

Relationship between instantaneous voltage drops at RIKEN and influence on transmission power lines

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A stable supply of electric power is very important for accelerator facilities. Power outages and momentary voltage drops are unwelcome not only because they can shut down equipment but also because they can damage it. In addition, power problems occurring during the delivery of high-intensity, high-energy ion beams to the user are serious because they can cause a shift in the beam trajectory and lead to serious accelerator failures. The Nishina Center has a gas-turbine-type cogeneration system (CGS)¹⁾ in addition to the power supply an external power company. If there is a risk of a lightning strike, the CGS is activated to power the chillers that use liquid He. Information on lightning strike hazard is provided by the power company, which can be found on the internet. In this study, we report the correlation between the instantaneous voltage drops at RIKEN and influence on transmission power lines. Data on the influence on the power lines were provided by TEPCO Power Grid and data on the instantaneous voltage drop at RIKEN were provided by RIKEN's Facilities Division.

Electricity is generated by nuclear, thermal, and hydroelectric power plants and transmitted via high-voltage transmission lines. These power plants are located far from RIKEN. The transmission lines from these power plants are networked to achieve a stable power supply. Transmission from the power plants is transformed in the sequence 500 kV, 275 kV, 154 kV,

66 kV, and 22 kV along the transmission path, and wired to various residential and factory areas. The voltage of transmission line drawn into a factory or a commercial facility is determined by the electric power used by the facility. Electricity delivered to RIKEN at 66 kV from the power company, converted to 6600 V at a substation on site, and then transformed to 400 V and 200 V at a voltage transformer in the center. Table 1 shows the number of instantaneous voltage drops at RIKEN from 2017 to 2022, categorized according to the influence on power lines to each transmission line. Instantaneous voltage drops at RIKEN due to lightning strikes on the 500 kV power lines account for approximately 60% of the total, and approximately 79% if statistics are taken from lightning strikes alone. Much of the 500 kV power line network is located close to the power plant and far from RIKEN. Preparation for instantaneous voltage drops due to lightning strikes requires attention to not only the nearby lightning advisories, but also to the lightning strikes occurring in the neighboring prefectures.

Reference

1) T. Fujinawa *et al.*, J. Part. Accel. Soc. Jpn. **8**, 18 (2011).

Table 1. The number of instantaneous voltage drops at RIKEN from 2017 to 2022, categorized the influence on power lines to each transmission line.

Transmission line voltage	Lightning strike	Accident	Other
500 kV	15	1	
275 kV	1	1	
66 kV	1		
unknown	2	2	2

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