Abstract KAERI (Korea Atomic Energy Research Institute) has been studying a VHTR (Very High Temperature Reactor) to utilize a nuclear power plant for diverse purposes. The VHTR is designed to operate under high-temperature and pressure condition for its lifetime (40 years or longer). To use the VHTR safely and efficiently, a reliable code to analyse the thermal-hydraulics in the reactor core is in demand. A commercial CFD tool might give an accurate solution, but it still has a burden in terms of the computational speed and computer memory usage. A system code to solve a fluid one dimension and a solid as three dimensions has been developed to investigate the temperature distribution and flow rate in the reactor core of a VHTR. In the present study, the hot spot temperature and temperature gradient in the columns in the reactor core are investigated with combinations of various unit cells.