About this CR-ROM

This CD-ROM compiles acceleration time history data recorded at the ONAGAWA Nuclear Power Plant during the 2011 off the Pacific coast of Tohoku Earthquake.

The CD-ROM also includes the following related data.
(1)Ground motion and building vibration data obtained from the April 7, 2011 aftershock off the coast of Miyagi.

(2) Ground motion data obtained from foreshocks and aftershocks that occurred between March 9 and October 31, 2011.
 [1] Epicenter within 100 km radius from the ONAGAWA Nuclear Power Plant and magnitude exceeding 4.5
 [2] Epicenter beyond 100 km radius from the ONAGAWA Nuclear Power Plant and magnitude exceeding 5.5
(3) Ground motion and building vibration data obtained from the August 16, 2005 Miyagiken-Oki Earthquake (M 7.2)

We hope that making this data public will aid advancement in seismology, earthquake engineering, and structural engineering among other scientific fields.

Please be advised that change in data may occur in future years as a result of advancement in data processing and analysis methods.

The directory structure of the CD-ROM is illustrated as follows.

```
/
| 00_readme.txt : This file
| 01_Data_File_Name.pdf
| 02_Data_Format.pdf
| 03_Maximum_Acceleration.pdf
| 04_Location_of_Seismometers.pdf
| 05_Soil_conditions_of_observation_points.pdf
| 06_Characteristics_of_Seismometers.pdf
+--DATA : Data flie
  |
  +- The 2011 off the Pacific coast of Tohoku Earthquake
  | |
  | +- Ground
  | |
  | +- Building
  |   |
  |   +- Reactor building of Unit 1
  |   +- Reactor building of Unit 2
  |   +- Reactor building of Unit 3
  |
  +- The earthquake occurred on April 7,2011.
  | |
  | +- Ground
  | |
  | +- Building
  |   |
  |   +- Reactor building of Unit 1
```

```
|    +- Reactor building of Unit 2
|    +- Reactor building of Unit 3
|
+- Foreshocks and aftershocks that occurred between March 9 and October 31, 2011.
|  |
|  +- 201103XXXXXXXX
|  |
|  +- 201103XXXXXXXX
|  |
|  .
|  .
|  .
|
|
+- The August 16, 2005 Miyagiken-Oki Earthquake (M 7.2)
```

Note

- The North direction of the seismometers concides with the NS-axis of the plant (Plant North, P.N.), along which all buildings are aligned. See file 04 for description of the P.N.

  However, the Cardinal direction needs to be corrected for the borehole data. See file 01 for details of the required correction.

(Seismometer)

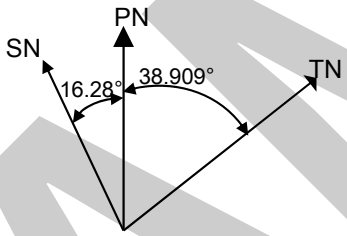
Installation location：Ground observation point

File name:201103111446_G-1.NS　(Data, hour, minute, and second of occurrence followed by Data name)

Data name	Observation Point	Component	Altitude*	Remarks
G-1.NS	G-1	NS	O.P.-128.4m	Correction from PN of unit 1, 2 and 3: -16.28° (Positive in clockwise direction)
G-1.EW		EW		
G-1.UD		UD		
G-2.NS	G-2	NS	O.P.-42.8m	Correction from PN of unit 1, 2 and 3: -15.66° (Positive in clockwise direction)
G-2.EW		EW		
G-2.UD		UD		
G-3.NS	G-3	NS	O.P.-8.6m	Correction from PN of unit 1, 2 and 3: -2.56° (Positive in clockwise direction)
G-3.EW		EW		
G-3.UD		UD		
G-4.NS	G-4	NS	O.P.+17.0m	Correction from PN of unit 1, 2 and 3: 0.53° (Positive in clockwise direction)
G-4.EW		EW		
G-4.UD		UD		

* O.P. is the reference altitude for the plant

(For example) The direction gap of Observation point G-1 (O.P. -128.4 m)



