Implementation of Radioactive Material Dispersion Impact Assessment at Kashiwazaki-Kariwa Nuclear Power Station

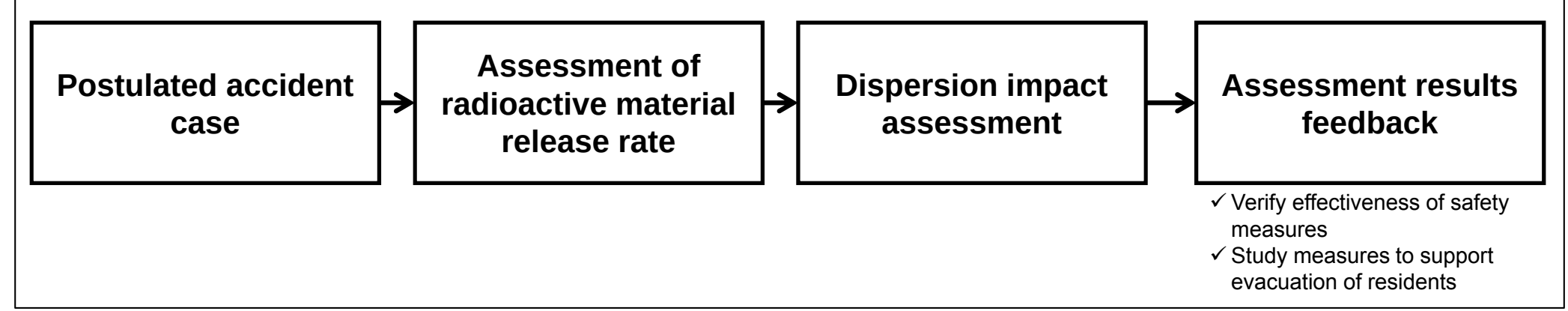
September 10, 2015

Tokyo Electric Power Company

Radioactive Material Dispersion Impact Assessment Conducted by TEPCO

- Out of regret as the main party responsible for the accident at the Fukushima Daiichi Nuclear Power Station, TEPCO has continued to advance improvements in our effort to enhance the safety of the Kashiwazaki-Kariwa Nuclear Power Station.
- Improvements have been implemented so as to avoid PCV venting by alternative cooling facilities, to extend venting time based on operational improvements, and to install iodine filters.
- To further improve safety in the future, we will continue our constant efforts, and, if an accident should occur, we intend to provide the maximum support for evacuation to ensure the safety of all residents.
- Accordingly, an assessment is to be conducted of the impact from radioactive material dispersion to achieve the following objectives.
  - ✓ To verify the effectiveness of safety measures adopted at the Kashiwazaki-Kariwa Nuclear Power Station
  - ✓ To study measures to support the evacuation of residents
- A radioactive material dispersion impact assessment is to be conducted in Niigata Prefecture as well.

Flow diagram of assessment



Accident Cases Assumed for TEPCO's Dispersion Impact Assessment

■ TEPCO will conduct dispersion impact assessments for the following five cases.

✓ Currently, the venting after 38 hours scenario is being assessed as part of the Nuclear Regulation Authority's regulatory licensing review (①) ⇒ The venting commencement time was extended from 25 hours → 38 hours based on a revision of the assessment conditions for ②, taking into account further improvements in safety related to safety measure equipment, enhancements in workforce skills as a result of training, and operational improvements

✓4 Niigata Prefecture assessment cases (June 6, 2014 Niigata Prefecture announcement: ②～⑤)

Case	Safety functions			Pressure vessel damage	Containment vessel damage	Time until release commenced	Regulatory licensing review	Niigata Prefecture	TEPCO
	Cooling water injection		FV						
	Design basis-response facilities	Severe accident response facilities							
① Venting after 38 hours scenario (regulatory licensing review scenario: ② assessment conditions revised)	×	○ Permanent equipment	○	No	No	38h	◌	–	○
② Venting after 25 hours venting scenario (Major LOCA※1＋loss of all emergency cooling system functionality＋station black out)	×	○ Permanent equipment	○	No	No	25h	—※2	○	○
③ Venting after 18 hours venting scenario (Loss of high and low pressure functionality ＋station black out＋ inability of fire engines to inject cooling water into reactor)	×	○ Fire engine	○	Yes	No	18h	–	○	○
④ Venting after 6 hours case (no scenario)	×	×	○	Yes	No	6h	–	○	○

