Outline of Filter Vent Facilities

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東京電力 TEPCO

What is a filter vent?

[Purpose of installation of a filter vent]

Given the lessons learnt from the accident at Fukushima Daiichi Nuclear Power Station, TEPCO is currently reinforcing water injection and cooling functions for reactors. A filter vent is installed so that the reliability of these functions can be enhanced and so that the influence of radioactive materials can be reduced as much as possible even in case these functions should fail.

[Roles of a filter vent]

- **A vent for core damage prevention**

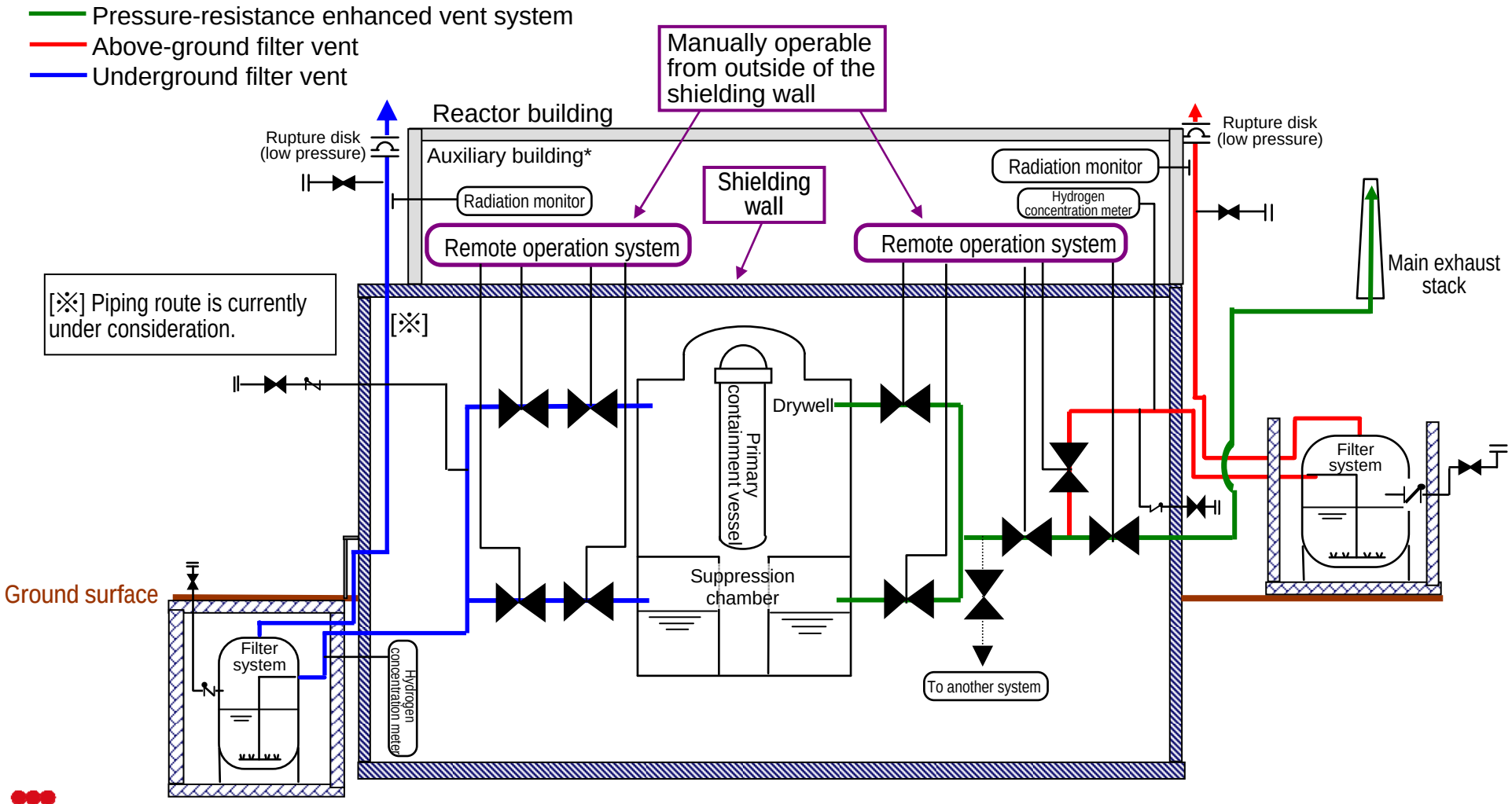
  Upon occurrence of the accident, a filter vent depressurizes the containment vessel for reliable achievement of depressurization of the reactor and low-pressure water injection into the reactor, and releases heat to atmosphere from inside the reactor. Thus, a filter vent can more reliably ensure that **containment of radioactive materials through core damage prevention is achieved**.

