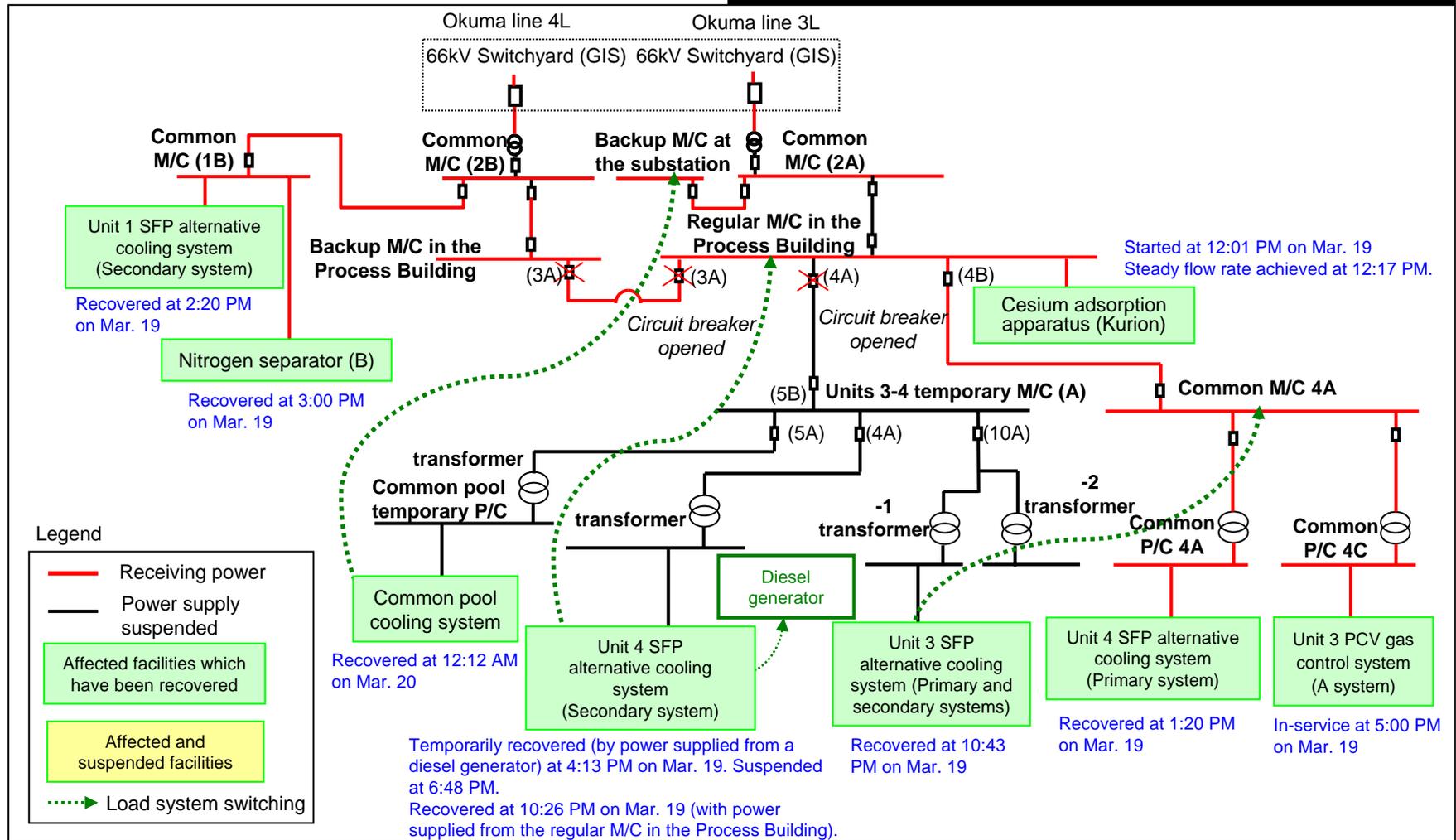


Progress of Investigation of Power Supply Facilities Failure at Fukushima Daiichi Nuclear Power Station

< Reference >
 March 25, 2013
 Tokyo Electric Power Company

At around 6:57 PM on March 18, 2013, there was an incident where the power supply facilities in the Main Anti-earthquake Building at Fukushima Daiichi Nuclear Power Station momentarily stopped. Upon investigation, the regular M/C (Metal-clad switch gear) in the Process Building, common M/C4A and Units 3-4 temporary M/C (A) were found to be stopped due to the incident.