＜Reference＞ ※1: LOCA: Loss-of-coolant accident, ※2: Previous scenario at time of establishment permit application

⑤【Reference case】 (Case where cooling water injection function is not taken into account and the PCV is damaged such that radioactive material is released without passing through a filtered vent.)	×	×	×	Yes	Yes	8h	–	○	○

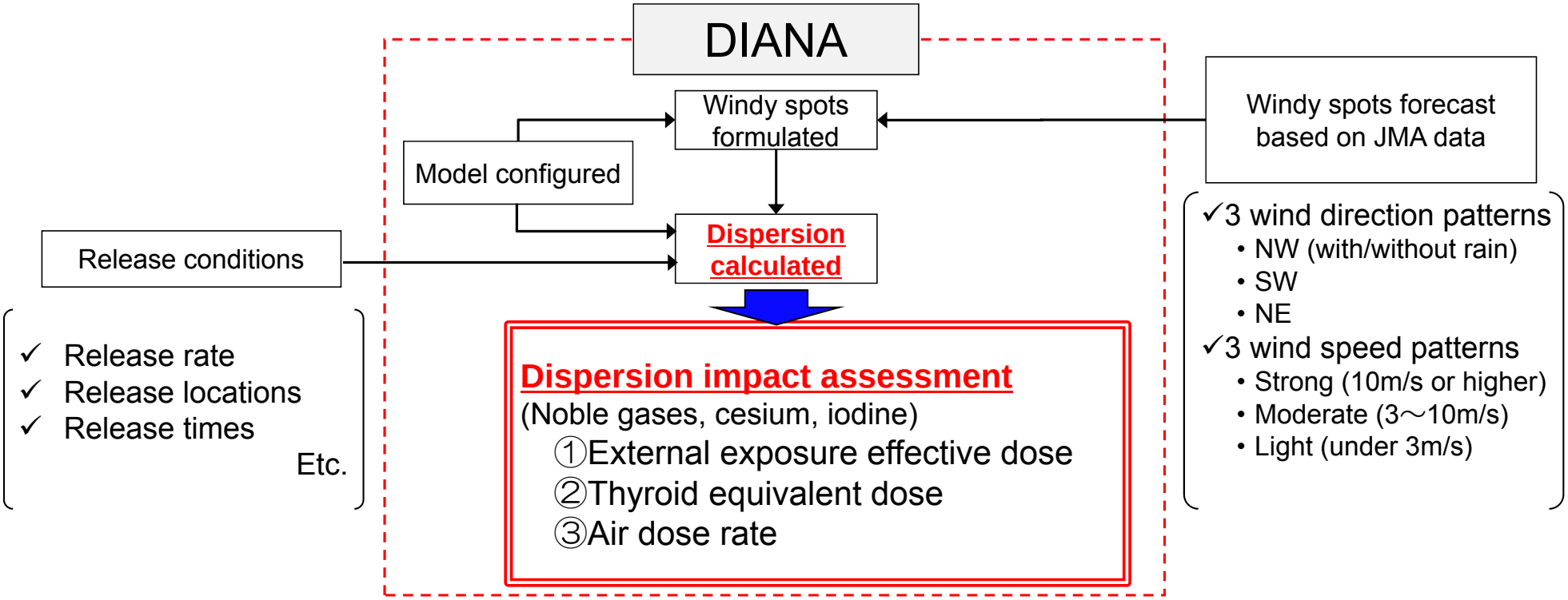
Overview of TEPCO Dispersion Impact Assessment

■ TEPCO's proprietary DIANA system is used to conduct assessments of the impact of radioactive material dispersions, and effective assessments are conducted taking into account evacuation of local residents and refuge indoors etc.

What is DIANA?

■DIANA is a system for calculating the dispersion of radioactive materials based on given input data.