- **A vent for preventing soil contamination and prolonged evacuation even in case of core damage**

  Further, even in case of a severe accident involving core damage, a filter vent prevents direct leakage of radioactive materials from the containment vessel and **removes cesium etc., thereby preventing extensive soil contamination and prolongation of the evacuation period.**

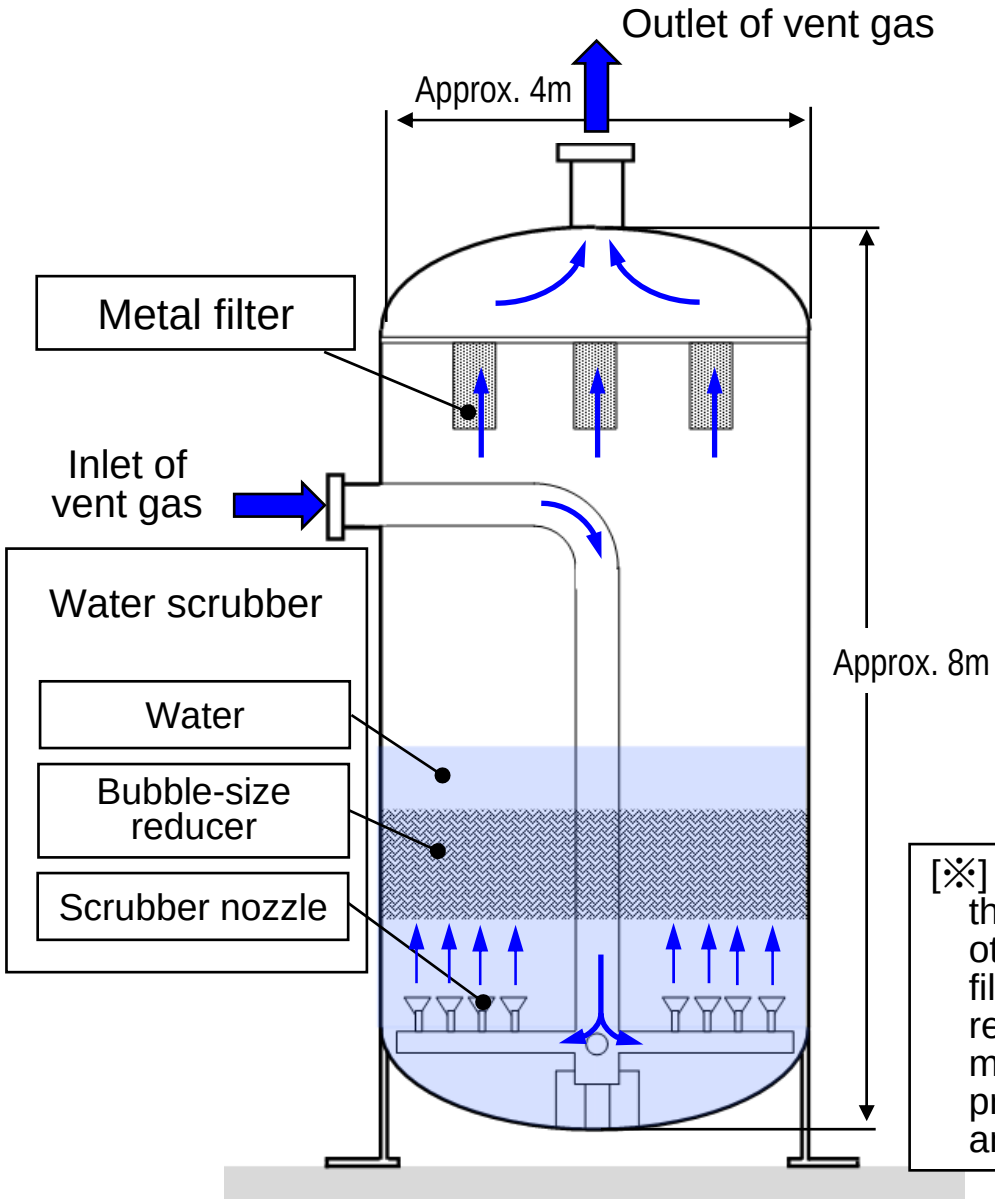
Outline of above-ground and underground filter vent equipment

