Analysis of the KS-150 Reactor Emergency Event in 1976: Coolant Loss and Fuel Overheating Serious Incident

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Abstract. The A1 Nuclear Power Plant (NPP), located near the township of Jaslovské Bohunice in southwestern Slovakia, was equipped with a KS-150 reactor of the HWGCR (Heavy Water Moderated, Gas Cooled Reactor) type. This reactor operated from 1972 to 1977. The short operational period of the reactor was caused by an accident involving core damage in 1977. The year before, in 1976, there was an accident involving coolant loss and insufficient residual heat removal. This article examines the impact of fundamental reactor design specifications on the occurrence and consequences of accidents. Key design characteristics that adversely affected accident scenarios included low thermal inertia, low moderator heat capacity, significant coolant heat capacity loss due to pressure drop, high thermal loading of fuel, weak feedback from gas coolant temperature, and a subsequent reliance on active safety systems. Conversely, the reactor featured a high negative temperature coefficient of reactivity from both the moderator and fuel temperatures, contributing to its inherent safety. Additionally, the design of the fuel rods, composed of uranium metal wires, and the reactor's channel design mitigated significant core destruction in the event of overheating. However, the penetration of heavy water and its interaction with the magnesium cladding of the fuel had fatal consequences for the reactor core.