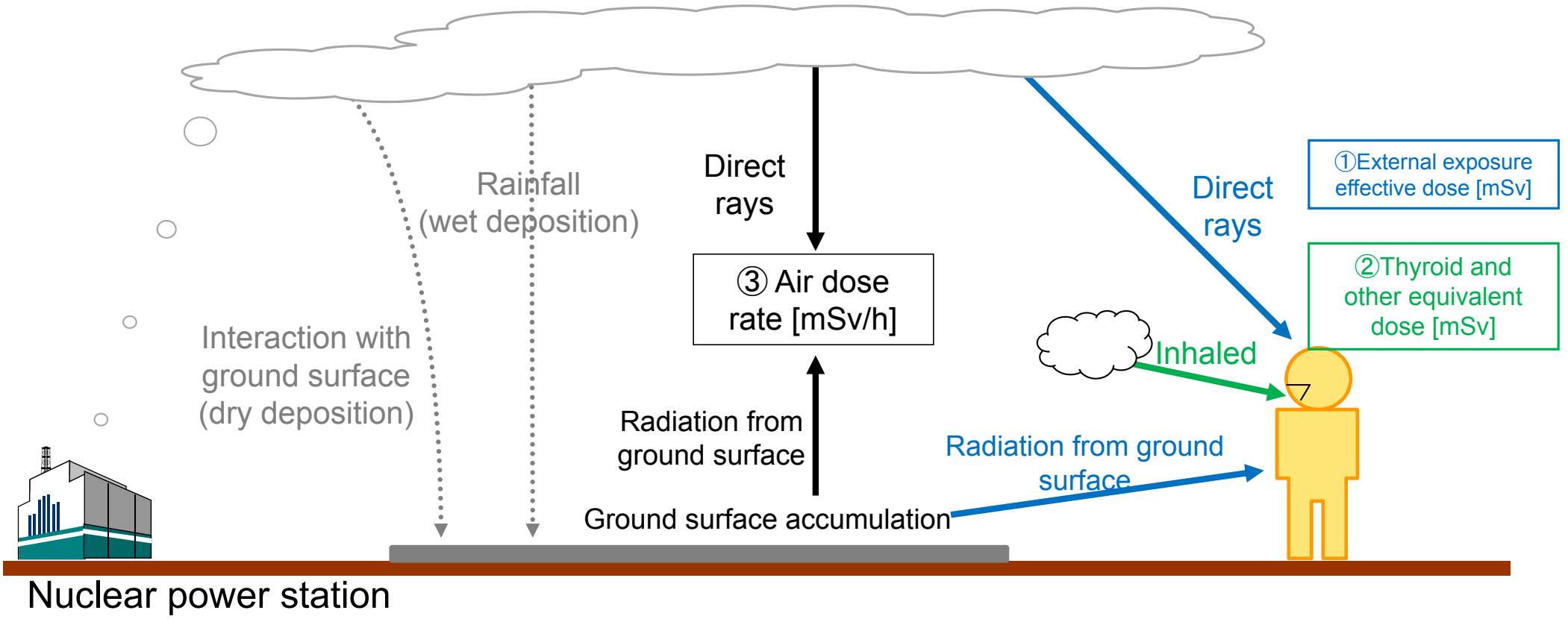
■The calculations allow for a variety of operations to be performed and radiation levels (rates) to be output for each chronological point



DIANA(Dose Information Analysis at Nuclear Accident): System for predicting and assessing radiation levels around nuclear power stations