- Exhaust gas is released from the roof of the reactor building after radioactive materials in the gas are reduced by means of a filter when passing through an exhaust line extended from the pressure-resistance enhanced vent system (the primary containment vessel in the case of underground vent equipment) installed at the time of initial construction.
- Valves requiring to be operated are made operable from outside of the shielding wall.
- The equipment is not shared with other plants (plus other systems and apparatuses in the case of underground vent equipment) so that the gas can pass through the filter without fail.



* The auxiliary building of a reactor building is a facility adjacent to the secondary containment facility with a shielding wall therebetween.

Structure of the filter system



Metal filter

○ Radioactive fine particles are captured when gas passes through the metal filter.

Water scrubber

○ Radioactive fine particles are captured when gas passes through water.

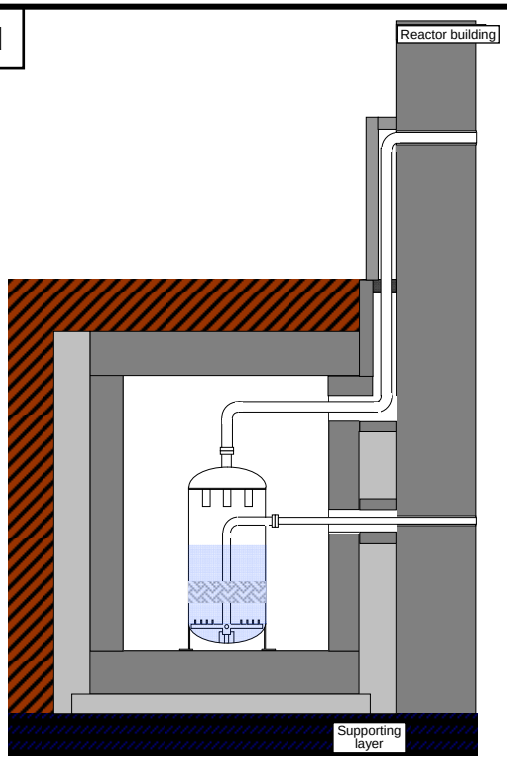
○ Radioactive materials are efficiently captured by having gas forcefully sprayed through scrubber nozzles and having bubbles reduced in size by the bubble-size reducer.

Removes 99.9% or more of particulate radioactive materials (radioactive cesium)

[※] The capabilities of the above-ground filter vent and the underground filter vent are equivalent to each other, and either the above-ground or underground filter vent facility will be designed to satisfy the requirements specified in the “standard evaluation method concerning evaluation of the effectiveness of preventive measures against severer core damage and containment vessel failure (examination guide)”.

