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Vulnerabilities in thermal power systems: dust-loading tests for air filters with volcanic ash

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We experimented with air filters to evaluate ash-fall impact on thermal power systems. Because, the electricity in Japan highly depends on thermal power plants after the Fukushima nuclear accident. The most of the thermal power plants use gas turbines, which can easily be damaged by inhalation of ash as in the case of jet engines of aircrafts. Although there is an air filter system in the thermal power plants, it may be clogged up by ash and partially or totally blocking the air flows into the gas turbines. We carried out the dust-loading test for pre-filter, middle-effective filter and combined filters with various spatial density of 3-phi-diametr volcanic ash in 70, 700, 7000 mg/m^3 under inhalation flux in 56 m^3/min. The middle-effective and combined filters were clogged up from 1 hour 30 minutes to 1 minute 40 seconds and from 3 hours to 3 minutes 30 seconds, respectively. Although the pre-filter took much longer times for clogging, half of the ash passed the pre-filter.

Keywords: volcanic ash, air filters, dust loading test, thermal power system