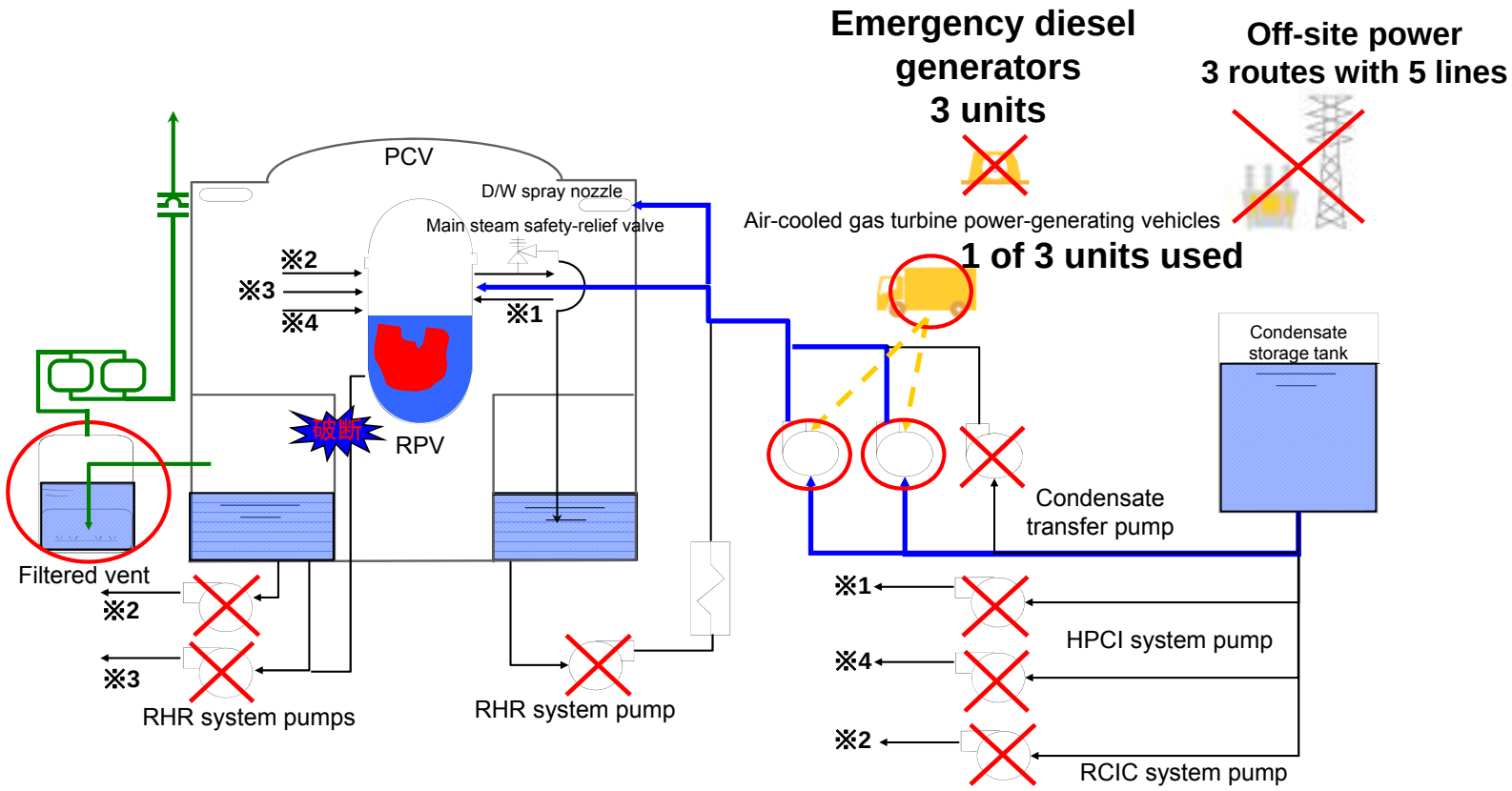
(Reference 1) Data Computed in Dispersion Impact Assessment

■ Based on input release and meteorological conditions, the DIANA system for the dispersion impact assessment computes the effective dose, thyroid and other such equivalent dose, and the air dose rate due to radiation from direct rays and ground surface that originates from radioactive materials released during an accident.



①**External exposure effective dose [mSv]**: radiation external exposure from direct rays and ground surface
②**Thyroid and other equivalent dose [mSv]**: internal exposure through inhalation
③**Air dose rate [mSv/h]**: radiation dose from direct rays and ground surface per unit of time

(Reference 2) Venting After ①38 Hours and ②25 Hours Scenarios



【Preconditions for cases ① & ②: Following states are assumed to continue unconditionally】

- A incident occurs in which a large quantity of water inside the reactor is lost
- All facilities for injecting cooling water into the reactor are unusable during the accident (however, some facilities inside the building are able to be used to inject cooling water into the reactor)

