# Coiled Tube Air Heaters (CTAHs)

The Mk1 PB-FHR uses two Coiled Tube Air Heaters (CTAHs) to transfer heat from the coolant salt to pressurized air in the nuclear air combined cycle (NACC) power conversion system. Due to the high temperature of the coolant salt leaving the FHR core, a power conversion cycle that utilizes air instead of the steam used by conventional LWRs maximizes the overall efficiency of the plant. Due to the coiled shape of the CTAH, the heat exchanger volume is minimized while the heat transfer area and effectiveness between air and the molten salt is maximized. The CTAH is made up of 36 sub-bundles stacked on top of each other, separated by spacer plates. One of these sub-bundles is pictured below. Heated molten salt from the reactor flows downward in the four outer manifold pipes, and then flows in a spiral pattern through the tubes of the bundle, exiting into four outlet manifold pipes where the cooled salt flows downward and out of the CTAH vessel. Air from the power conversion system enters from the bottom of the CTAH vessel, flows up the center of the bundle, and then radially outward through the tube bundle to be heated. The heated air exits from the top of the CTAH vessel and is returned to the gas turbine. The CTAH cools the molten salt from ~700 $^{0}$C to ~600 $^{0}$C before returning it to the FHR core. At the same time, the air enters the CTAH at ~418$^{0}$C and is heated up to ~670$^{0}$C. The air pressure varies between the two CTAHs. One of the CTAHs has a high inlet pressure for air at approximately 18.76 bar. The other CTAH has a low inlet pressure at approximately 4.98 bar. These temperatures and pressures are based on the design parameters of the Air Brayton Reheat Cycle used for power conversion in the FHR.

A sub-bundle from a Mk1 CTAH is pictured below. Heated molten salt from the reactor flows downward in the four outer manifold pipes, and then flows in a spiral pattern through the tubes of the bundle, exiting into four outlet manifold pipes where the cooled salt flows downward and out of the CTAH vessel. Air from the power conversion system enters from the bottom of the CTAH vessel, flows up the center of the bundle, and then radially outward through the tube bundle to be heated. The heated air exits from the top of the CTAH vessel and is returned to the gas turbine.