Canadian Nuclear Safety Commission | Commission canadienne de sûreté nucléaire

# Regulatory Basis for Filtered Venting in Canada

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Canada

# Regulatory Framework
## Power Reactor Licensing Strategy

***Transparent licensing decision by independent Commission***

- Periodic operating licence renewal (currently 5 years) based on
  - operating experience
  - adequacy of licensee's programs
  - proposed safety improvements
  - new requirements

- Long-term operation based on Integrated Safety Review (ISR)
  - assessment of necessary repairs and replacements
  - determination of reasonable and practical safety improvements, including measures to mitigate consequences of beyond design basis accidents
  - consideration of modern international standards and practices through cost-benefit analysis

***…Focus on continuous safety improvement***

# Regulatory Basis
## Filtered Venting Design Requirements

***Risk-informed, performance-based regulatory approach***

- Plant design shall be capable of meeting safety goals
  - Severe Core Damage Frequency: 1E-4 to 1E-5
  - Large Release Frequency: 1E-5 to 1E-6 (< 1% Cs-137)
- Containment shall maintain its role as barrier against
  - releases for a period of approximately 24 hours
  - uncontrolled releases of radioactivity after this period
- Containment system shall have design capability to
  - remove heat to preserve containment integrity
  - control hydrogen concentration to prevent deflagration
  - remove fission products, hydrogen and other combustible gases

***…Consistent with ISR approach, existing plants assessed against requirements for new builds***

# Regulatory Basis
## Filtered Venting Analysis Requirements

### *Holistic approach to maintain containment integrity*

- Design Basis
  - Deterministic requirements based on single and dual-failure criteria
    - loss of coolant accident and loss of cooling injection for containment performance analysis
  - Assessment of accident progression and safety system performance through Level 1 PRA
- Beyond Design Basis
  - Assessment of accident progression and containment performance through Level 2 PRA
    - safety goals
    - internal and external events, including seismic, fire and flood
    - other extreme weather conditions, as deemed necessary
  - Identification of safety enhancements
    - make-up capability for various coolant reservoirs
    - passive autocatalytic recombiners (PAR)
    - emergency containment filtered ventilation

***…Multiple layers of defence-in-depth***

# Regulatory Basis
## Filtered Discharge Systems

***Effectiveness of existing systems confirmed by post Fukushima Reviews***

- Design Basis
  - pressure suppression through dousing to prevent containment failure for single-unit stations
  - Emergency Filtered Air Discharge Systems (EFADS) to maintain containment below atmospheric pressure for multi-unit stations

- Beyond Design Basis
  - Emergency Containment Filtered Venting (ECFV) system design to prevent containment failure and limit radioactive releases to atmosphere
    - installed for single-unit stations
    - design options for multi-unit stations to be finalized

***…Focus on protecting the public and minimizing land contamination***

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# Emergency Filtered Containment Venting System
## Point Lepreau Nuclear Generating Station

*…Evaluated as part of long-term operation for events beyond original plant design*

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# *Emergency Filtered Containment Venting*
## *Technical Specifications*

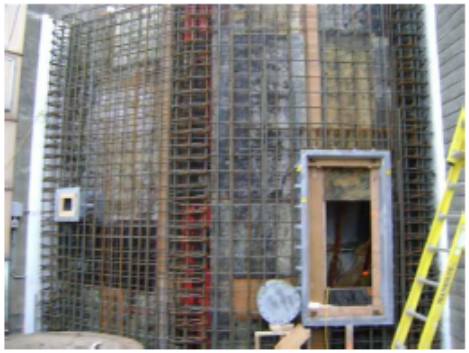
- Seismically qualified
- Manually and remotely operated (no external power)
- Design pressure of 400 kPa(g)
- Max design temperature of 200°C
- Design load of aerosols up to 300 kg
- Operate passively to relieve containment pressure and remove fission products (FP) with retention rates of
  - aerosols > 99.9%
  - molecular cesium > 99.5%
  - FPs (CsI, RbI, CsOH, RbOH) > 99.5%
  - Elemental iodine > 99%
  - Organic iodine approx. 80%

# *Emergency Filtered Containment Vent*
## *Point Lepreau Nuclear Generating Station*

**Scrubber Vessel**

# *Emergency Filtered Containment Vent*
## *Point Lepreau Nuclear Generating Station*

**Building Enclosure**



# Emergency Filtered Containment Vent
## Point Lepreau Nuclear Generating Station

### Stack Installation

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