

The nitrogen injection from the accumulators: a risky complication during a SBO/LOCA accident

The worst accident that a nuclear plant might face is the total loss of electric power (Station Black-Out SBO). Losing all the power prevents the reactor's safe shut down activities. The Fukushima disaster is a clear example of this kind of accident.

Furthermore, the SBO also unleashes a new serious challenge: a Loss Of Coolant Accident (LOCA) across the main RCP seals. Without power, only the accumulators can cope with this situation. They passively inject its waters to replenish the core.

But when all the water is depleted, a new complication arises: Its nitrogen freely enters and disseminate over the system.

The harmful effects of nitrogen inside the RCS



- It stops the passive core cooling. Accumulated in the upper side of the SG's U tubes, nitrogen blocks the natural circulation flow. And strongly diminishes the steam condensation in the tubes. Reflux Cooling will be also compromised.
- System pressure will rise due to the nitrogen bubble heated with steam from the core. The pressure will remain high for a long time, hindering the water injection from the Emergency Injection pumps.



Why this nitrogen injection has high probabilities to happen?

- LOCA is permanent and the RCS pressure will drop constantly.
- Nitrogen is already inside and there are big amounts!
- It has an open & direct path to the reactor.
- At all time is trying to enter into the RCS.

Current strategies to cope with nitrogen

- Closing (on time) the accu output isolation valves.
- Opening (on time) the accu exhaust valves.
- Keeping the pressure above the nitrogen pressure.

All needs **power** and **operator** effort to get success!



1% N₂ + 99% H₂O

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CONCLUSIONS

The nitrogen Injection to RCS is a complication which has a high probability of occurrence. It will threaten the core cooling and the fuel integrity during an SBO/LOCA accident.

The current mitigation strategies to prevent the nitrogen Injection are not reliable and prone to failure. They all use active components which require power to operate. They also needs the operators efforts during a time-critical period while they have many other challenging tasks to handle. Their actions are time critical.

Using the ASVAD, the nitrogen injection can be easily prevented without any need for operator assistance, and allowing them to focus on the core cooling, or other recovering tasks. Once nitrogen is avoided, RCS can be further depressurized to facilitate the accident recovery, providing a longer coping time.

ASVAD is a passive element, which automatically vents the nitrogen at the right time. The overall plant safety will be improved by installing ASVAD on each accumulator.

ASVAD, is the **SAFEST** solution available now

The ASVAD Valve has been awarded with the EURATOM Nuclear Innovation Prize* 2025 in safety of reactor systems.

Still with doubts? Ask their inventor in the lobby

parts needed. With minimal maintenance cost.

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