## Plant Data of Fukushima Daiichi Nuclear Power Station at the time of the Tohoku-Chihou-Taiheiyou-Oki Earthquake

May 16th, 2011

Tokyo Electric Power Company

Disclaimer

This English translation is only for reference purpose. When there are any discrepancies between original Japanese version and English translation version, the original Japanese version always prevails.

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#### 1. Description of data

Fukushima Daiichi Nuclear Power Station was hit by the Tohoku-Chihou-Taiheiyou-Oki Earthquake occurred at 14:46 on March 11<sup>th</sup>, 2011, and the following massive tsunami, and the plant facilities got severely damaged. While plant data at around the time of the earthquake remained at the site including the main control room of each unit, we had no choice but to focus on the work for stabilization of the plants. Since it was difficult to take the printed data directly to the uncontaminated area due to the high level air dose around the plants including the main control rooms and the prints themselves were contaminated, we could not computerize the data by staying in the main control rooms for long hours. However, as the situation gradually improved, we collected and organized as much plant data as possible in accordance with the instructions from the national government. Data collected and organized are as below.

(1) Charts

Recording papers widely used to record various data of the plants. Plant data are recorded in roll paper with color ink.

(2) Data of abnormal events including alarm records

A kind of data output from process computers, including the times of abnormal events and operation logs of the plant systems. They are basically printed out and kept as printed records.

(3) Operation logs

Operation records, data recorded by operators in the main control rooms and daybooks with handover messages for operators of the next shift.

(4) Data of process computers

Process computers also store data indicating plants' behavior. Their functions are similar to the transient recorders described below.

(5) Data of transient recorders

Triggered its operation by the occurrence of abnormal events, a transient recorder records numerical data on plant's behavior for a few minutes prior to and 30 minutes after the event.

The amount of data above varies, depending on the plant situation and the type of the computer. For example, Unit 4 was in the regular inspection and all of the fuels were taken out to the spent fuel pool in order to replace its shroud. Since the process computer was being replaced at the same time, related data does not exist. Also, since the transient recorder of Unit 6 was not in operation due to the unit's regular inspection, transient record of Unit 6 does not exist. Data organized in this report are described in Table-1.

While most of major data were collected and organized in this report, please note that there still can be some data unrecorded due to the damage of the detectors caused by tsunami. As further facts are getting revealed by detailed analyses of other parameters and reliable

evidences from persons involved, it is expected that additional information such as operation records of equipments will be known in the future. In such a case, we will report them accordingly.

### 2. References

- (1) Unit 2, Fukushima Daiichi Nuclear Power Station Restoration of alarm records
- (2) Unit 3, Fukushima Daiichi Nuclear Power StationAdjustment of the recorded times of the transient recorders

		Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6						
	Diant status	In an anti-	Te anantian	In an anti-	In outage	In outage	In outage	Remarks					
	Plant status	In operation	In operation	In operation	(All fuel pulled out)	(During pressure test on RPV)	(RPV closed)						
	Chart	Plant charts continued to record data after t	he earthquake. However, the amount o	f data actually collected was very little	as the tsunami caused the loss	of signals and power for measurement	instruments in most cases. Data						
	Chart	recording resumed after the restoration of po	wer supplies for instruments for some of	the plant charts, but plant-related parameter	eters have been gathered and att	ached for data continuity.							
		Data entries up to 15:00 o	n March 11 obtained	Data entries up to 19:00 on March			BOP						
				11 obtained		Periodic data recording function was	Periodic data recording function	(Operation information)					
		Core performance data up to 14:00 on Mar	ch 11, and typer output on control rod	Core performance data up to 19:00		suspended as the plant was in	was suspended as the plant was	Core performance					
	Alarm activation	position data, etc. up to		on March 11 and typer output on control rod position data, etc. up to		outage.	in outage.	calculation, control rod					
	records and other	r		18:00 on March 11			positions, etc.						
Process computer	data	yper output for approx. 10 minutes after the scram Typer output for approx. 2 minutes after the scram; Data up to 15:50 on March 11 was recovered from the collected hard disk.		Typer output up to 18:00 on March 11	Process computer system being replaced	Typer output for approx. 2 minutes after the earthquake <u>Typer output resumed from around</u> <u>0:00 on March 12</u> Data up to 16:18 on March 12 was recovered from the collected hard disk.	Typer output up to around 15:39 on March 11 <u>Backup output from 15:40 to</u> <u>14:07 on March 11</u> <u>Typer output resumed at around</u> <u>0:00 on March 12</u>	Alarm activation records					
uter	Process computer system data (Operation data)	No electronic storage function	Hard disk from the data storage server recovered	No electronic storage function		Hard disk from the data storage server recovered	No electronic storage function						
	Additional description of the	No re-output function for alarm activation records, etc.	Re-output function available for alarm activation records, etc. Power supplies required if records are not found	No re-output function for alarm activation records, etc.	-	Re-output function available for alarm activation records, etc.	No re-output function for alarm activation records, etc.						
	process computer system's performance		, and switched to battery power upon the lar power supplies for some devices at U			Normally on AC power, and switched AC power (specifically for							
	Operation log	Operation log for March 11 obtained											
S	hift turnover logs	There are separate shift logs for shift supe from two night shifts on March 10 and on obtained. The log for March 11 from the ti- whiteboard in MCR and transcribed to the showing the information written on the white	he day shift from March 11 have been me of the earthquake was written on the he logbook later. Notes and memos	Both logs from two night shifts on M	arch 10 and one day shift from as and memos written by shift	ft supervisors and shift members. March 10 and one day shift from							
Nuclear plant A		The recorder had its hard disk re	emoved and data recovered.	Difficult to recover the hard disk itself, but the device was turned on to recover data.	Transient event recorder being replaced	The recorder had its hard disk removed and data recovered.	Event recording function was suspended for outage. <u>Difficult</u> to recover the hard disk itself, resulting in no data recovery						
dvan( lveic	-	Normally on AC power	er, and switched to battery power upon the	e loss of AC power		Normally on AC power, and switched AC power (specifically for co							
ced Transient da	<ul> <li><u>Short-cycle event</u></li> <li><u>data (reported on</u></li> <li><u>May 16, 2011)</u></li> </ul>	• 10ms cycle data over approx. 35 minutes from 14:42:03 on 3/11	• 10ms cycle data over approx. 35 minutes from 14:41:56 on 3/11 and 35 minutes from 15:12:06 on 3/11	• 0.1s cycle data from around 14:41 to 16:05 on 3/11	<u> </u>	• 35-minute 10ms cycle data at every hour (starting 5 minutes to the hour) from 14:00 to 23:00 on 3/11							
ata Recording and	Miscellaneous (Reported on July 17, 2013)	• 1min cycle data from 12:00:59 to <u>15:36:59 on 3/11</u> (Records starting at 10:59:59 on 3/3)	_	Average, maximum, minimum and <u>RMS figures in 10min cycle data</u> <u>from 12:09 to 19:09 on 3/11</u>	_	•10min cycle data from 12:00 on 3/11 to 16:50 on 3/12 and from 12:03:56 on 3/11 to 16:43:56 on 3/12	_	Some of the data has been deemed unnecessary.※					
-		num and RMS binary data in 1h cycle up to 1.	5:00 on 3/11 at Unit 1, instantaneous, ave	(Records starting at 7:59 on 3/8) erage, maximum, minimum and RMS bi	nary data in 1h cycle up to 15:0	(Records starting at 15:00 on 3/2 and <u>11:53:56 on 3/2 respectively</u> ) 0 on 3/11 at Unit 2, average, maximum,		10min cycle up to 16:50					

3/12 at Unit 5 are available. However, they have been deemed unnecessary based on the amount of data already reported and additionally reported this time (July 17, 2013).

Table-1

## Unit 2, Fukushima Daiichi Nuclear Power Station Restoration of alarm records

#### 1. Introduction

It is recognized that the alarm equipment (function of output alarm records to Alarm Typer) of Unit 2, Fukushima Daiichi Nuclear Power Station produced records for approximately 2 minutes immediately after the scram, but stopped thereafter for some reasons. We restored alarm records based on the data stored in hard drives.

#### 2. Overview of the functions of alarm equipments

The alarm equipments have functions to collect information about plant status from process computers and produce alarm records to Alarm Typer. Items of information produced to Alarm Typer are as below.

Status changes of Digital Input Points (changes of contact points) Changes of the position of control rods Monitoring Alarm (excess of the limits/restoration) Operation records (data insertion / alarm exclusion / scan exclusion) Transferred results of outputs from computers Time and messages

The restoration of alarm records this time was conducted as to and , based on the record of plant process data produced by the process computer of Unit 2. The ways to produce and are as below.