Power supply system structure of the affected facilities



Analysis of the Power Supply Facilities Failure

[Power supply system structure]

Since power receiving cable renovation for the regular M/C in the Process Building (as part of Tsunami countermeasures) was ongoing at the time of the incident, the regular M/C was temporarily receiving power from the backup M/C in the Process Building.

[Analysis]

1. The ground relay in B system operated

: The failure is assumed to have occurred in B system and high voltage power supply system.

2. The circuit breakers of the regular M/C (3A) and (4A) in the Process Building and the backup M/C in the Process Building (3A) tripped due to overcurrent.

: The failure is assumed to have occurred in the downstream of the regular M/C in the Process Building (4A).

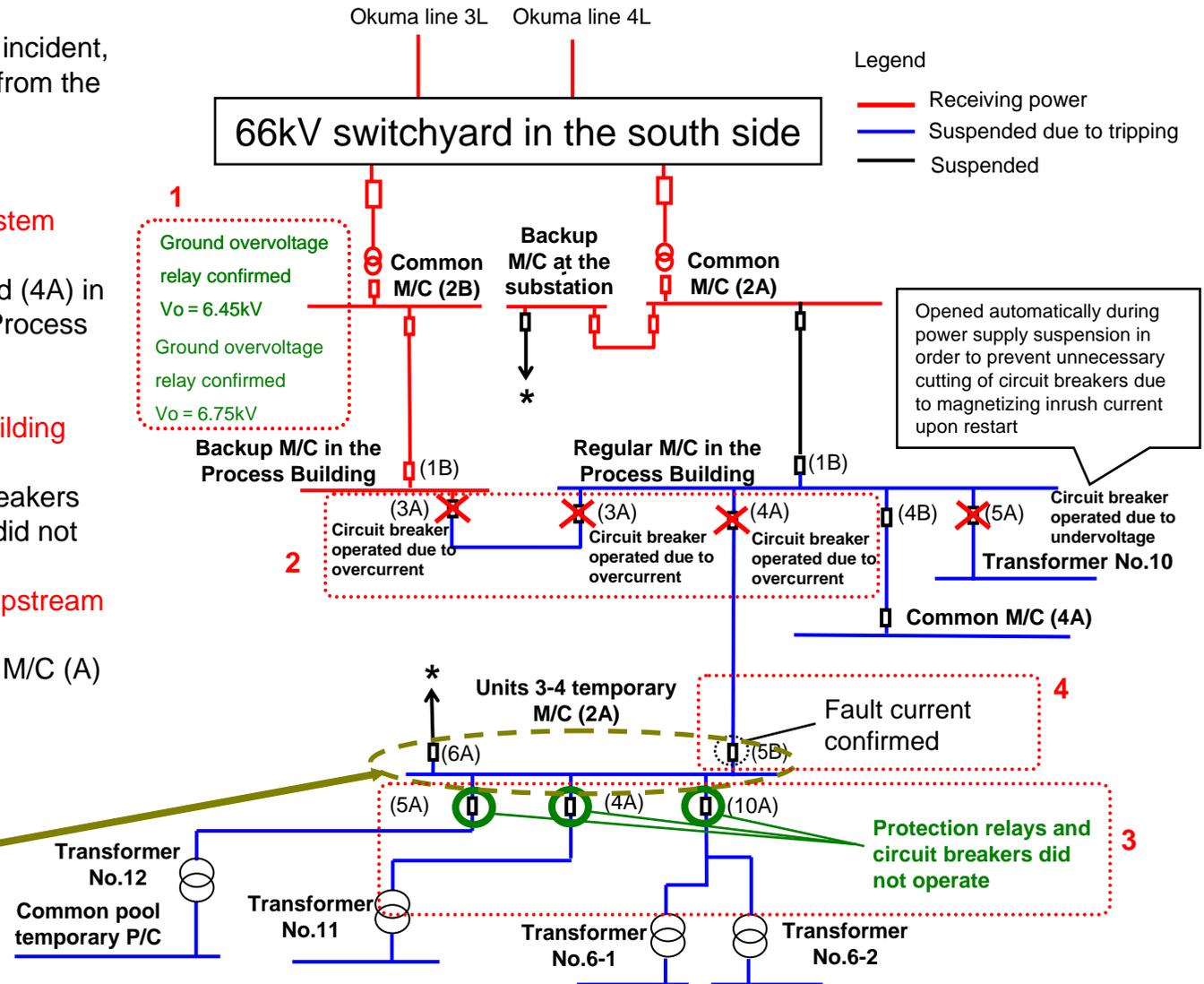
3. The ground directional relays and the circuit breakers of Units 3-4 temporary M/C (4A), (5A) and (10A) did not operate.

