Inspection of protection equipments of transmission lines at substations, etc.

(Report)

June 8, 2011

Tokyo Electric Power Company

Contents

1. Introduction

Due to the earthquake occurred at off Miyagi Prefecture on April 7th, 2011 (hereinafter referred to as the “Earthquake”), blackouts occurred in wide-spread area supplied by Tohoku Electric Power Company, Incorporated. Also, due to these blackouts, off site powers were lost temporarily at Higashidori Nuclear Power Station of Tohoku Electric Power Company and Rokkasho Reprocessing Plant of Japan Nuclear Fuel Limited.

One of the main causes of such wide-spread blackouts was believed to be a failure of a protection equipment of 270,000 Volts transmission line when many earth faults and short circuits occurred simultaneously at the time of the Earthquake. The isolation function of such protection equipment could not be restored because the lost of the isolation function was not sensed because the protection equipment failed to display its status. As a result, due to the actuations of protection equipments of other transmission lines, etc. nearby such broken protection equipment, other transmission lines, etc. nearby were cut off.

In this report, we report the result of survey regarding inspection of protection equipments of transmission lines conducted in order to prevent the wide spread blackout by the same cause, following the instruction “inspection of protection equipments of transmission lines at substations, etc” received from NISA on May 17.

2. Summary of instruction

(1)Inspect protection equipments of the transmission lines consisting the trunk transmission system and the protection equipments of substations and switching stations connected to the transmission line to the nuclear power plants and reprocessing facilities and check whether the possibility of malfunction in displaying the status of the protection equipments when the isolation function of such protection equipments is lost (hereinafter referred to as the “display malfunction”). In case display malfunction may occur, such malfunction shall be restored by June 8, 2011. Further, such equipment shall be put under the regular surveillance in order to prevent the occurrence of malfunction.

(2)As to the protection equipments that are discovered to have possibility of malfunction, permanent measures to prevent malfunction shall be taken. Implementation plan of such measures shall be established by June 8, 2011.

3. Survey of protection equipment

(1) Facilities subject to survey

TEPCO's trunk transmission lines consist of 500kV and 275kV lines. In addition to those two classes, 154kV and 66kV lines are used for the connection with nuclear power plants and reprocessing facilities. Survey was conducted for the protection equipment of transmission lines as well as of bus bars and substations. Equipments subject to the survey were classified for the protecting facilities (Table 1).

Table 1: facilities protected by the equipments subject to survey

No	facilities protected by the equipments	Unit
1	Transmission lines with 500kV and 275kV	278 (24)
2	Bus bar of 500kV and 275kV	174 (6)
3	Substation with primary voltage of 500kV and 275kV	308 (4)
4	Bus bar at the substation connecting to 154kV lines to nuclear power plants	1
5	154kV and 66kV lines connecting to 4*	12
6	Transformer with primary voltage of 154kV connecting to 4	4
Total		777

Number in parenthesis represents the transmission lines connecting to the nuclear power stations, substations and substation bus bars connecting to such lines.

*this includes the 66kV connecting to 500kV transformer in the substation.

(2) Survey method

Using the related drawings (standard design drawings, elementary wiring diagram) of the protection equipment, the possibility of display malfunction was checked based on the following decision chart.