- a. Way to produce the status changes of Digital Input Points
   In the case of occurrence of change of contact point the time and the situation are output to Alarm Typer.
- b. Way to produce Monitoring Alarm (excess of the limits/restoration)
   In the case that the monitored Analogue Input Point exceeds the alarm limit or deviates from the designated range or that indicator trouble occurs, the time and the situation are output to Alarm Typer.
- 3. Methodology for the restoration of alarm records

Among records, 1171 Analogue Input Points and 503 Digital Input Points of the plant process data were used for the restoration of alarm records. Position data related to the movement of control rods were not used.

In the restoration, automatic process methods searching for record data (excel files) were

adopted as below.

### (1) Digital Input Point

Search for the time of occurrence of change in status of the target input point and output the time, PID and the value before and after the change

## (2) Analogue Input Point

Search for the time of occurrence of change in quality information of the target input point and output the time, PID and the value before and after the change

End

	1	f⊊ ON 8	9	10	11	12	13	14	15	16	17	18	19
1	ポイントID	D703	· ·	D706		D707	10	D708	10	D709		D710	10
	ポイント詳細	RCIC 注	2	ADS A	1	ADS B	1	SGTS A		SGTS B		SRNM 8	1
	ポイント単位	OFF/ON		OFF/ON		OFF/ON		OFF/ON		OFF/ON		正常/高高	
31		OFF	正常	OFF	正常	OFF	正常	ON	正常	OFF	正常	高高	警報
32	2011/3/11 14:50:28	OFF	正常	OFF	正常	OFF	正常	ON	正常	OFF	正常	高高	警報
33	2011/3/11 14:50:29	OFF	正常	OFF	正常	OFF	正常	ON	正常	OFF	正常	高高	警報
34	2011/3/11 14:50:30	OFF	正常	OFF	正常	OFF	正常	ON	正常	OFF	正常	高高	警報
35	2011/3/11 1450:31	OFF	正常	OFF	正常	OFF	正常	ON	正常	OFF	正常	高高	警報
36	2011/3/11 14:50:32	OFF	正常	OFF	正常	OFF	正常	ON	正常	OFF	正常	高高	警報
37	2011/3/11 14:50:33	ON	正常	OFF	正常	OFF	正常	ON	正常	OFF	正常	高高	警報
38	2011/3/11 14:50:34	ON	正常	OFF	正常	OFF	正常	ON	正常	OFF	正常	高高	警報
39	2011/3/11 14:50:35	ON	正常	OFF	正常	OFF	正常	ON	正常	OFF	正常	高高	警報
0	2011/3/11 14:50:36	ON	正常	OFF	正常	OFF	正常	ON	正常	OFF	正常	高高	警報
1	2011/3/11 14:50:37	ON	正常	OFF	正常	OFF	正常	ON	正常	OFF	正常	高高	警報
12	2011/3/11 14:50:38	ON	正常	OFF	正常	OFF	正常	ON	正常	OFF	正常	高高	警報
3	2011/3/11 14:50:39	ON	正常	OFF	正常	OFF	正常	ON	正常	OFF	正常	高高	警報
4	2011/3/11 14:50:40	ON	正常	OFF	正常	OFF	正常	ON	正常	OFF	正常	高高	警報
15	2011/3/11 14:50:41	ON	正常	OFF	正常	OFF	正常	ON	正常	OFF	正常	高高	警報
6	2011/3/11 14:50:42	ON	正常	OFF	正常	OFF	正常	ON	正常	OFF	正常	高高	警報
7	2011/3/11 14:50:43	ON	正常	OFF	正常	OFF	正常	ON	正常	OFF	正常	高高	警報
8	2011/3/11 14:50:44		正常	OFF	正常	OFF	正常	ON	正常	OFF	正常	高高	警報
9	2011/3/11 14:50:45		正常	OFF	正常	OFF	正常	ON	正常	OFF	正常	高高	警報
0	2011/3/11 14:50:46		正常	OFF	正常	OFF	正常	ON	正常	OFF	正常	高高	警報
1	2011/3/11 14:50:47	ON	正常	OFF	正常	OFF	正常	ON	正常	OFF	正常	高高	警報
2	2011/3/11 14:50:48	ON	正常	OFF	正常	OFF	正常	ON	正常	OFF	正常	高高	警報
3	2011/3/11 14:50:49	ON	正常	OFF	正常	OFF	正常	ON	正常	OFF	正常	高高	警報
4	2011/3/11 14:50:50		正常	OFF	正常	OFF	正常	ON	正常	OFF	正常	高高	警報
55	2011/3/11 14:50:51		正常	OFF	正常	OFF	正常	ON	正常	OFF	正常	高高	警報
6	2011/3/11 14:50:52 H\A500-A625/D500-		正常	OFF	正常	OFF	正常	ON.	正常	OFF	正常	高高	警報