: The failure is assumed to have occurred in the upstream of the load systems of Units 3-4 temporary M/C.

4. Fault current was found in Units 3-4 temporary M/C (A) (5B).

: The failure is assumed to have occurred in the downstream of Units 3-4 temporary M/C (A) (5B).

The failure is assumed to have occurred in Units 3-4 temporary M/C (A).



Appearance of Units 3-4 Temporary M/C (A) (1)



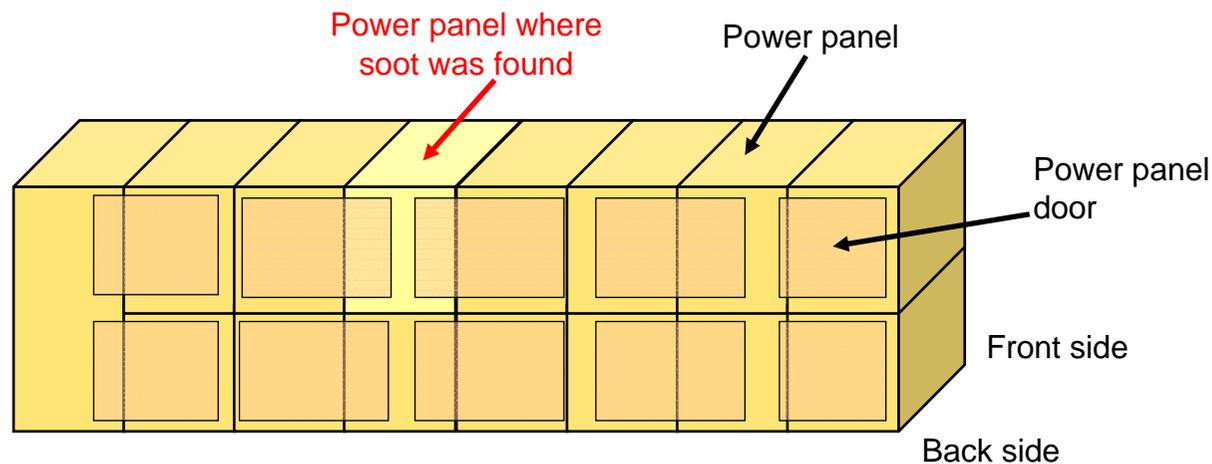
Full view of Units 3-4 temporary M/C (A)
(Units 3-4 switchyard)



Appearance of Units 3-4 temporary M/C



Inspection of Units 3-4 temporary M/C



Units 3-4 temporary M/C (A) power panels and their doors



Units 3-4 temporary M/C with the power panel door opened (below the power panel where soot was found)

