime extensions, and security and vulnerability assessments over a broad range of phenomena. Sandia's expertise includes evaluation of containment when subjected to high velocity impacts, enormous pressures and stresses, and attacks by saboteurs. Sandia's resources enable the completion of a complex scientific investigation in its entirety. Its engineers are capable of performing a numerical analysis in totality, from modeling a structure in software to validating the calculations with experiments and journal data.

Comprehensive Capabilities

Sandia infrastructure and capabilities include the knowledge and broad technical expertise supporting the collection of experimental data, numerical simulation analyses tools, and the knowledge base needed to provide the U. S. Nuclear Regulatory Commission (NRC) with the ability to make reliable and technically sound regulatory decisions. The laboratories utilize the latest engineering software both from industry (i.e. ABAQUS) and developed by Sandia (i.e. SIERRA Solid Mechanics). These codes provide the most sophisticated analyses possible for finite element analysis of structures. Sandia's high performance computing (HPC) platforms include some of the world's most powerful supercomputers, which are used for numerically intensive simulations.

Sandia constructed the largest and most comprehensively instrumented scaled nuclear reactor containment vessel ever tested, and hosts numerous on-site experimental facilities including a rocket sled track for testing high-velocity impacts, shock thermodynamics research lab, modal and



Quarter-scale containment is the largest nuclear reactor containment vessel model ever tested

structural dynamics testing, and a 100 m³ AMSE pressure vessel at the Surtsey site. . The coupling of analytical expertise with a deep knowledge of the regulatory environment produces a comprehensive package uniquely available at Sandia.

Reducing High Consequence Uncertainties

Sandia researchers reduce uncertainties in areas of potentially high significance, safety or security risk and develop the technical basis for risk-informed, performance-based regulations. Sandia maintains the breadth of technical capability and information needed for the resolution of nuclear safety and security issues, and provides technical support and consultation in the related specialized disciplines. The laboratories offer independent assessments through the review, analysis, and evaluation of the safety performance of facilities licensed by the U.S. NRC.

Sandia researchers have planned and conducted large-scale structural tests and complex structural analyses using both commercial and Sandia codes. Computational methods developed in structural mechanics, heat transfer, fluid mechanics, shock physics, and many other fields of engineering can be an enormous aid to understanding the complex physical systems.



Prestressed concrete containment vessel model structural failure mode testing.



Sandia capabilities include the development of methods, data, standards, and metallurgical modeling tools for evaluating degradation mechanisms on reactor pressure vessel steels; fracture mechanics measurement and analysis technologies; and tools to quantitatively assess changes in structural reliability of nuclear plant systems, structures and components as a result of operating environment effects or aging of materials. Sandia technical capabilities

address emerging issues by providing the expertise for revision and development of NRC Regulatory Guides (RGs) and NUREG reports, as well as responses to inquiries from the Commission, Advisory Committee on Reactor Safeguards (ACRS), and Congress.

Drawing on nearly 60 years of accrued knowledge and support provided to the U.S. NRC, Sandia applies its extensive knowledge of both regulation- based and extra-regulatory environments to model, test and analyze structures within the area of nuclear energy to address structural engineering and containment integrity issues.

Publications

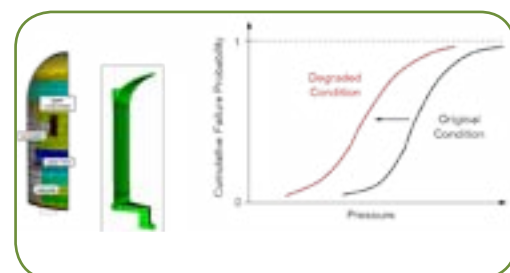
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Fracture Analysis of Degraded Containment



Containment Failure Test
Prestressed concrete containment vessel model structural failure mode testing.



Containment Vulnerability Studies
Water Slug Testing

For more information please contact:

Patrick Mattie
E-mail: pdmattie@sandia.gov
Phone: (505) 284-4796
Website: ne.sandia.gov