Above-ground and underground filter vent equipment

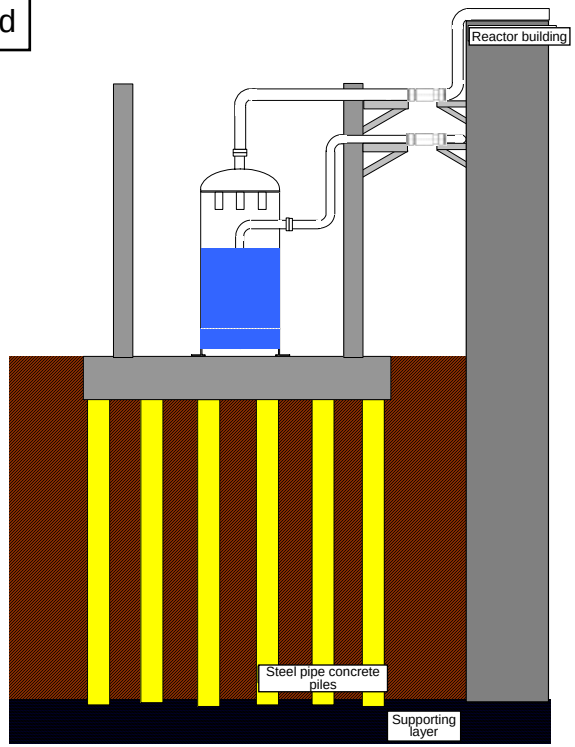
Underground



Characteristics

- Built on the same supporting rock as the reactor building is.
- Relative displacement between the buildings is absorbed by elastic deformation of the piping.

Above-ground



Characteristics

- Built on the same supporting rock as the reactor building is, with the steel pipe concrete piles between itself and the supporting rock.
- Relative displacement between the buildings is absorbed by an expansible joint (capable of absorbing horizontal and vertical displacement of ±30cm).

Evaluation of radiation exposure and release amounts

(1) In venting for reactor core damage prevention
Radiation dose at the site border: Approx. 4.2×10^{-2}mSv (The threshold value in the examination guide: 5mSv or less)

(2) In venting for containment vessel damage prevention (after reactor core damage)
Release amount of cesium-137: Approx. 2.5×10^{-3}TBq (TBq=10^{12}Bq) (The threshold value in the examination guide: 100TBq or less)

Evaluation of radiation exposure and release amounts at the site border

The "examination guide concerning evaluation of the effectiveness of preventive measures against severe core damage and containment vessel failure of commercial power plant reactors" stipulates the following requirements.

[Evaluation of the effectiveness of preventive measures against core damage]

- In evaluation of the effectiveness of an accident sequence group using a containment vessel pressure relief device, effective doses at the site border is evaluated for confirmation that there would be no risk of substantial exposure of the surrounding communities to radiation (exposure is **required to be approx. 5mSv or less in case of an accident**).

- Accident sequence groups that must be assumed (in the case of BWR)
  - Loss of high-pressure/low pressure water injection function
  - Loss of high-pressure water injection/depressurization function
  - Loss of all AC power
  - Loss of decay heat removal function
  - Loss of reactor shutdown function
  - Loss of water injection function during LOCA, etc.

Internal and external radiation exposure due to released radioactive materials was evaluated to be approx. 0.042mSv at the site border.

[Evaluation of the effectiveness of preventive measures against containment vessel failure]

- In order to verify that the measures are "capable of minimizing the influence on the environment, including the environmental contamination from radioactive materials", it shall be verified that the release amount of **Cs-137 would be lower than 100TBq** under postulated containment vessel failure modes.

- Containment vessel failure mode that must be postulated
  - Static loads by internal pressure or temperature (damage by over-pressurizing or overheating of a containment vessel)
  - High pressure melt ejection/direct heating of containment vessel atmosphere
  - Molten fuel and coolant interaction outside the reactor pressure vessel
  - Hydrogen burning
  - Direct contact with the containment vessel (shell attack)
  - Molten core and concrete interaction (MCCI), etc.

The total release amount of cesium 137 was evaluated to be approx. 0.0025TBq, which is below 100TBq and indicates that soil contamination outside of the station site would be substantially prevented.