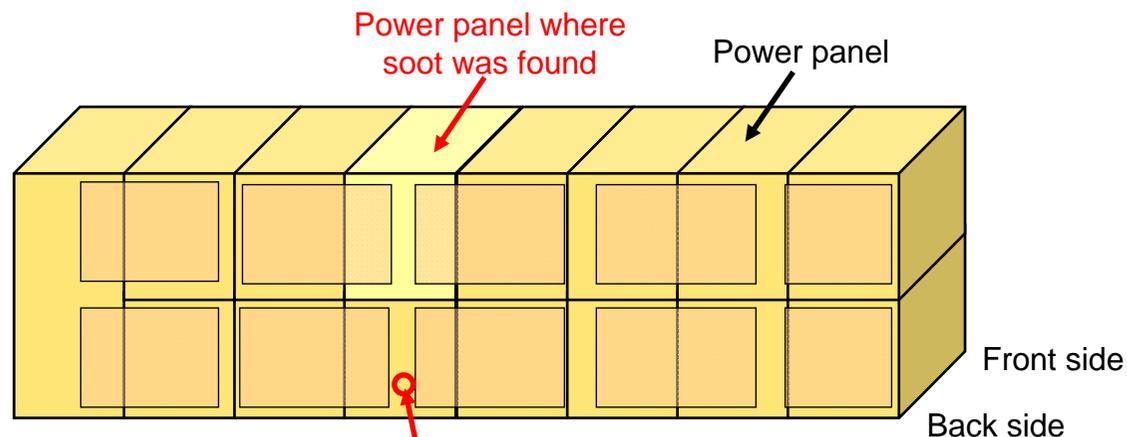
Appearance of Units 3-4 Temporary M/C (A) (2)



Soot found on the instrument current transformer (terminal) of Units 3-4 temporary M/C



Soot found on the walls of Units 3-4 temporary M/C



Location where a dead small animal (mouse) was found (on the power panel floor underneath the power panel where soot was found)

Units 3-4 temporary M/C (A) power panels and their doors



A small animal (mouse) found dead (Photo taken from above)



Inspection Results of Units 3-4 Temporary M/C (A) Compared to Sound Condition

Regular inspection

Visual inspection (check for abnormalities, strange sound/smell from the outside of the power panel) is performed once a week during patrol. No problem was found at a visual inspection performed in the morning of March 18, 2013.

Results of inspection of the inside of the power panels after the power supply facilities failure

No problem was found with units other than 5A where short circuit occurred.