PN：Plant North

TN：True North

SN：Sensor North

Data format
The data format is described using example data.
- Line 1: Header information
- Starting Line 2: Data (Unit: Gal = cm/s/s)

- Header

Line 1 (1) Location and Recorded date (2) Observation point (3) Altitude of observation point
(4) Component (5) Total number of data (6) Sampling interval
(7) Duration (8) Maximum acceleration

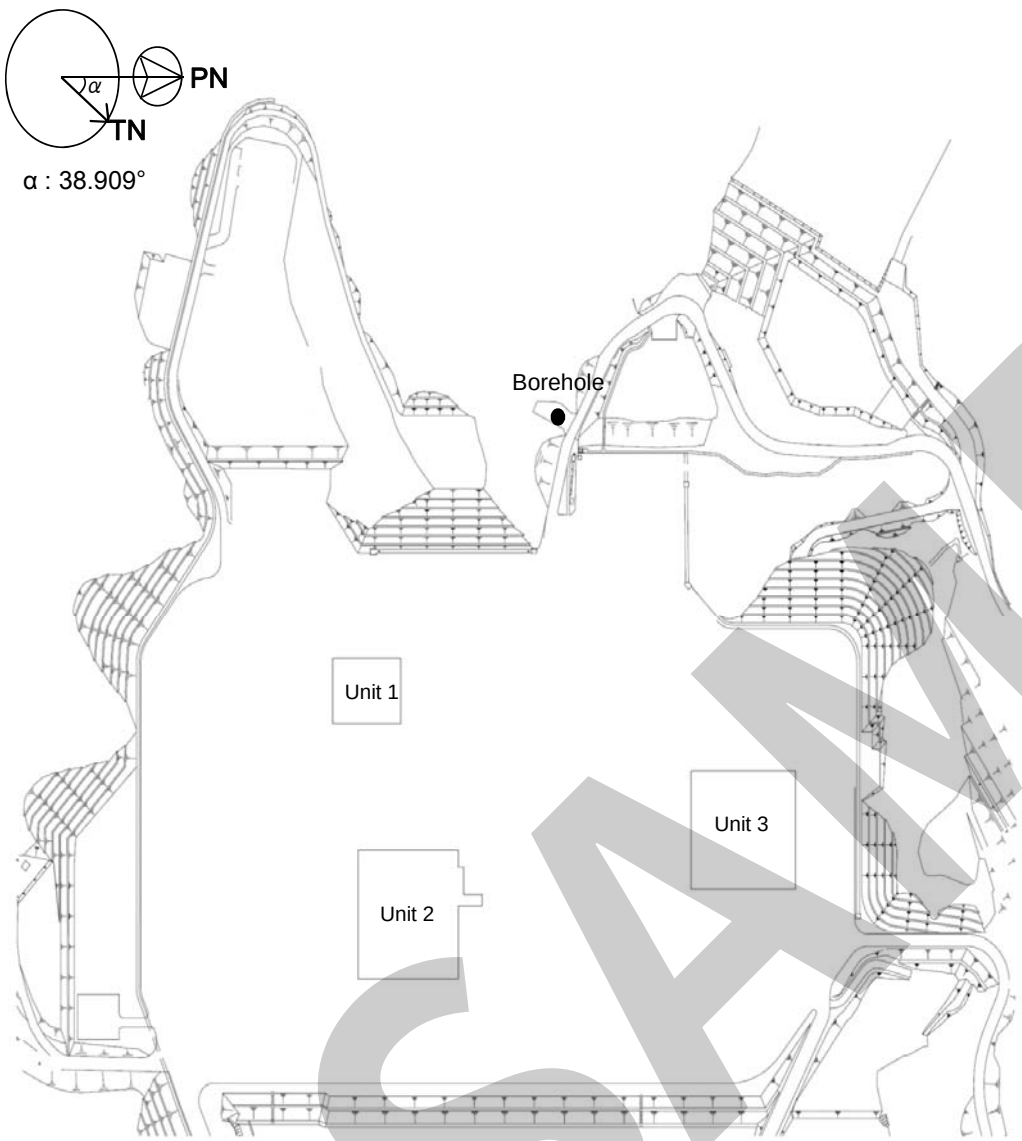
<Example>

1	2	3	4	5	6	7	8
ONA 201103111446	G-1	O.P.-128.4m	NS	30000	1.00000E-02	3.00000E+02	4.19932E+02

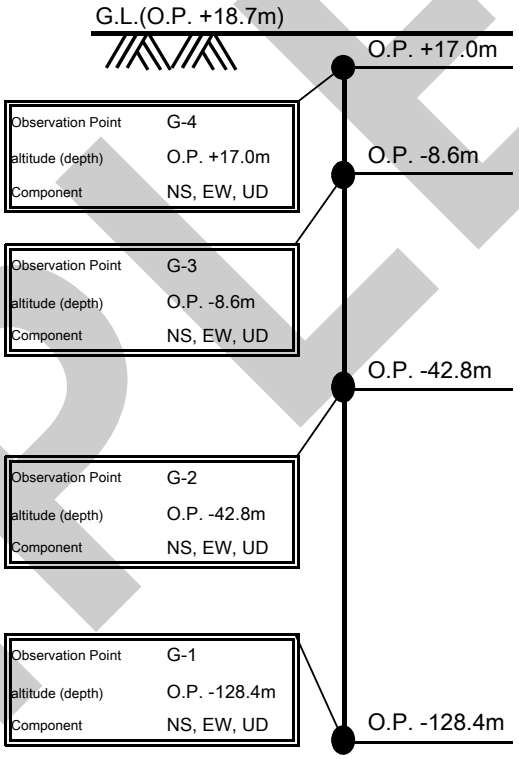