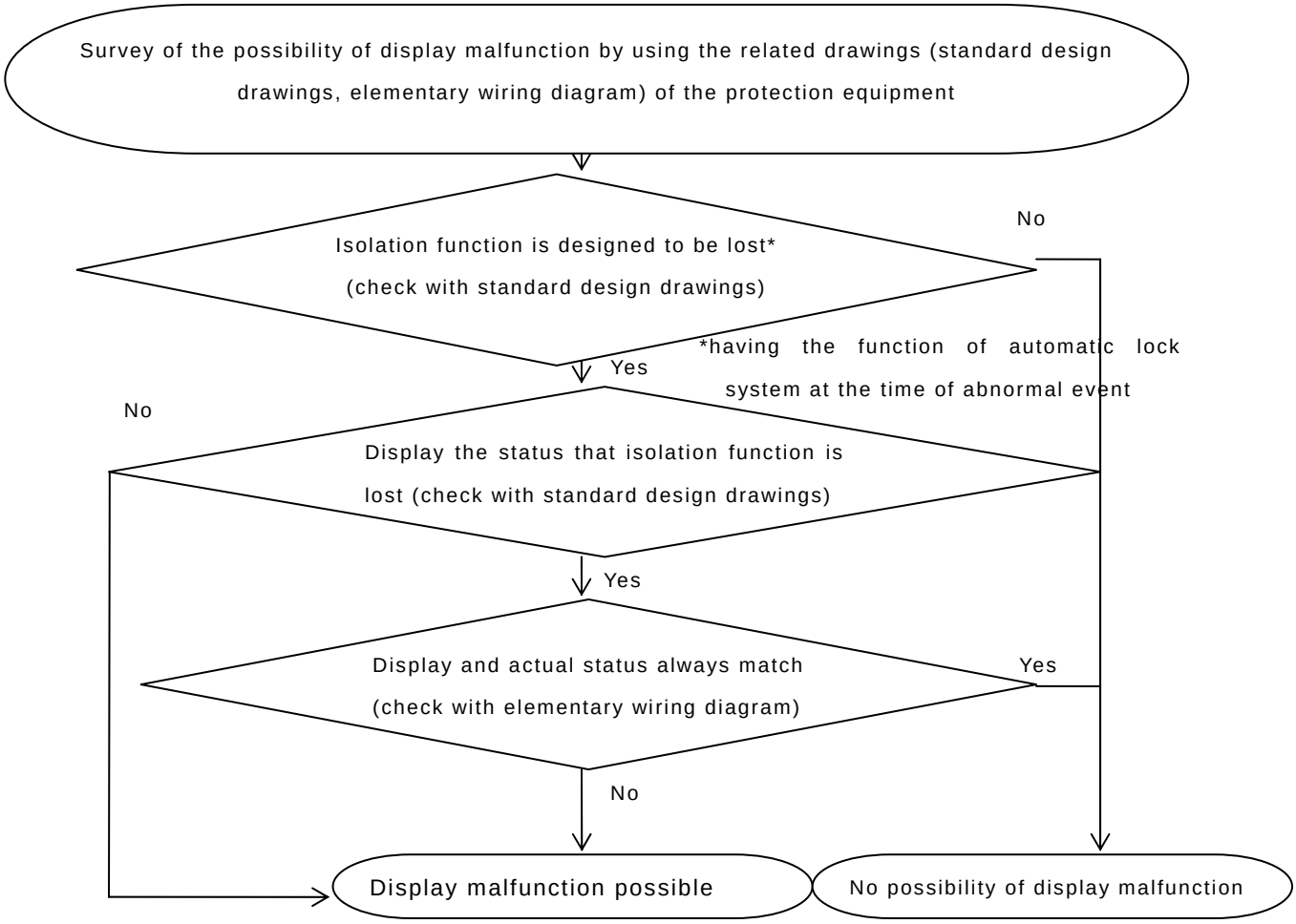

Chart 1: Survey result flow chart

Definition of terms:

Standard design drawings: depicting the standard design (structure, spec, function) set by TEPCO for all the equipments or for each equipment

Elementary wiring diagram: depicting the internal wiring (input wiring, output wiring, display wiring) of each protection equipment

(3) Survey result regarding the possibility of display malfunction

Survey result revealed that no equipment has possibility of display malfunction as shown in table 2 below.

Table 2: possibility of display malfunction

No	facilities protected by the equipments	Unit	Possibility of display malfunction	
			no	Yes
1	Transmission lines with 500kV and 275kV	278 (24)	278 (24)	0 (0)
2	Bus bar of 500kV and 275kV	174 (6)	174 (6)	0 (0)
3	Substation with primary voltage of 500kV and 275kV	308 (4)	308 (4)	0 (0)
4	Bus bar at the substation connecting to 154kV lines to nuclear power plants	1	1	0
5	154kV and 66kV lines connecting to 4*	12	12	0
6	Transformer with primary voltage of 154kV connecting to 4	4	4	0
total		777	777	0

Number in parenthesis represents the transmission lines connecting to the nuclear power stations, substations and substation bus bars connecting to such lines.

*this includes the 66kV connecting to 500kV transformer in the substation.

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