⇒ **②Venting after 25 hours**

（Previous scenario at time of establishment permit application）

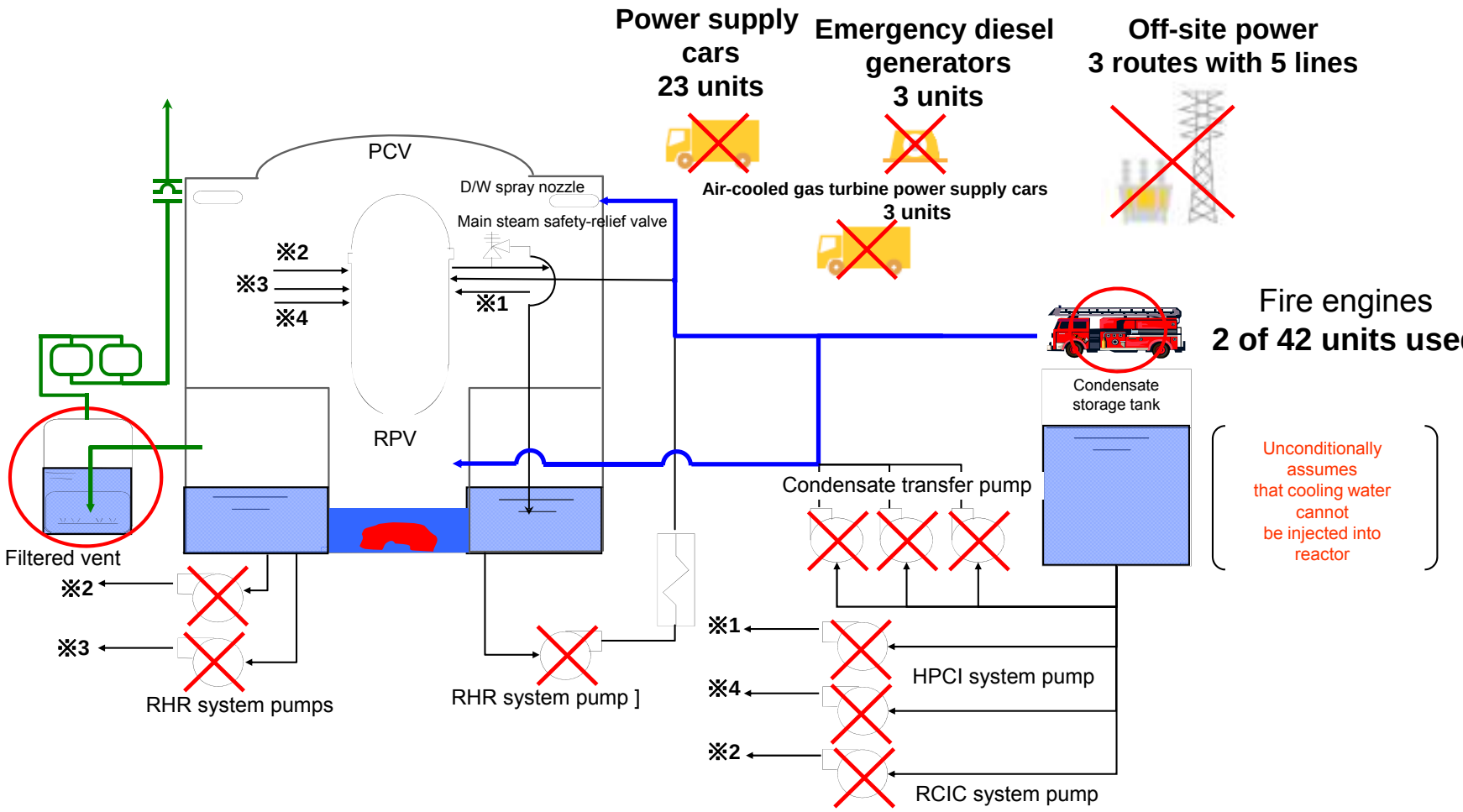
Operational improvements and enhanced skills due to training

- Start of receiving power from gas-turbine generator lowered from 120 minutes ⇒ 70 minutes
- Quantity of water supplied from reservoir to condensate storage tank increased from 90m^3/h ⇒ 130m^3/h etc.