- Data (Unit: Gal = cm/s/s)

<Example>

1	2	3	4	5	6	7	8
3.40939E-02	-3.91007E-02	2.52724E-02	-4.12464E-02	2.78950E-02	-3.17097E-02	4.24385E-02	-3.24249E-02
3.05176E-02	-2.31266E-02	5.00679E-02	-2.28882E-02	3.38554E-02	-3.07560E-02	4.12464E-02	-2.69413E-02
2.98023E-02	-4.81606E-02	2.16961E-02	-3.45707E-02	2.83718E-02	-4.38690E-02	2.88487E-02	-3.31402E-02



Plant Arrangement Plan

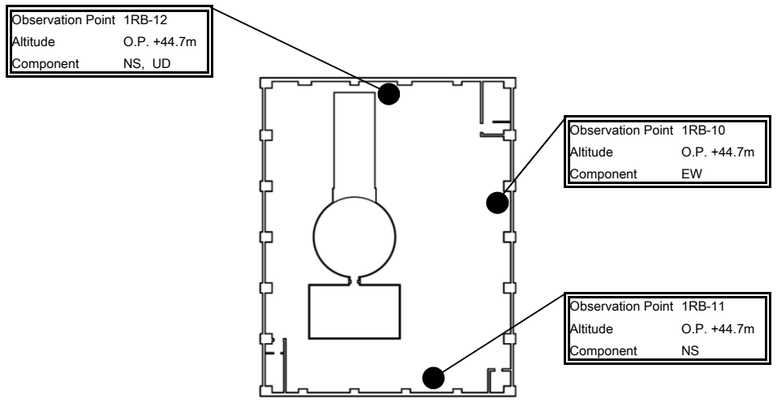


Explanatory note

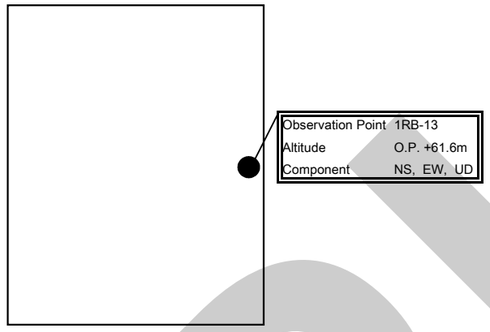
Observation Point	○○○
Altitude (depth)	O.P. △△△
Component	○○, ○○

