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# Investigation of VVER-1200 Under Steam Line Break Containment and Partial Turbine Failure

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The world currently employs nuclear energy to meet the growing energy demand and contributes 10% of global electricity output. Pressurized Water Reactors (PWRs) and Boiling Water Reactors (BWRs) are the main types of reactors used in the nuclear power industry. Together, they are known as Light Water Reactors (LWRs) and account for over 90% of the world's reactors, with PWRs making up more than 75% of them.

Ongoing advancements in nuclear reactor technology have led researchers to develop the Water-Water Energetic Reactor (WWER) or VVER. The evolution of VVER-1000 and VVER-1200 is the latest reactor design, featuring a higher power capacity of approximately 1200 MWe (gross) and upgraded passive safety measures.

Safety and risk mitigation are central to nuclear plant design and include numerous security layers to handle malfunctions and safely shut down operations. Even with these precautions, there remains a small chance of core damage and containment failure, which could lead to radiation exposure. PCTRAN's latest version can handle both DBAs and BDBAs, including faults like LOCA, core melt, and station blackout, making it a strong tool for assessing emergency response scenarios.

This analysis investigated the plant's reaction to combined internal and external steam line breaks alongside a turbine trip. In the first scenario (C1), each steam line break was assumed to have a 25% failure rate, while the turbine trip was set at 50%. In the second case (C2), all malfunctions were modeled at a 50% failure rate. The simulation examined changes in plant variables, such as reactor pressure, temperature, core water level, and thermal output, and how emergency safety systems were engaged in controlling hazardous conditions.

## Technical Track

Safety and Severe Accidents

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