⇒ **①Venting after 38 hours**

(Regulatory licensing review scenario)

(Reference 2) ③Venting After 18 Hours Scenario

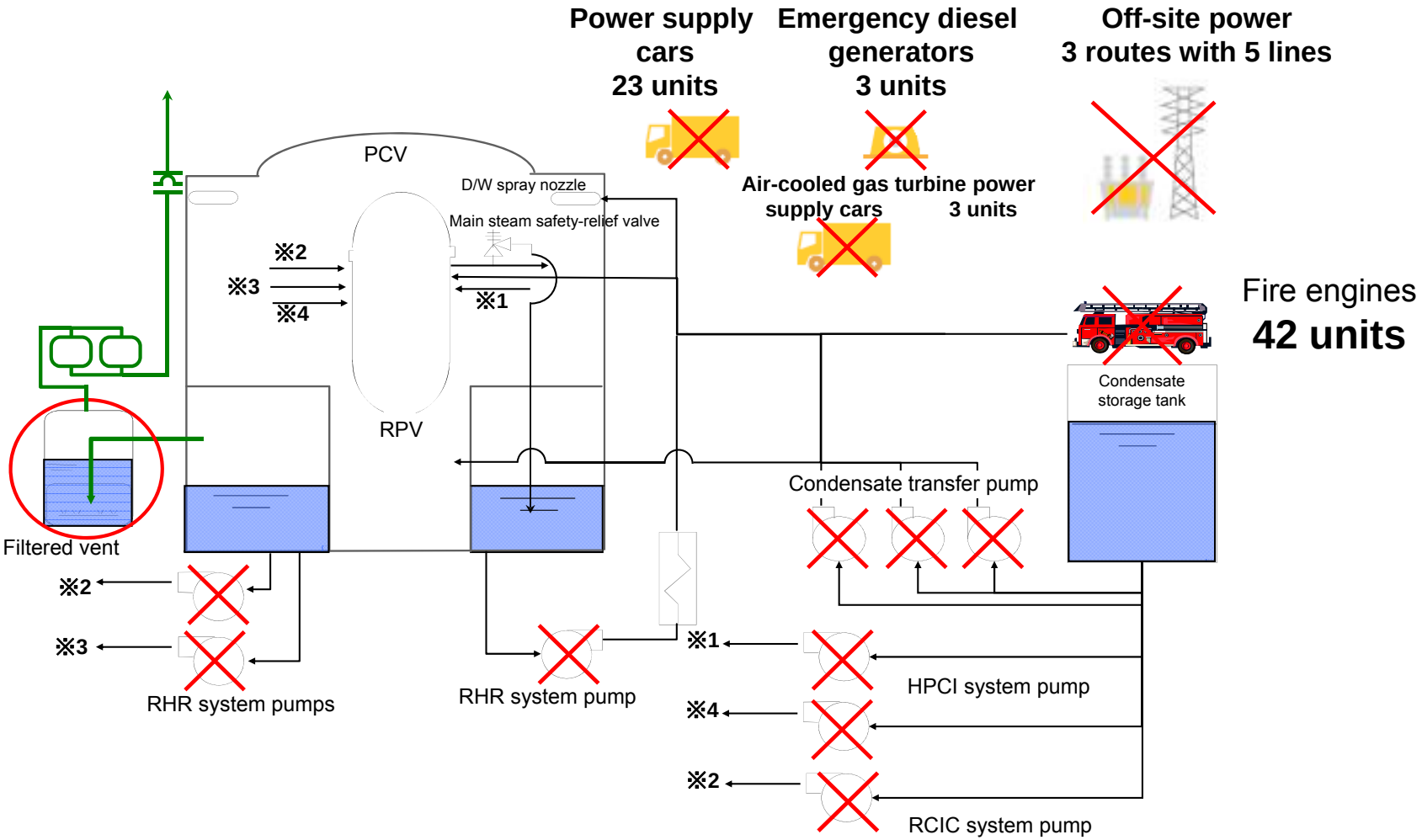


【Preconditions for case ③: Following states are assumed to continue unconditionally】

- All facilities inside the building for injecting cooling water into the reactor are unusable
- Fire engines unable to inject cooling water into reactor (cooling water can be injected only into the PCV)

