The BWX Technologies, Inc. (BWXT) Failure Analysis Laboratory (FAL) is equipped with a wide range of digital photography 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 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 material damage or failure
- Characterizing materials and evaluating their compliance with specifications and their condition after service

Experience

Most FAL projects involve radioactive components originating from pressurized water reactors or boiling water reactors, although non-radioactive samples have been examined as well. Recent projects include reactor vessel head degradation, leaking bottom-mounted instrumentation nozzles, pressurizer heater tube cracking, steam generator tube failures, filter debris analysis, and investigations involving cracking in springs, pipe weldments and valve hardware. BWXT is experienced with many alloy systems used in nuclear facilities including zirconium alloys, inconel alloys, stellite alloys and various stainless, carbon and alloy steels.

Services

Metallurgical and failure analysis services offered on radioactive components removed from service includes:

- Visual and stereovisual examinations
- X-ray radiography
- Dimensional inspection
- Liquid penetrant inspection
- Machining/sectioning
- Rockwell hardness testing
- Automated microhardness testing
- X-ray diffraction
- Microstructural examination
Services (continued)

- Scanning electron microscopy
- Energy dispersive spectroscopy
- X-ray fluorescence
- Bulk chemical analysis
- Mechanical testing
- Formal reporting

Support services

- Fatigue and fracture mechanics testing
- Sub-zero and high-temperature testing
- Helium/hydraulic leak rate testing
- Hydraulic burst testing
- Sample heat treatment
- Quality assurance program (NQA-1, and 10 CFR 50, Appendix B)
- Reactor vessel surveillance program
- Post irradiation examination
- Analytical chemistry
- Radiochemistry
- Decontamination
- Nondestructive evaluation

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

- X-ray photoelectron spectroscopy
- Secondary ion mass spectroscopy
- Scanning auger microscopy
- Scanning transmission electron microscopy
- Raman spectroscopy
- Residual stress determinations
- Electron microprobe