Inside the power panel (5A) after short circuit occurred

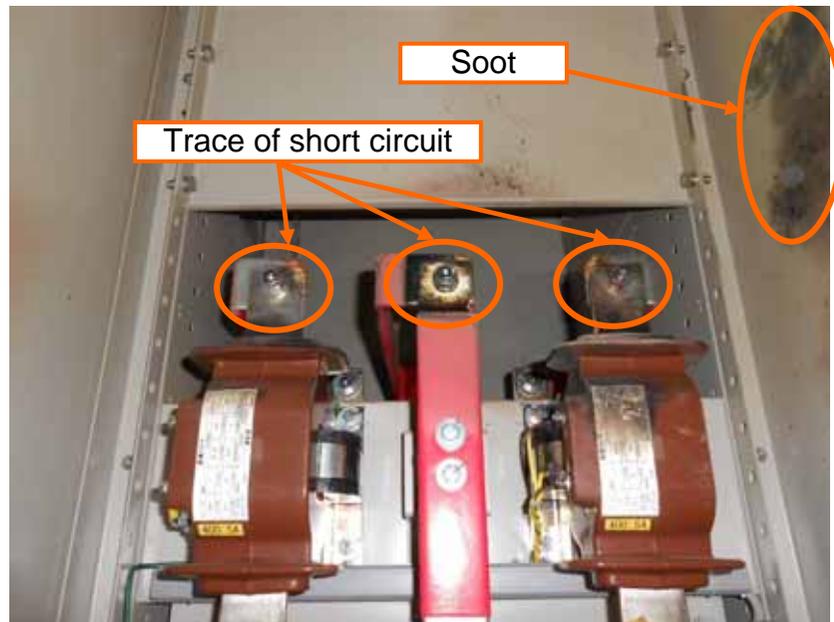


Photo 1: Inside the power panel after short circuit occurred

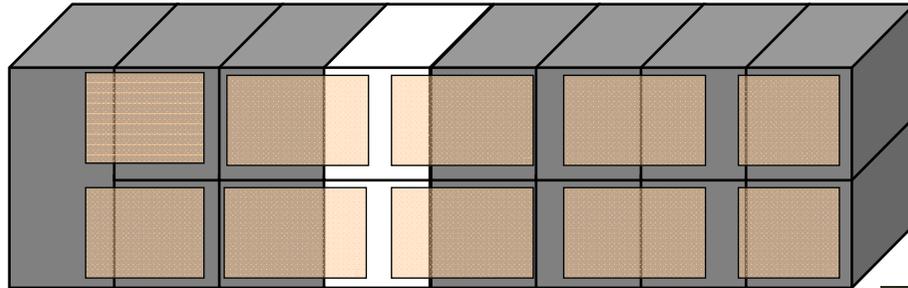
Sound condition of power panel (6A)



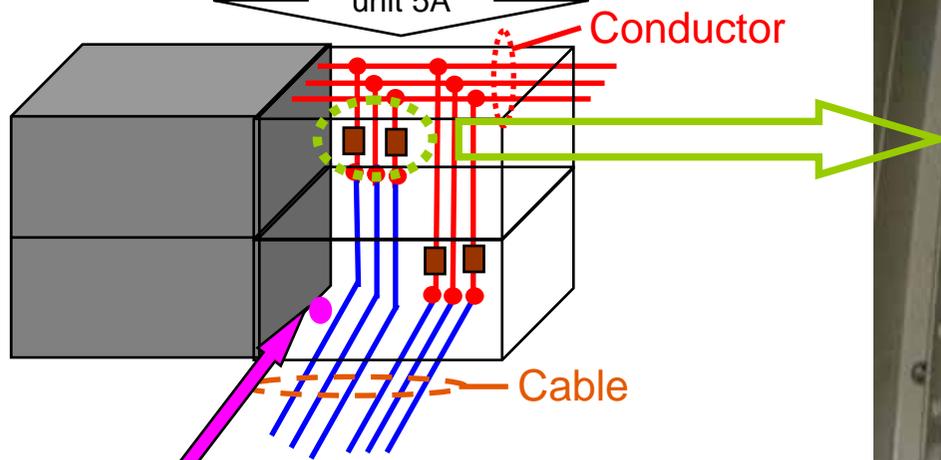
Photo 2: Sound condition of power panel

Cause of Phase Fault Occurred in Units 3-4 Temporary M/C (A)

Back side of Units 3-4 temporary M/C (A)
and the power panel doors



Enlarged
image of
unit 5A



Dead small animal
(mouse)

