

ENHANCED ORGANIC IODINE RETENTION (I-CATCH)

Efficient Organic Iodine Retention and Activity Release Limitation

Framatome's I-CATCH provides capturing of organic and remaining elemental iodine and supplements standard two-staged filtered containment venting systems.

Challenge

Even with a standard Filtered Containment Venting System equipped with a venturi scrubber and metal fiber filter, organic iodine is not adequately retained. Therefore, after a severe accident and containment venting for pressure release, short-term evacuation of the population in the vicinity of the nuclear power plant may be required.

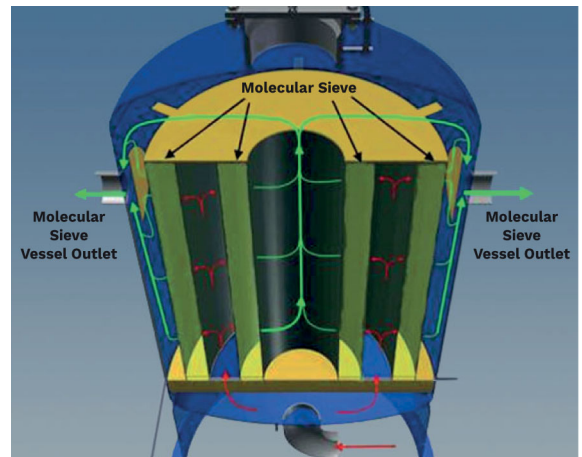
In addition, the state of the art of organic iodine formation and behavior has changed significantly in the last decades (see, e.g., PHEBUS experiments). Efficient and robust retention of those difficult to retain organic iodine species, especially methyl iodide, is required.

Solution

Framatome's Enhanced Organic Iodine Retention (I-Catch) provides retention of organic and elemental iodine in an additional filtration stage. This additional stage follows the wet (venturi scrubber) and dry (metal fiber filter) stages of a standard filtered containment venting system (FCVS).

After the vent gas has been cleaned in the venturi scrubber and dried in the metal fiber filter, as part of a standard FCVS, the vent gas will be throttled before entering the molecular sieve. Although the throttling results in a decrease in temperature after the orifice plate, because the process is extensively isenthalpic and adiabatic, the throttled vent gas is still superheated. This is advantageous because the superheated vent gas conditions required for the adsorption process are generated by a completely passive process.

After throttling, adsorption of the organic iodine takes place in the molecular sieve containing silver-doped sorbents in a fixed bed designed to achieve low flow velocities for long residence times. The long residence times are required for effective adsorption of iodine on the large internal surface area of the porous sorbents and the formation of chemically stable silver iodide.



Enhanced Organic Iodine Retention – I-CATCH
Section view

Customer benefits

- Easy to retrofit downstream already existing Filtered Containment Venting Systems.
- Highest NPP safety in order to protect the environment.
- Fully passive and reliable system operation.

Technical information

Improvement of decontamination factors (DF) after retrofitting the I-Catch stage to existing FCVS systems:

- The DF for elemental iodine increases from > 200 to >> 1000.
- Framatome's I-Catch can be designed to meet the required DF, as the DF depend on the volume of the molecular sieve, as well as the volume and surface area of the sorbent respectively. Based on large scale verification tests performed out at the JAVA PLUS facility DFs of > 10 (typically 25-50) but even up to 1000 could be achieved.



Example of an installed retrofit solution

Qualification

Scaling effects of the organic iodine retention with the sorbent section have been avoided in the I-Catch qualification process in particular by appropriate sizing of the molecular sieve section of the JAVA PLUS largescale facility.

Licensing is based on the large scale verification tests and theoretical up-scaling with its associated uncertainties is not required.



Example of a molecular sieve filled with sorbent material

References

Filtered Containment Venting System applications are installed in more than **100** PWR, BWR, CANDU, ABWR and PHWR reactors worldwide.

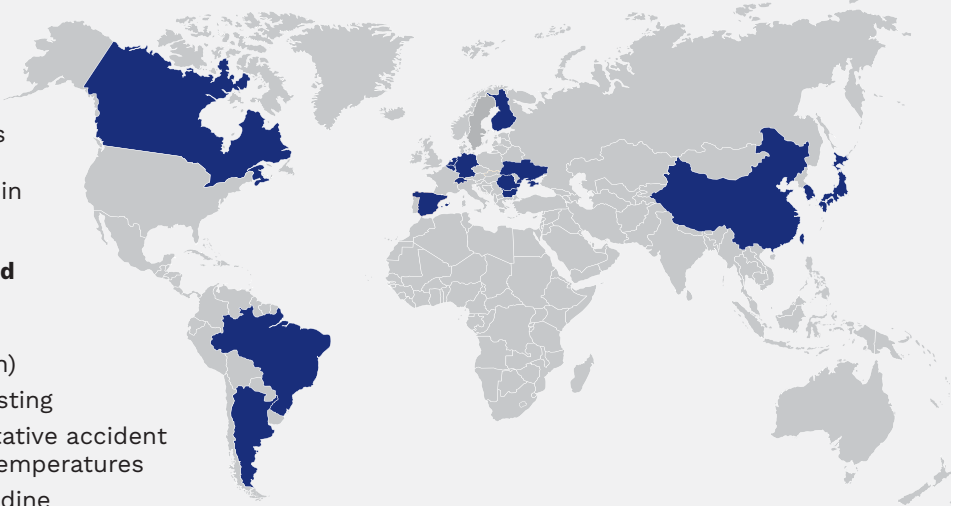
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Licensing

Framatome has broad experience on licensing and supports utilities by an extensive qualification and large scale verification data base in the discussion with regulators.

Extensive process qualification and performance verification

- Full scale process section tests (JAVA Plus Test Facility Karlstein)
- Third party and international testing
- Tests performed with representative accident aerosols at high pressure and temperatures
- Retention tests with gaseous iodine (elemental and organic iodine)
- Seismic Qualification (up to 8 g (peak) respectively 5 g (rigid body))



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