*O.P. is the reference altitude for the Plant

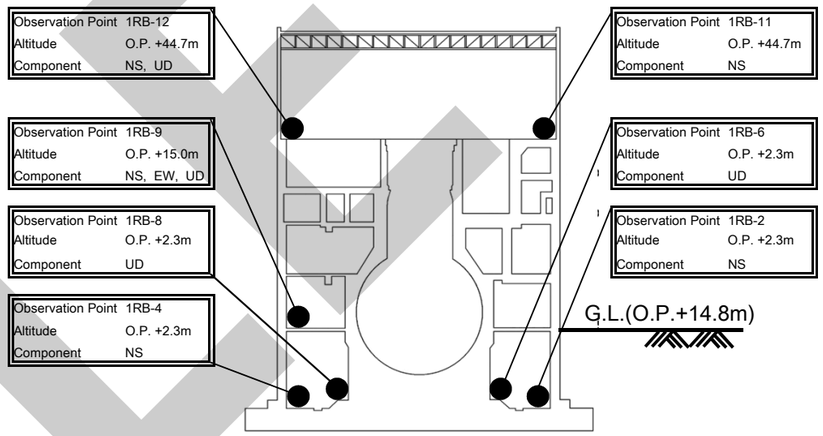
Ground observation point



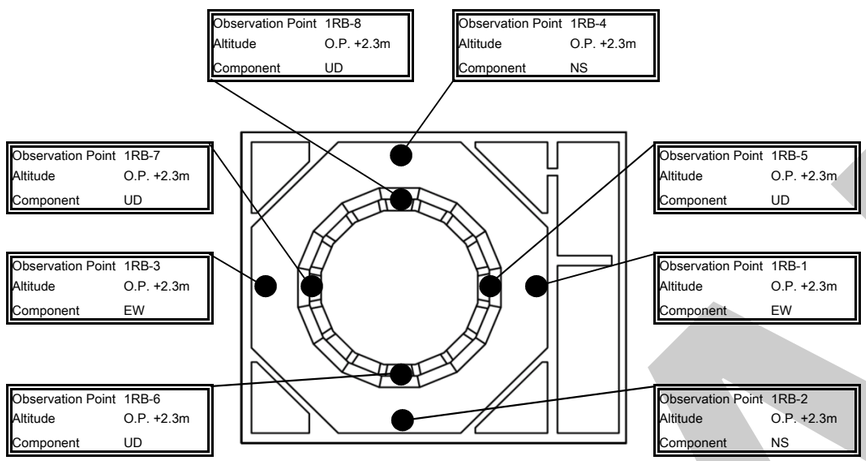
Fifth floor plan



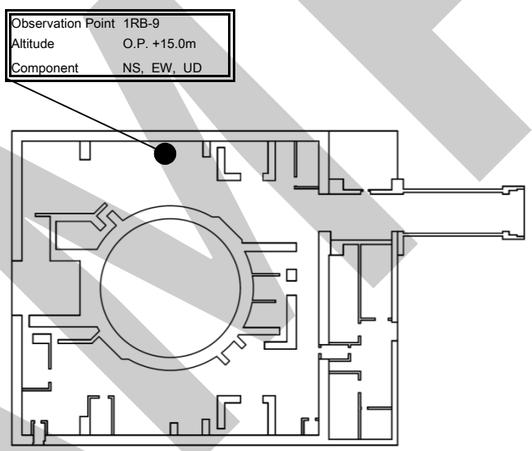
Roof floor plan



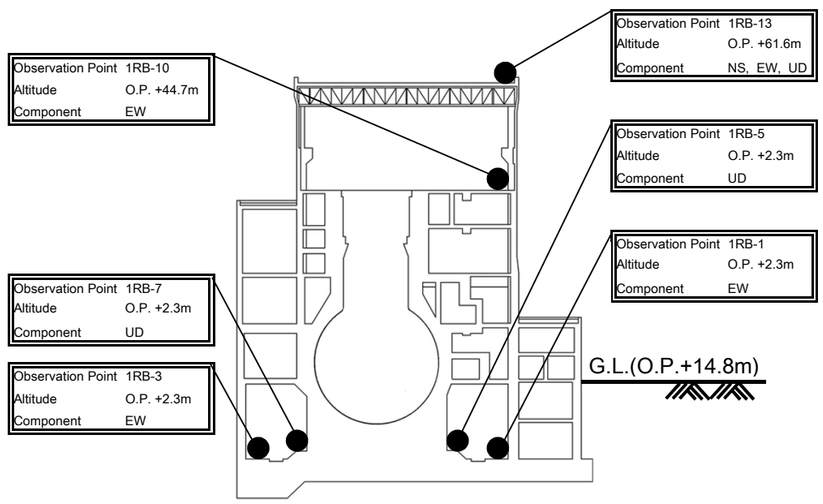
Section B-B



Second basement floor plan



First floor plan

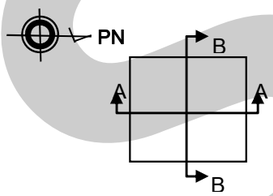


Section A-A

Explanatory note

Observation Point ○○○
Altitude O.P. △△△
Component ○○, ○○

*O.P. is the reference altitude for the Plant

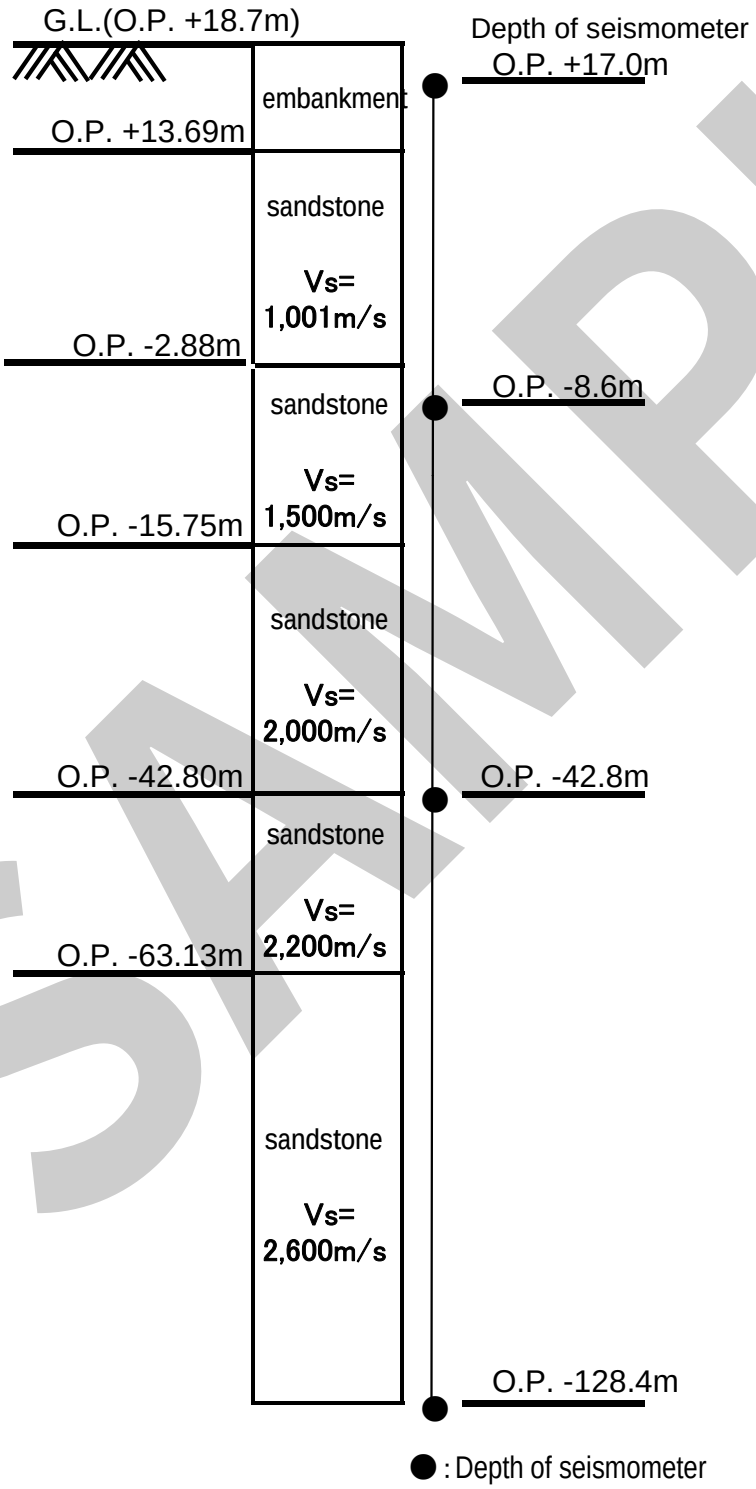


Location of seismometers at Unit1 reactor building

Elastic wave velocity of observation point

O.P. (m)			T.P.(m)			P-Wave Velocity Vp (m/s)	S-Wave Velocity Vs (m/s)
13.69	to	-2.88	14.43	to	-2.14	2,690	1,001
-2.88	to	-15.75	-2.14	to	-15.01	2,882	1,500
-15.75	to	-42.8	-15.01	to	-42.06	4,101	2,000
-42.8	to	-63.13	-42.06	to	-62.39	4,503	2,200
-63.13	to	-128.4	-62.39	to	-127.66	5,300	2,600

