6.0 ENGINEERED SAFETY FEATURES

The design, fabrication, testing and inspection of the Nuclear Steam Supply System and its protection systems assures safe and reliable operation under all anticipated normal, and abnormal conditions.
→(DRN 04-705, R14)
Engineered safety features (ESF) are provided to mitigate the consequences of postulated accidents in spite of the fact that these accidents are highly unlikely. The safety features function to limit, contain, control and terminate an accidental release of radioactive fission products, particularly as the result of a loss-of-coolant accident (LOCA). ESF systems keep exposure levels to the public and plant personnel below applicable limits (e.g., 10CFR50.67, GDC-19, etc.).
←(DRN 04-705, R14)

In order to meet the above safety goals, Waterford 3 utilizes the following ESF Systems:

a) Containment Vessel (Subsection 6.2.1)

A metal primary containment vessel is provided. The containment vessel is a low leakage cylindrical steel shell with hemispherical dome and ellipsoidal bottom. The vessel is designed to contain the radioactive material that could be released from a loss of integrity of the reactor coolant pressure boundary. Design information is presented in Section 3.8.

b) Shield Building (Subsection 6.2.3)

The containment vessel is surrounded by a reinforced concrete Shield Building. The primary and secondary containments are separated by an annular air space. The Shield Building is a medium leakage structure which protects the containment vessel from external missiles and flooding, provides biological shielding, and provides a means of controlling radioactive fission products that leak from the containment if an accident should occur. Detail design information for the Shield Building is given in Section 3.8.

c) Containment Spray System (Subsections 6.2.2 and 6.5.2)

The Containment Spray System provides borated water spray for post accident heat removal, pressure reduction and iodine removal from the containment atmosphere.

The Containment Spray System consists of two redundant full capacity trains each consisting of a spray pump, Riser fill pump, spray header and associated nozzles, valves, instruments and controls. This system does not operate during normal operation.

d) Containment Cooling System (Subsection 6.2.2)

The Containment Cooling System removes heat by passing containment air over coils cooled by the Component Cooling Water System.

There are two redundant trains of containment fan coolers each capable of removing its design heat load. Four containment fan coolers are provided, each of which consists of cooling coils, vane axial, two speed fan and housing. During normal operation, three of the four fan coolers are in operation. On receipt of a safety injection actuation signal the fourth fan cooler is started and all fans operate at low speed.

e) Shield Building Ventilation System (Subsections 6.2.3 and 6.5.1)

The Shield Building Ventilation System maintains a negative pressure in the Shield Building annulus following a LOCA or MSLB, mixes Shield Building in-leakage with the air in the annulus and discharges it through an ESF filter train which includes charcoal and HEPA filters.

The system consists of two full capacity redundant fan and filter systems located in the Reactor Auxiliary Building which exhaust the annular space and discharge through the plant stack to the atmosphere. On the suction side of each fan, the air is drawn sequentially through a demister, electric heating coil, prefilters, HEPA filter, charcoal adsorber and HEPA afterfilter. An automatically operated back draft damper located on the discharge side of the exhaust fan precludes backflow through the system.

f) Containment Isolation System (Subsection 6.2.4)

The Containment Isolation System provides a double barrier on all fluid penetrations not serving ESF and supporting systems to minimize out-leakage from the Reactor Coolant System or the containment atmosphere to the environment. Barriers are comprised of safety class 2, seismic Category I piping systems, both inside and outside the containment vessel, and manual or automatic isolation valves.

All automatic valves for containment isolation are closed upon receipt of a containment isolation actuation signal.

g) Combustible Gas Control System (Subsection 6.2.5)

→(DRN 05-1135, R14-B)

Combustible gas management in the containment following an accident is accomplished by the use of the Hydrogen Analyzer System.

The Containment Atmosphere Release System provides a means of purging containment atmosphere when pressures have been reduced to approximately atmospheric.

←(DRN 05-1135, R14-B)

→(DRN 05-1135, R14-B)

The Hydrogen Analyzer System analyzes the post beyond-design-basis accident containment atmosphere for potential hydrogen buildup by use of an automatic hydrogen gas analyzer.

←(DRN 05-1135, R14-B)

The hydrogen recombiners, the Containment Atmosphere Release System and the Hydrogen Analyzer System are put into operation manually from the main control room.

h) Safety Injection System (Section 6.3)

The Safety Injection System injects borated water from the safety injection tanks and the refueling water storage pool, into the Reactor Coolant System for post accident cooling to limit core damage and fission product release and assures adequate shutdown margin. The Safety Injection System also provides continuous long-term post accident cooling of the core by recirculation of borated water from the SIS sump back to the reactor core.

i) Emergency Feedwater System (Subsection 10.4.9)

The Emergency Feedwater System is provided to automatically supply feedwater to one or both of the steam generators for cooldown of the Reactor Coolant System following a main steam or feedwater line break, or loss of normal feedwater.

The Emergency Feedwater System employs one full capacity steam turbine driven pump and two half capacity motor driven pumps, all capable of supplying one or both steam generators.

j) ESF Air Filtration Systems (Sections 6.4 and 6.5)

→(DRN 04-705, R14)

The Control Room Air Conditioning System (all of this system's operating modes and equipment do not provide an ESF function; i.e., the actuation of the portion resulting from toxic chemical detection or high radiation is not an ESF actuation), the Controlled Ventilation Area System, and Shield Building Ventilation System provide emergency filter trains to limit the radiological consequences offsite and in the main control room of postulated accidents.

←(DRN 04-705, R14)