

Summary of the paper to be presented at the workshop  
on Advanced Reactors With Innovative Fuels (ARWIF 2001)

Technical Area: 3 Evolutionary Water Reactors & Modular Water Reactors

PWRs using HTGR Fuel Concept with Cladding for Ultimate Safety

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The growth in population and energy demand not only for electricity but also ordinary heat source for human lives in one hand, the global climate crisis in the other hand we have to establish consensus of available energy resources in accordance with sustainable development. With regards to this fact, effective use of nuclear energy is indispensable.

From this point of view, an innovative PWR concept has been studied that uses carbon-coated particles moderated by graphite as that of HTGR but cooled by pressurized light water. The aim of this concept is to taking both the best advantage of fuel integrity against fission products release and the reliability of PWR technology based on the long operational experience. The fuel is clad by zircalloy lest it should contact with steam or air in case of LOCA or other accidents. The quantity of graphite for moderation is selected so that it has enough thermal capacity but negative void reactivity coefficient. The power density is lower than that of the current PWRs' in order to maintain higher thermal margin during operation. Only control rods control transient reactivity without soluble boron. Burnable absorbers control long- term reactivity and suppress extra reactivity to get required shut down margin with minimum control rods. The reactor lifetime can be expected for more than a few years without refueling with enriched uranium oxide of 5w/o.

With such features the reactor can be operated with very high safety margins such that the maximum fuel temperature is about one thousand degree Celsius lower than the operating temperature of the coated-particle fuel and no operator action is required for several hours incase of LOCA even with a passive residual heat removal system. Thus the plant with this reactor could be accepted to construct near a city. It may be suitable for district heating or desalination.

In the paper the current status of the evaluation of nuclear characteristics of the reactor and outline of the plant is discussed. The manufacturing process and area for the future investigation is also presented together with an application of this plant for a district heating.