HI-COOL: A Passive Spent Fuel Pool Cooling System

HOLTEC INTERNATIONAL

HI-COOL is a passive cooling system that relies on the Organic Rankine Cycle[1] to discharge heat from the spent fuel pool. HI-COOL can be retrofit to existing plants for use both as an emergency cooling system under station blackout scenarios and as an auxiliary system to provide operational flexibility during corrective and elective maintenance (particularly during outages). HI-COOL can also be incorporated into the plant design for new build projects to operate as the primary cooling system, thereby removing station blackout as a possible threat to spent fuel pool safety.

- ✓ Can be retrofit to existing plants for emergency cooling system or incorporated into new build design as primary cooling system
- ✓ Holtec's various divisions provides a unique set of expertise that enables the implementation of the HI-COOL system at any plant

HI-COOL extracts the decay heat from the spent fuel by evaporating a low boiling point fluid (e.g. refrigerant) inside a small heat exchanger that is placed inside the spent fuel pool (see Figure 1). The refrigerant vapor travels through a turbine that generates electricity and then travels to an air cooling tower where it is condensed (see Figure 2). The electricity generated from the turbine is used to pump the condensed refrigerant back to the pool and to power a fan that forces air over the air cooled condenser fins. In many cases, there can be more than 7 hp (5 kW) of surplus power that can be used to run pool instrumentation or recharge batteries. The HI-COOL system is a closed system – at no time is pool water removed from the pool.

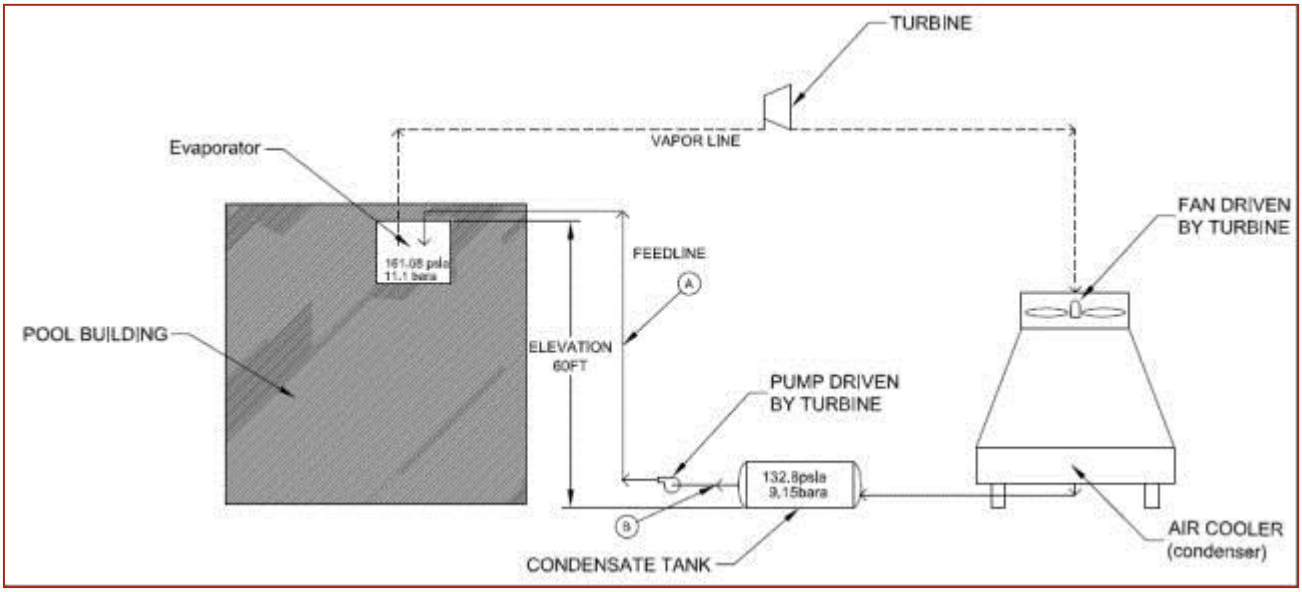

Figure 1: Process Flow Diagram of the HI-COOL System
(disclosed to the U.S. patent office for international protection under application number 61475086)

[1] The Organic Rankin Cycle is commonly deployed in geothermal, solar, biomass, and waste heat recovery power stations.

The air cooled condenser is designed by Holtec's Air Cooled Condensing Division in San Diego, California and the balance of the heat exchanger equipment is designed the Holtec's Nuclear Power Division and Power Plant Components Division based in Marlton, New Jersey.

All the equipment is designed to meet the site's Operating License requirements, including:

- pool temperature limits
- max ambient temperature
- seismic spectra
- pool drop accidents
- flooding events
- tornado missiles

In addition, redundancy can be designed into the HI-COOL system by use of multiple, independent trains, with the ACC units spatially separated to maintain cooling following postulated aircraft impact events. Holtec can work with individual plants to establish the functionality objectives of HI-COOL when used as an auxiliary heat exchanger under normal operation or outage conditions to support maintenance on the existing pool heat exchangers, reactor maintenance (particularly for older generation BWR reactors), and reduced spent fuel building temperatures.

The combined experience of Holtec's various divisions provides a unique set of expertise that will enable implementation of the HI-COOL system at any plant:

- Design, licensing, and site services on over 100 wet storage rack projects
- Design, licensing, and site services on over 60 dry spent fuel storage and transport projects
- Design of hundreds of pieces of heat exchanger equipment (10 MW – 1500 MW)
- Design of over 80 ACC systems deployed worldwide
- In-house fabrication capacity for all critical equipment[2]

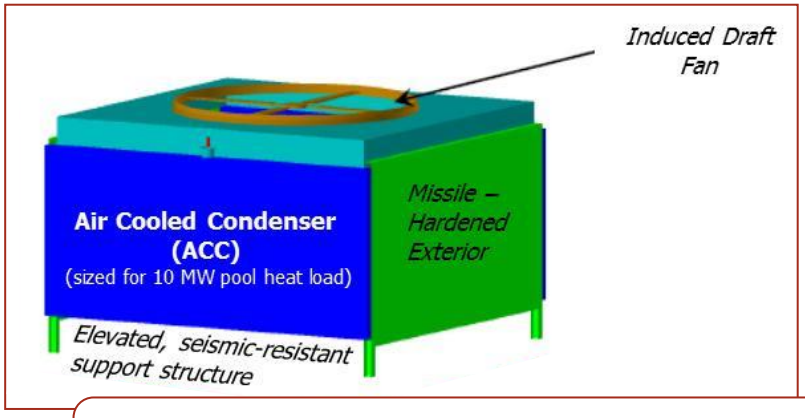

Figure 2: Air Cooled Condenser (ACC) Sized for 10 MW Pool Heat Load
(disclosed to the U.S. patent office for international protection under application number 61475086)

Additional information on Holtec's experience can be found online at www.holtecinternational.com

Holtec has already performed design verifications for clients for pool heat loads ranging from 1 MW

[2]Holtec Manufacturing Division is HMD is certified to fabricate components meeting the ASME "N" (Nuclear Components), "N3" (Transportation/Storage Components), "NPT" (Nuclear Partial), "U' (Pressure vessels and heat exchangers), "R" (Vessel Repair) and ISO 9001.

(central storage pool with cold fuel) to 13 MW (reactor side pools with a full core offload). The equipment can be designed for proper functionality over nearly all design conditions.