③Venting after 18 hours

(Reference 2) ④ Venting After 6 Hours Case: No Scenario

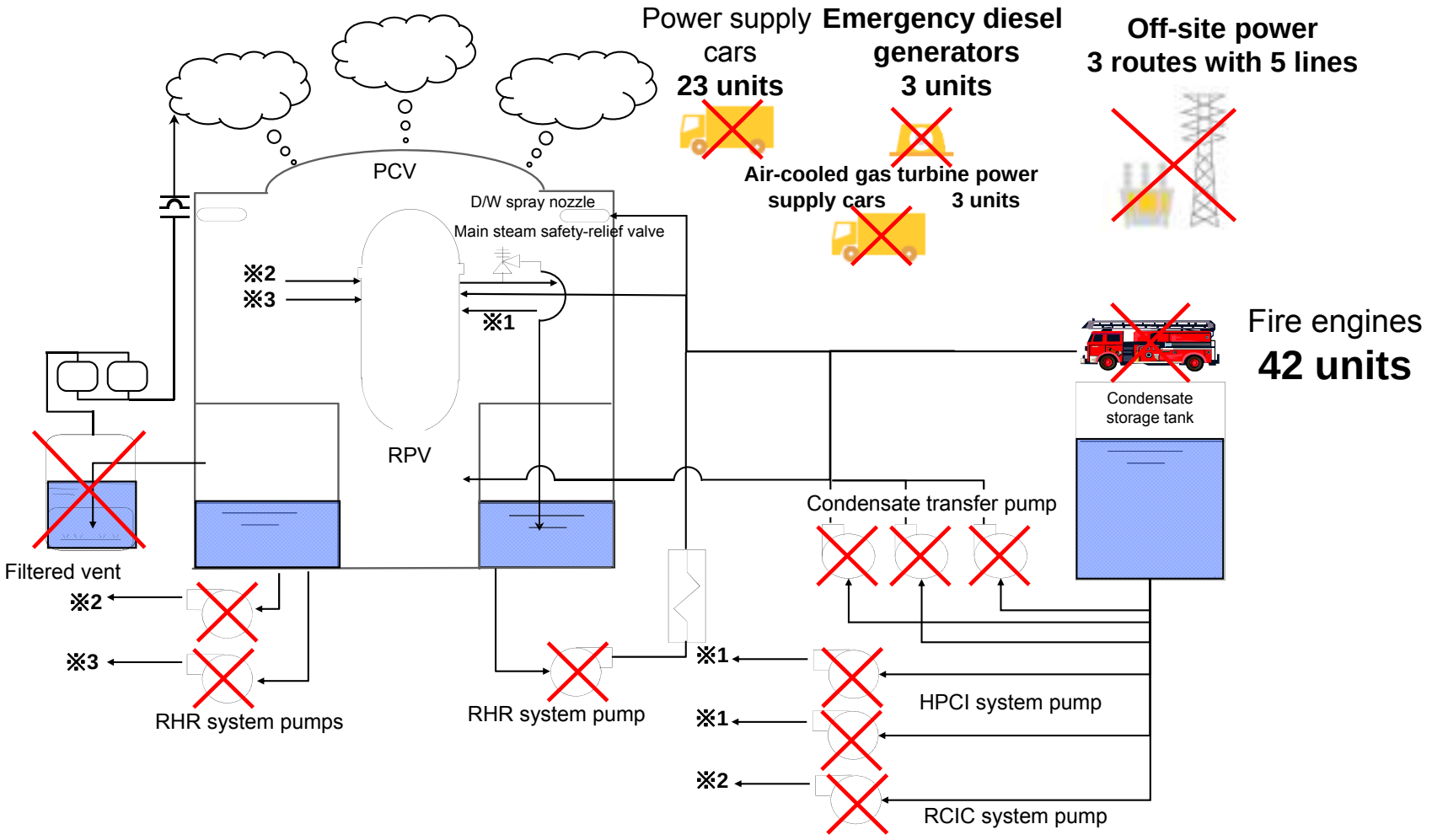


【Preconditions for case ④: Following states are assumed to continue unconditionally】

- Soundness of PCV forcibly maintained
- Only FV usable

④Venting after 6 hours

(Reference 2) ⑤ Reference Case



【Preconditions for case ⑤: Following states are assumed to continue unconditionally】

➢All facilities inside the power station are unusable

⑤PCV damage after 8 hours