ALTERNATE DECAY HEAT REMOVAL EVALUATION

CUSTOMER BENEFITS

The Alternate Decay Heat Removal (ADHR) system provides heat removal capacity during the early stages of an outage. This makes the Residual Heat Removal (RHR) system available for maintenance/repairs at the earliest possible opportunity after reactor shutdown, thus enabling fuel movement to proceed earlier and save outage critical path time. As a result, the ADHR system can reduce outage duration by 5 to 7 days, thereby achieving a full return on its investment in a single outage.

The system is simple to operate and maintain and is independent of existing plant systems. It can function as a stand-alone unit, or the RHR and Fuel Pool Cooling System (FPCS) may be used to supplement the system to handle the desired decay heat load.
In the past, the RHR system has been used primarily to remove decay heat until that function can be handled by the Fuel Pool Cooling System. This approach has kept one of the RHR loops dedicated to this purpose until late in the outage, delaying maintenance/repair work on the RHR system. As a result, outage duration can be extended by several days.

The reliability of the ADHR system is enhanced by using a dual train concept. Outage performance is optimized by using the system to pre-cool the fuel pool before the outage begins. The system can be customized to meet plant-specific design basis.

SCOPE

The ADHR design concept can be best represented by descriptions of its functional modules.

GE has developed a fluid model to analyze heat transfer from the core area to the reactor cavity to the fuel pool by the natural convection process. This model demonstrates the effectiveness of mixing the hot reactor cavity water with the cool fuel pool water after the fuel pool gates are opened, thereby establishing the viability of heat removal via the fuel pool. The analytical model has been benchmarked against field tests at several plants. Plant-specific analyses can be performed using this model.

Primary Loop
The primary loop draws hot water from the fuel pool, circulates it through heat exchangers and returns cooled water to the fuel pool. This loop consists of two trains, each equipped with pumps and heat exchangers of the required heat removal capacity. The two-train concept is introduced to increase reliability, since any malfunction while handling the fuel pool water could jeopardize the outage schedule. All components in this loop are housed in the secondary containment area.

Secondary Loop
The secondary loop transfers heat from the heat exchangers to atmosphere using heat sink devices such as cooling towers, mechanical refrigeration units or ground water (in warmer areas). This loop has two trains, each comprised of a pump and connection to the ultimate heat sink device (any one or combination of those listed above). The components of this loop are located outside the reactor building.

The ADHR is offered as a fully customized and installed system capable of augmenting fuel pool cooling on demand. The entire system is designed as passive essential. The position retention of all components of the ADHR system is established to mitigate the consequences of a safety-related system becoming inoperative during a seismic event. All components are constructed of stainless steel. If a seismic event were to affect the operability of the ADHR system, one of the two RHR loops could be brought back into service within a specified time so that fuel pool temperatures would not exceed technical specification limits. The dual train concept also assures that one train will be operable following a seismic event.

Each installed ADHR system includes:

- Supply and installation of all hardware.
- Design calculations Piping & Instrumentation Diagram
- Procurement specifications
- Detailed shop drawings
- Maintenance instructions

- System operating procedures

EXPERIENCE

GE, as the steward of the BWR technology, has accumulated four decades of experience in core heat transfer and natural circulation as well as in the design of cooling systems for a variety of BWR auxiliary systems. Black & Veatch, as a world leader in power plant engineering, has designed heat transfer and heat rejection systems for a large number of electrical generation facilities. Thermal cycle heat rejection systems are optimized on a performance basis for installation at power plants worldwide. B&V has the system engineering and retrofit installation experience to accommodate the specific requirements of existing power plant facilities. This experience and technology has been applied to development of the ADHR systems to be offered by GE.

CUSTOMER INPUT INFORMATION

TBD

DELIVERABLES

GE will provide a letter report addressing Alternate Decay Heat Removal System.

SCHEDULE

TBD

GE CONTACT

For further information on this product or other concerns, please contact your Technical Projects Manager (TPM) or visit our website.