Overview
Modifications to nuclear plant components are often required as components age. These modifications may be required to improve access for inspection or maintenance, to repair in-service degradation and damage, or to address other plant-related needs. BWXT’s experience designing and providing field services to nuclear pressure vessel equipment enables our engineers to design and qualify practical vessel modifications that are optimized for field installation.

Applications
BWXT’s experience and capabilities include qualification of a large range of field modifications, including:

- Modification of openings
- Field-installed inspection ports and handholes (often without the need for welding to the pressure boundary), including unreinforced or partially reinforced designs
- Installation of Helicoils™ to repair damaged threads
- Installation of Hydra-Nuts™
- Operation with damaged or missing studs on openings
- Changes of gasket materials

Capability and Tools
BWXT has developed extensive knowledge in bolt design and analysis, gasket selection, gasket seating design, gasket analysis and seal-weld analysis through years of experience with gasketed and seal-welded openings subject to pressures in excess of 3000 psi.

BWXT performs gasket analyses using a variety of methods, both rule-based (ASME and PVRC methods) and numerical-based, using commercial Finite Element (FE) codes (ANSYS®, ABAQUS™).

Capabilities include:

- Selection of gaskets based on joint behaviour, gasket stiffness and leakage requirements
- ASME Code design of gasketed joints/bolts, including thermal transient and fatigue analysis
- Selection of bolt assembly preloads for good gasket seating and no-leakage during operation
- Gasket and bolt design using the PVRC method, including interpretation of Room Temperature Tightness (ROTT), gasket test data and their application to bolt design
- Finite element modeling of non-linear gasket behavior including elastic-plastic modeling for the prevention of gasket leakage
- Prediction of joint rotation and optimization of joint geometry
- Fatigue analysis of seal welds
Finite Element model of elliptical shaped manway under thermal, pressure transient loading and preload with nonlinear gaskets

Contact pressure distribution of the nonlinear gaskets of elliptical shaped manway at certain time of the transient

Finite Element analysis of a manway stud and Hydra-Nut™ during tensioning