# 【In the case of Digital Input Point】

R63	37C8	*	≴ ON							_	-
	68	69	70	71	72	73	74	75	76	77	78
1											
2				2011/3/11 14:50:33		RCIC 注入并 開	OFF	ON	正常	正常	
3				2011/3/11 15:25:34		RCIC 注入弁 関	ON	OFF	正常	正常	
1				2011/3/11 15:39:42		RCIC 注入弁 開	OFF	ON	正常	正常	
5				2011/3/11 14:47:43		SGTS A 起動信号	OFF	ON	正常	正常	
3				2011/3/11 14:48:14	D708	SGTS A 起動信号	ON	OFF	正常	正常	
7				2011/3/11 14:48:22		SGTS A 起動信号	OFF	ON	正常	正常	
1				2011/3/11 15:37:39	D708	SGTS A 起動信号	ON	OFF	正常	正常	
				2011/3/11 15:37:55	D709	SGTS B 起動信号	OFF	ON	正常	正常	
)				2011/3/11 15:40:36	D709	SGTS B 起動信号	ON	OFF	正常	正常	
				2011/3/11 14:47:50	D710	SRNM 計数率 高高 Ch	正常	高高	正常	警報	
2				2011/3/11 14:55:19	D710	SRNM 計数率 高高 Ch	高高	正常	警報	正常	
3				2011/3/11 14:47:50	D711	SRNM 計数率 高高 Ch	正常	高高	正常	警報	
4				2011/3/11 14:55:02	D711	SRNM 計数率 高高 Ch	高高	正常	警報	正常	
5				2011/3/11 14:47:50	D712	SRNM 計数率 高高 Ch	正常	高高	正常	警報	
ĵ.				2011/3/11 14:54:41	D712	SRNM 計数率 高高 Ch	高高	正常	警報	正常	
7				2011/3/11 14:47:50	D713	SRNM 計数率 高高 Ch	正常	高高	正常	警報	
3				2011/3/11 14:55:06	D713	SRNM 計数率 高高 Ch	高高	正常	警報	正常	
3				2011/3/11 14:47:50		SRNM 計款率 高高 Ch		高高	正常	警報	
)				2011/3/11 14:55:06	D714	SRNM 計数率 高高 Ch	高高	正常	警報	正常	
				2011/3/11 14:47:50		SRNM 計款率 高高 CH		高高	正常	警報	
>				2011/3/11 14:54:35		SRNM 計数率 高高 CH		正常	警報	正常	
				2011/3/11 14:47:50		SRNM 計款率 高高 Ch		高高	正常	警報	
1				2011/3/11 145428		and the second s	高高	正常	警報	正常	
5				2011/3/11 14:47:50		article article realized art	正常	高高	正常	警報	
3				2011/3/11 1453:43		and the second s	高高	正常	警報	正常	
7				2011/3/11 14:48:03		SRNM ベリオド 短短 C		短短	正常	警報	
3				2011/3/11 14:48:05		SRNM ペリオド 短短 C		正常	警報	正常	
3				2011/3/11 14:48:10		SRNM ペリオド 短短 C		短期	正常	警報	

