framatome

Post-Accident Sampling System - PASS

In-situ Containment Atmosphere, Fuel Pool and Sump Sampling

Framatome's PASS provides in-situ sampling of the containment atmosphere, the fuel pool and the containment sump, even after a severe accident.

Challenge

The amount and composition of radionuclides present in the containment atmosphere and sump water provide valuable information about the damage state of the reactor core in case of accidents. Simple extraction systems suffer massive losses, especially of aerosols, during sample transport. In addition, the high activity content of undiluted samples poses a major problem for the handling of extracted samples.

Therefore, a post-accident sampling system is required to:

- Collect sample from different locations inside the containment.
- Dilute samples to reduce activity levels for ease of handling.
- Provide for safe collection and handling of samples after dilution.
- Provide for effluent return to the containment to limit activity release from the containment.

Customer benefits

- In-situ sampling during LOCA and Severe Accidents
- Important information of core damage state as input for accident management
- No losses during sampling allows high measuring accuracy
- Low sample activity concentration
- Modular design adaptable to sampling situation

Solution

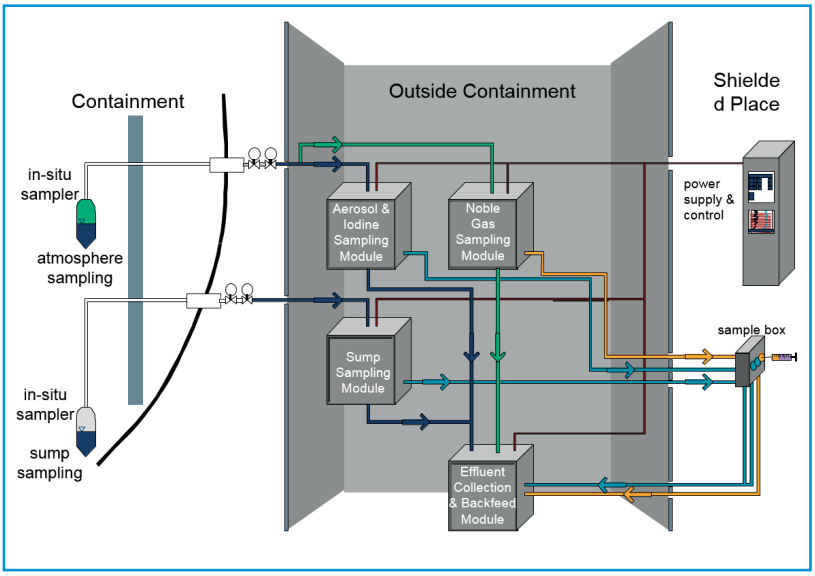
Framatome's In-situ Post-Accident Sampling System (PASS) provides for the collection of samples from the containment atmosphere, the fuel pool and the sump water.

The containment atmosphere samples are preconditioned inside the containment, where aerosols and iodine are retained in the scrubbing liquid of the sampler. The remaining gaseous sample contains mainly radioactive noble gases. The subsequent automatic sample dilution limits the radiation exposure to personnel during sampling and analysis.

The scrubbing liquid in the sampler contains activity from aerosols, and gaseous iodine is sampled separately.

Fuel pool and containment sump samples can be collected using a dedicated pool samplers or by connecting to an existing system.

All sample effluents (liquid and gaseous) are collected and returned to the containment to prevent spread of activity.



Simplified Process Diagram of the Post-Accident Sampling System

Technical information

Allowable containment ambient conditions

- Temperature: up to 155 °C
- Pressure: up to 7 bar_{abs}
- Humidity: 100 % (relative humidity)
- Steam: up to 62 %
- Activity concentration: up to 1E+16 Bq/m³

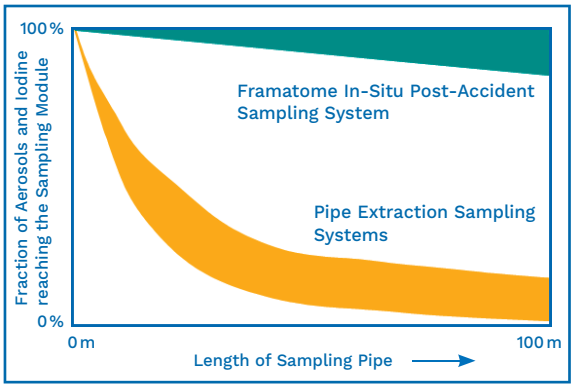
Sampling system

- Dilution factor: up to 1:1000
- Sampling accuracy factor (including dilution): 2
- Maximum activity (final sample): 1E+09 Bq

Qualification

- Full scope process qualification performed for:
  - Up to 100 m pipe length
  - Pressure of 1 to 7 bar
  - Temperature of 20 to 155 °C
  - Aerosol suspension

Pool sampler installed inside the containment

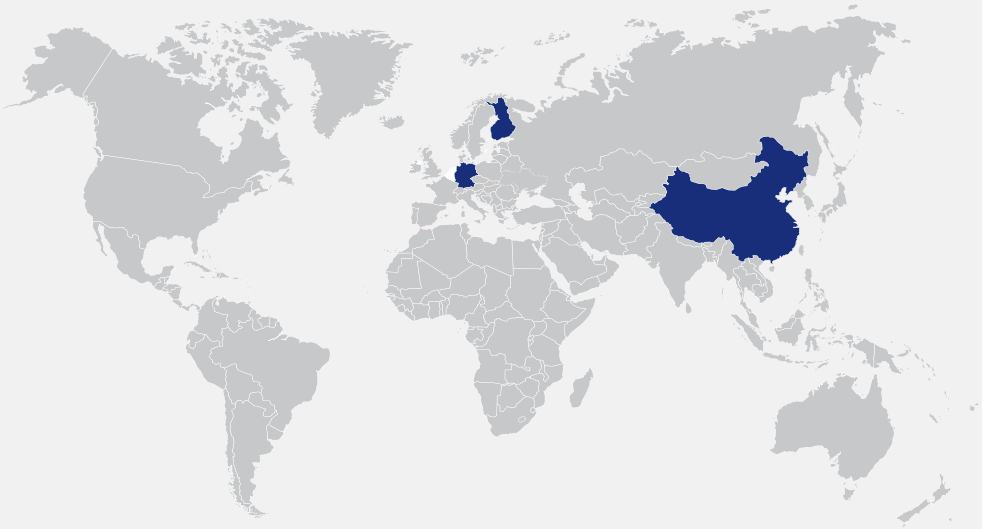


Principle comparison of losses in pipelines of post-accident sampling systems

References

Framatome's PASS application has been designed, installed, commissioned and licensed in nuclear power plants of the following countries:

- Germany: 15 (PWR, BWR)
- China: 2 (PWR)
- Finland: 1 (PWR)



PWR: pressurized water reactor
BWR: boiling water reactor

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