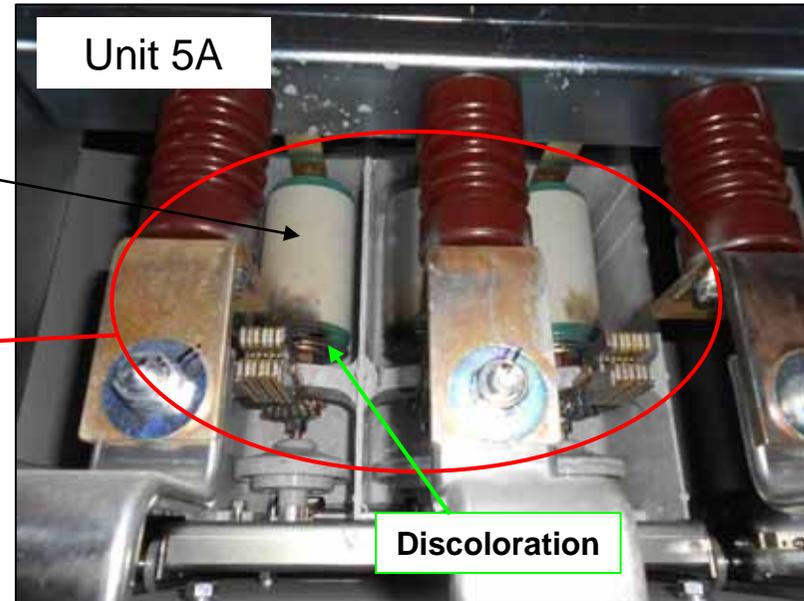
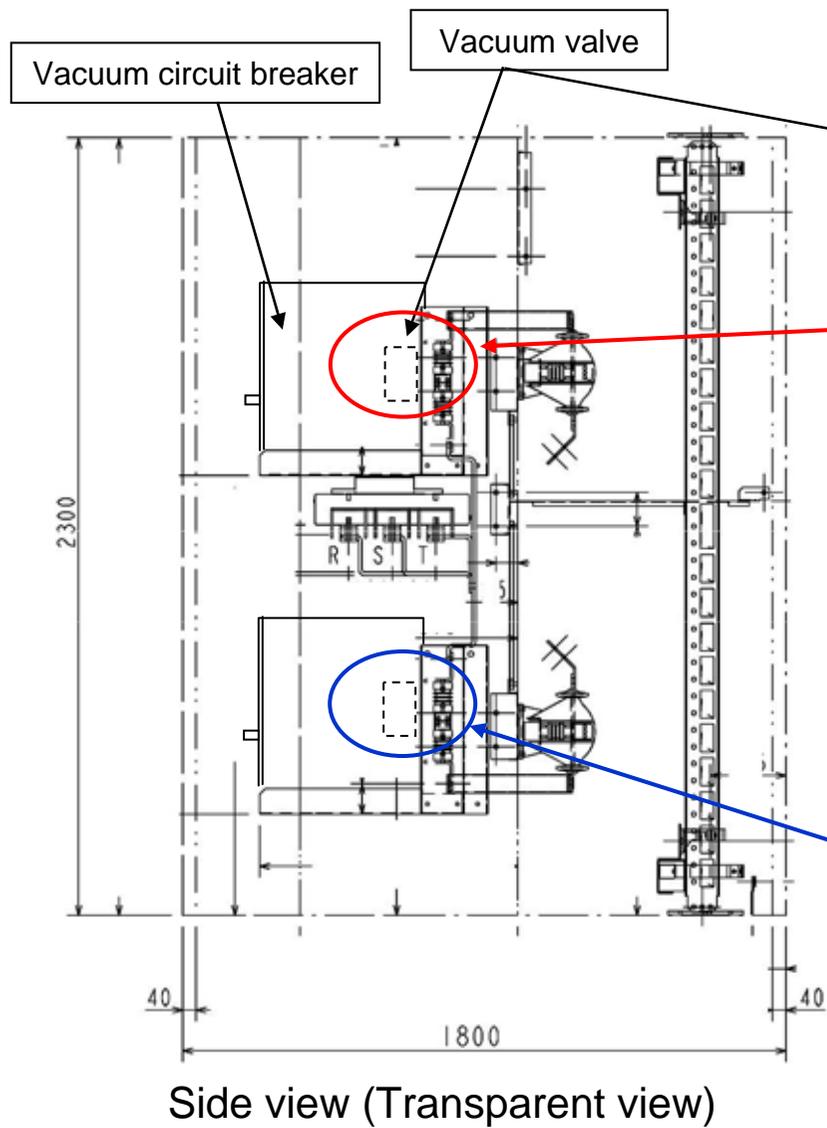
[Site investigation results]

- A trace of short circuit was found on the conductor in the back of Units 3-4 temporary M/C (A) (5A). Also, a dead small animal (mouse) with an electric mark was found on the floor of the same unit.
- No trace of short circuit or foreign substance was found in other units in Units 3-4 temporary M/C (A) and the main line.