	B4	*	fs 12.1464	004517										
		A	В	C	D	E	F	G	н	I	J	K	L	M
1	ポイント	ID	E000		E001		E004		E005		E006		E007	
2	ポイント	詳細	所内変圧器		所内変圧器		6. 9KV 2		6. 9KV 2		6.9KV 2	1	6.9KV 2	
3	ボイント	単位 💌	MW 💌		MW 💌		¥V ¥		ev 💌		V V		•V •	
78	2011/	/3/11 14:47:54	9.3744	正常	10.0296	正常	6908.3999	正常	6892.2002	正常	6922.7998	正常	6899.3999	正常
79	2011/	/3/11 14:47:55	9.2808	正常	9,9144	正常	6903.0000	正常	6890.3999	正常	6917.3999	正常	6895.7998	正常
80	2011/	/3/11 14:47:56	9.1368	正常	9.7488	正常	6910.2002	正常	6894.0000	正常	6922.7998	正常	6897.6001	正常
31	2011/	/3/11 14:47:57	2.5488	正常	2.7504	正常	6643.7998	正常	6352,2002	正常	6654.6001	正常	6346.7998	正常
32	2011/	/3/11 14:47:58	0.1944	正常	0.1800	正常	6679.7998	正常	6571.7998	正常	6699.6001	正常	6579,0000	正常
83	2011/	/3/11 14:47:59	0.0288	正常	0.0432	正常	6699.6001	正常	6593.3999	正常	6715.7998	正常	6595.2002	正常
84	2011/	/3/11 14:48:00	0.0072	正常	0.0360	正常	6688.7998	正常	6589.7998	正常	6705.0000	正常	6588.0000	正常
35	2011/	/3/11 14:48:01	0.0000	嵌	0.0288	正常	6699.6001	正常	6597.0000	正常	6714.0000	正常	6598.7998	正常
36	2011/	/3/11 14:48:02	0.0000	低	0.0216	正常	6703 2002	正常	6600.6001	正常	6710.3999	正常	6598.7998	正常
37	2011/	3/11 14:48:03	0.0072	低	0.0216	正常	6706.7998	正常	6607.7998	正常	6723.0000	正常	6609.6001	正常
38	2011/	3/11 14:48:04	-0.0072	低	0.0144	正常	6715,7998	正常	6620.3999	正常	6728.3999	正常	6620,3999	正常
39	2011/	/3/11 14:48:05	0.0072	低	0.0216	正常	6755.3999	正常	6654.6001	正常	6766 2002	正常	6656.3999	正常
0		/3/11 14:48:06			0.0144			正常		正常	68003999		6697.7998	
1	2011/	/3/11 14:48:07	-0.0072	低	0.0216	正常	6829 2002	正常	6746.3999	正常	6845 3999	正常		正常
12	2011/	/3/11 14:48:08			0.0144		6796.7998	正常	6714.0000		6811 2002	正常	6714.0000	
3		/3/11 14:48:09		1.001	0.0144		6775 2002		6692 3999		6791 3999		6694 2002	
4	2011/	/3/11 14:48:10	-0.0072	低	0.0216	正常	6728.3999		6674,3999		6744.6001		6676,2002	_
5		/3/11 14:48:11	-0.0072	1.00	0.0144		6683.3999	Annual - 1 -	6642.0000	and the second s	6692,3999		6642.0000	Annual - 11-
ő		/3/11 14:48:12			0.0144		4357.7998			正常	4411.7998		6669.0000	
7		/3/11 14:48:13		1	0.0216		3583,8000	_		正常	3592,8000			正常
8		/3/11 14:48:14		1967	0.0072	and the second s		正常		正常		正常	6643,7998	A.M
9		/3/11 14:48:15			0.0144		894,6000			正常	894,6000		6642,0000	
ŏ		/3/11 14:48:16		1.00	0.01 44		532,8000	and the second s		正常	531,0000			正常
ĭ		/3/11 14:48:17		100	-0.0144		421.2000		6573.6001		414.0000		6571.7998	
2		/3/11 14:48:18			0.0216		180,0000		6449 3999		180.0000		6465.6001	
3		/3/11_14:48:19		1	0.0072	1.00	117,0000	Andrea - 11-	5698.7998	and the second second	117,0000	makes 1 1 1	5792 3999	And Color
	H\Sh		-0.0072	14.2	0.0072	18.2	11730000	10.00	1000.1000	IF m	1	IF m	5782.5888	IF m

# 【In the case of Analogue Input Point】

	AC24		-	fr .	10	10			45	15	10	41.1	47		414
1	Y		Z	AA	AB	AC		AD	AE	AF	AG	AH	AI	AJ	AK
2						2011/3/11	14:48:01	FOOD	所内安庄	9 MW	0.0072	0	正常	18	
3		*				2011/3/11			所内変圧		0.0144	-0.0144		46	
	正常	-				2011/3/11			6. 9KV		3.6		正常	低低低低低	
	正常					2011/3/11			6. 9KV		3.6		正常	低	
	正常					2011/3/11			6. 9KV		3.6		正常	低	
1	正常					2011/3/11			6. 9KV		5.4		正常	低	
	正常					2011/3/11			275KV		32		正常	不良	
	正常					2011/3/11			275KV		58		不良	正常	
	正常														
	正常														
	正常														
	正常														
	正常														
	正常														
	正常														
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	正常														
	正常														
2	正常														
3	正常														
	正常														
5	正常														
	正常														
	正常														
	正常														

