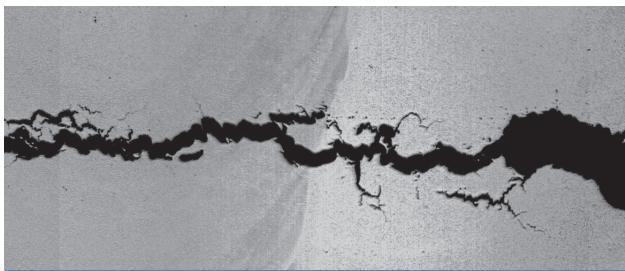


# Failure Analysis Laboratory

The BWX Technologies, Inc. (BWXT) Failure Analysis Laboratory (FAL) is equipped with a wide range of photographic and metallurgical instruments used to support failure analysis investigations. The laboratory is operated by an experienced staff of engineers and technicians trained in failure analysis techniques including microstructural characterization of metals and deposits, fractography, corrosion processes, welding metallurgy, and mechanical testing. Projects conducted in the FAL will typically involve:

- Identifying the mechanism or cause of damage or failure of components in service and recommending corrective actions to prevent reoccurrence
- Solving material-related problems in manufacturing or fabrication of components
- Identifying service-related environmental impurities that contribute to materials damage or failure
- Characterizing materials and evaluating their compliance with specifications and their condition after service



Cracking through Alloy 182 weld material

## Experience

Components analyzed in the FAL typically originated from pressurized water reactors or boiling water reactors, although non-radioactive samples have been analyzed as well. Project examples include reactor vessel head degradation, leaking bottom-mounted instrumentation nozzles, core shroud cracking, evaluation of fuel channel and water channel material, pressurizer heater tube cracking, failures of mechanical pump seals, and cracking of springs, pipe weldments, and valve hardware. BWXT is experienced with many alloy systems used in nuclear facilities including zirconium alloys, Inconel alloys, and a variety of stainless, carbon, and alloy steels.



Optical metallography

## Services

Metallurgical and failure analysis services offered on radioactive components include:

- Visual and Stereovisual Examinations
- Dimensional Inspection
- Liquid Penetrant Inspection
- Machining/Sectioning
- Rockwell Hardness Testing
- Microstructural Examination
- Automated Microhardness Testing
- Scanning Electron Microscopy
  - FE and Tungsten Instruments
- Energy Dispersive Spectroscopy

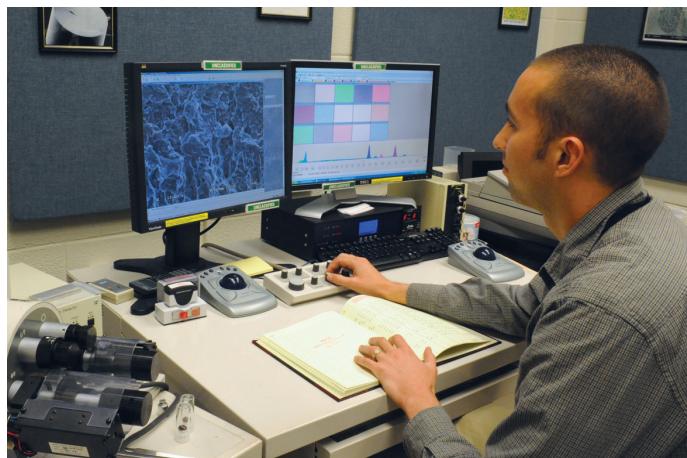
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## Services (continued)

- X-Ray Fluorescence
- Oxygen, Nitrogen, and Hydrogen Analysis
- Mechanical Testing
- Formal Reporting

## Support services

- 3-D Imaging of Fractures and Other Surfaces
- Fatigue and Fracture Mechanics Testing
- Sub-Zero and High-Temperature Testing
- Helium/Hydraulic Leak Rate Testing
- Hydraulic Burst Testing
- Heat Treatment
- Quality Assurance Program (10 CFR 50, Appendix. B, NQA-1)
- Reactor Vessel Surveillance Program
- Post Irradiation Examination
- Bulk Chemical Analysis
- Analytical Chemistry
- Radiochemistry
- Decontamination



Scanning electron microscopy

In addition to our in-house capabilities, BWXT working relationships with other laboratories with additional analytical capabilities for radioactive samples. The project engineer directs and oversees the work performed by these laboratories. Examples include:

- X-ray Photoelectron Spectroscopy
- Secondary Ion Mass Spectroscopy
- Scanning Auger Microscopy
- Scanning Transmission Electron Microscopy
- Fourier Transform Infrared Spectroscopy
- Raman Spectroscopy
- Residual Stress Determinations

People Strong

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