A small animal (mouse, 25cm long) getting close to the conductor generated an arc leading to a phase fault which developed into a three-phase short circuit.

Discoloration of Units 3-4 M/C (A) Circuit Breakers



Traces of Short Circuit Found in Units 3-4 Temporary M/C (A)

Traces of short circuit found near the terminal of unit 5A



Traces of short circuit found on the top surface of unit 5A



Traces of short circuit found on the side surface of unit 5A

(Legend)

 Trace of short circuit

Electric Mark Found on the Dead Small Animal

A dead small animal (mouse (photo 1)) was found on the floor of Units 3-4 temporary M/C (A) unit 5A. An electric mark (photo 2) was found on its

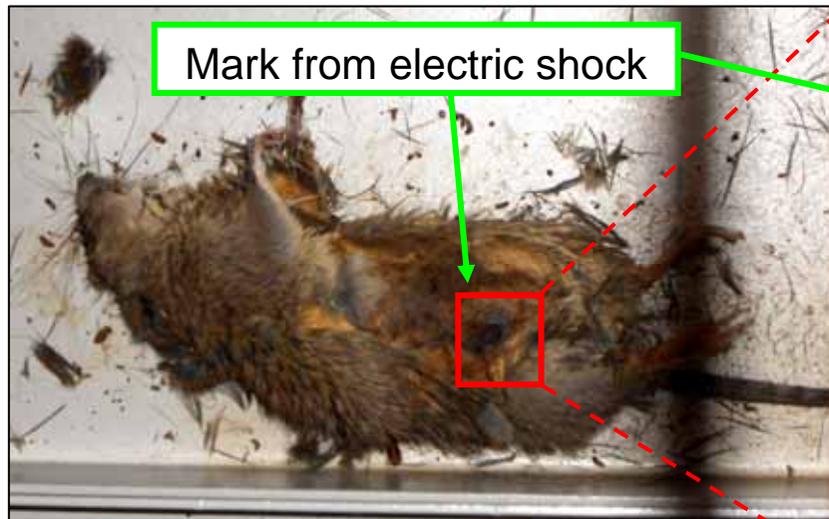


Photo 1: Dead small animal (mouse)
found in unit 5A



Photo 2: Enlarged image of the electric mark

Condition of the Opening of Units 3-4 Temporary M/C Container

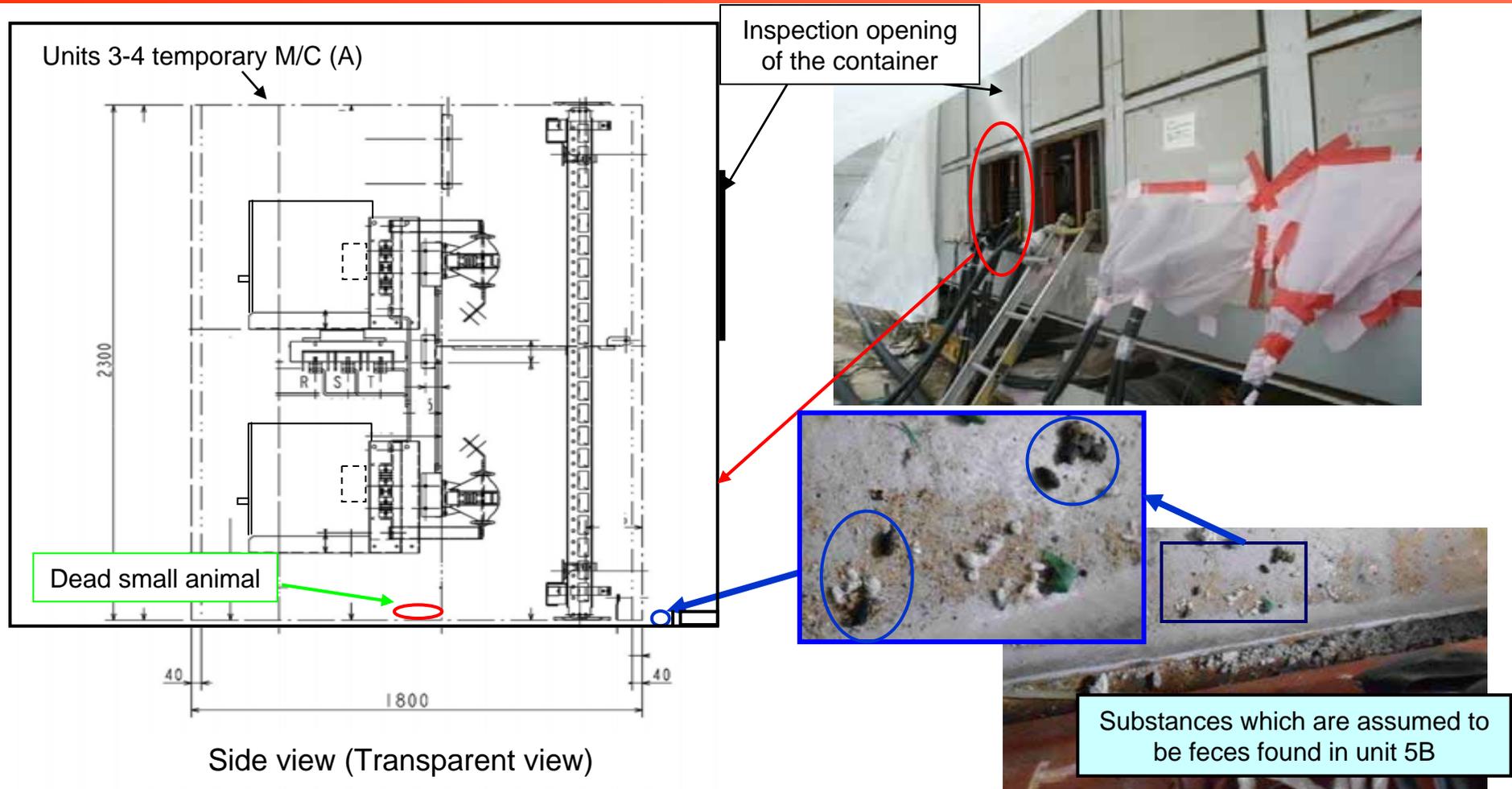
Location where the cable is drawn in
(Side surface of the container)

The opening found in the location
where the cable is drawn in has
been closed with a sheet.

The sheet is removed for
inspection (which makes a large
opening). Normally, the opening
is closed with sheet.



Feces of Small Animal Found in Units 3-4 Temporary M/C (A)



- A small animal (mouse) may have gotten into the unit from the opening generated by sheet partially coming off.
- Since the sheet was removed for investigation, trace of small animal (mouse), etc. could not be confirmed.
- Substances which are assumed to be feces of the dead small animal (mouse) were found on the floor of Units 3-4 temporary M/C (A) unit 5B.
- No abnormality was found with the appearance of the sheet, etc. at the time of inspection performed in the morning of March 18.



Cause of the Power Supply Failure of Units 3-4 Temporary M/C (A)

A small animal (mouse) got into Units 3-4 temporary M/C (A)

Short circuit occurred due to the small animal (mouse) getting close to the current-carrying area

Overcurrent was generated among the backup M/C in the Process Building, regular M/C in the Process Building and Units 3-4 temporary M/C (A)

Since the same overcurrent value is set for the M/C circuit breakers above, the circuits were cut simultaneously and power supply failure occurred.

Cooling systems for Unit 3 SFP, Unit 4 SFP and the common pool were suspended.

M/Cs other than the above were affected by the potential changes accompanying the momentary stop of power supply, Unit 1 SFP alternative cooling system (secondary system) and nitrogen separator (B) were suspended.