*The elastic wave velocity is fit to recorded data.



*O.P. (the reference altitude for the plant) is T.P. -0.74m.

Characteristics of Seismometers

Equipment		Specification		
Detector (Accelerometer)			Buildings	Ground
		Type name	SD-240	SD-112
		Method	Electromagnetic feedback	Electromagnetic feedback
		Frequency range	0.1 ~ 30Hz	0.1 ~ 30Hz
		Sensitivity	5mV/Gal 10mV/Gal	5mV/Gal
		Measurement range	±1000Gal ±2000Gal	±2000Gal
Amplifier		Frequency characteristics	0.1 ~ 100Hz	
		Low-pass filter	Cutoff frequency 30Hz，6th order butterworth filter（ - 36dB / oct ）	
Recording device	Boot processing unit	Boot Method	Unit1： Logical operators"or" or three-component Unit2： Startup of recording device of Unit 1 or Logical operators"or" or three-component Unit3： Startup of recording device of Unit 1 or Logical operators"or" or three-component	
		Boot level	Unit1： 1Gal Unit2： 10Gal（Also startup of recording device of Unit 1 ） Unit3： 10Gal（Also startup of recording device of Unit 1 ）	
	Data processing section	Return measures after a power outage	Automatic return	
		Frequency band	DC ~ 30Hz	
		Recording medium	CF card 22GB（1GB×22 ）	
		Maximum recording time	About 50 hours	
		Calibration	Once a month, Enter the specified current (CAL signal) at the secondary coil, check the rated output voltage (response waveform) of the primary coil.	
		Pre-trigger	20 seconds	
		Post-trigger	30 seconds	
		The maximum record time	300 seconds	
		Recording method	Saved to CF card, and ,automatically transferred to the control device and the receiving device in the head office.	
		A/D Resolution	24bit	
		Sampling frequency	100Hz	
	Clock section	Display	Year ,month, Day, hour, minute and second	
		Calibration	Automatic calibration by GPS	
		Accuracy	Synchronization with GPS(less than 10 seconds)	
Uninterruptible power supply		Guarantee time	About 10 minutes（only recording device : about two hours ）	

(Reference)General characteristic of Frequency