# Unit 3, Fukushima Daiichi Nuclear Power Station Adjustment of the recorded times of the transient recorders

1 Outline of the recording by the transient recorder of Unit 3

The transient recorder installed at Unit 3 starts recording data in the case of an event that makes substantial change in preset plant parameters. At the time of the Tohoku-Chihou-Taiheiyou-Oki Earthquake on March 11, the transient recorder started recording at 14:46, 14:47, 14:59, 15:09, 15:19 and 15:29 and recorded data for 5 minutes before and after the each starting time (10 minutes in total for each). It should be noted that every parameter triggered the recording was on the vibration of the upper part of the recirculating pump except for the reactor scram at 14:47.

Since these data do not have the recorded times, time-series data is necessary to be developed through the restoration of fragmented information based on the times of the trigger events. In the process of the restoration, we compared the data of the transient recorder with other records (charts, Alarm Typer etc.) and made adjustments to a part of the time data, as we found inconsistency in a part of the data.

2 Discontinuity of the recorded data

Figure 1 shows the data of the water level of the reactor (narrow band).

This shows that the water level rapidly increased at around 14:59 (signed with arrow) and went over the scale limit (1,500 mm) only in 0.1 second from approx. 1,300 mm. Similar fluctuation was recorded in broad band data, but the fluctuation range was approx. 400 mm, which was inconsistent. On the other hand, Alarm Typer recorded fluctuation of the water level around 1,000 mm at around 15:00.

Taking into account those inconsistencies, we examined other data than water level and found several discontinuities in parameters. Examples are;

- D/G (A) Current 72A 146A

- Rotation Velocity of Turbine 263 rpm 5 rpm

Consequently, we determined that the recorded data this time has discontinuity at around 14:59.



Figure 1: Data of the water level of the reactor (narrow band)

### 3 Consistency with other records

Since inconsistencies have been found among the recorded times, as described in section 2, we conducted estimation of correct times through comparing with other records (charts, Alarm Typer etc.).

3.1 Comparison with the water level in the reactor

Figure 2 is the chart of the water level in the reactor (narrow band).

Figure 2 tells that the water level of the reactor went over the scale limit at around 15:30 and went blow the limit at around 16:00. These can be confirmed in the Alarm Typer records indicating that the water level went over the upper scale limit at 15:25 and went below the lower scale limit at 15:59. Based on the information above, data recorded by the transient recorder from 15:00 to 15:30 can be estimated as data from 15:30 to around 16:00 in actual.

And, Alarm Typer has records that the water level went in the reactor over the scale limit and came back 4 times at around 15:35, and these movements are in line with the transient recorder's data at around 15:05. This concurrence also supports the estimation that the transient recorder recorded data 30 minutes late.



Figure 2: Water level in the reactor (narrow band) and Chart (in red) Note: Because of the differences of the feeding speed and the up/down direction of paper, the figure is enlarged and reversed.

3.2 Comparison with the time when the emergency diesel generator (D/G) stopped (Alarm Typer)

Figure 3 shows the voltage of the emergency diesel generator (A), which was recorded by the transient recorder. Based on this figure, it seems that D/G stopped at approx. 15:08, but Alarm Typer recorded D/G's trip at 15:38. Here is approx. 30 minutes gap with the data of the transient recorder again.

21. AnaloguePIDA754, Voltage of D/G 3A R-T



Figure 3: Voltage of D/G 3A

3.3 Comparison with the movement of Safety Relief Valve (Alarm Typer) Figure 4 shows the movements of Safety Relief Valve, indicating that Safety Relief Valve had not moved since around 15:18. However, compared with the record that Alarm Typer printed the movements of Safety Relief Valve until 15:39, here is approx. 30 minutes gap with the data of the transient recorder again.



Figure 4: Movements of Safety Relief Valve

4 Adjustment of the recorded times

As described above, the duration of the interruption of the data is estimated to be approx. 30 minutes, based on the judgment that there is discontinuity of data at around 14:59:43 on March 11. Therefore, we made adjustment to the time, approx. 30 minutes, after 14:59:43 on March 11.

End