Information

Facts about Earthquake at Kashiwazaki-Kariwa Nuclear Power Station in Japan

The Niigata-Chuetsu-Oki Earthquake at 10:13 a.m. on July 16 attacked Kashiwazaki-Kariwa Nuclear Power Station of Tokyo Electric Power Co., Inc.. (TEPCO). Japan Atomic Industrial Forum, Inc. (JAIF), in cooperation with Japan Nuclear Technology Institute (JANTI), presents the facts about the earthquake and the Kashiwazaki-Kariwa Nuclear Power Plant, by support of TEPCO in data provision.

Followings were so far observed:

1) The earthquake caused very strong ground motions. Nevertheless, the nuclear reactors in the operating mode were shut down under control.
2) The most significant safety measures functioned, as intended in the design, of protecting high radiations in the reactors in the multiple-defense and multi-layered manners.
3) Consequently the nuclear plant safety is maintained and this indicates the basic appropriateness of seismic regulation concepts including the relevant regulatory guides.

JAPAN ATOMIC INDUSTRIAL FORUM, INC.

Address: 5th floor, Shimbashi Fuji Building, 2-1-3 Shimbashi, Minato-Ku, Tokyo 105-8605 Japan TEL: +81-3-6812-7104 FAX: +81-3-6812-7110

* Dept of Int'l Cooperation & Industrial Infrastructure Development

URL http://www.jaif.or.jp/english/index.html

Japan Nuclear Technology Institute

Address: 7F NOF Shiba Bldg., 4-2-3 Shiba, Minato-Ku, Tokyo, 108-0014 Japan TEL: +81-3-5440-3601 FAX:+81-3-5440-3606

* General Affairs Division

URL http://www.gengikyo.jp/English/

Niigata-Chuetsu-Oki Earthquake in Japan

Kashiwazaki-Kariwa Nuclear Power Station

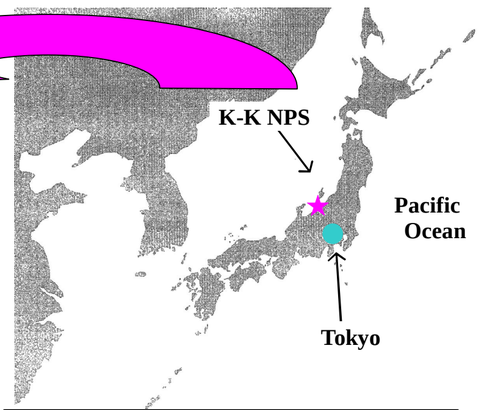
*Kashiwazaki-Kariwa NPS (K-K NPS) is located north side from Tokyo, about 200km.

*K-K NPS of Tokyo Electric Power Co., INC (TEPCO) is the largest NPS in the world, which has 7 Units of BWR bigger than 1,000 MWe.

Unit No.	1	2	3	4	5	6	7	Total
Electric Power (MWe)	1,100	1,100	1,100	1,100	1,100	1,356	1,356	8,212
Commercial Operation	1985	1990	1993	1994	1990	1996	1997	-
Reactor Type	BWR					A-BWR		-
	Mk. II	Mk. II Mod.						

Overview of the Kashiwazaki-Kariwa NPS

Photo: Courtesy of The Tokyo Electric Power Company, Inc



K-K NPS is about 200 Km north of Tokyo

Niigata-Chuetsu-Oki Earthquake

*Data:
10:13 am on July 16

*Magnitude:
Richter Scale 6.8

*Epicenter:
16 Km north of K-K NPS

*Source Depth: 17Km

Picture: Courtesy of The Tokyo Electric Power Company, Inc

Some Old Wooden Houses were destroyed

Railway was bent

Few Concrete Building were damaged

The Earthquake at the Kashiwazaki-Kariwa Nuclear Power Station

Units Status at the time of the earthquake

Operating: Unit 3, 4, 7 Starting Up: Unit 2 Outage: Unit 1, 5, 6

Acceleration recorded by seismometers exceeded designed value.

Acceleration of Earthquake (Unit: gal 1G=980gal)

Unit No.	Records of the reactor building lowest floor			Design values for the same location		
	North-south	East-west	Up-down	North-south	East-west	Up-down
1	311	680	408	274	273	(235)*
2	304	606	282	167	167	(235)*
3	308	384	311	192	193	(235)*
4	310	492	337	193	194	(235)*
5	277	442	205	249	254	(235)*
6	271	322	488	263	263	(235)*
7	267	356	355	263	263	(235)*

* The up-down values in brackets are used in static design only.

Safety of K-K NPS

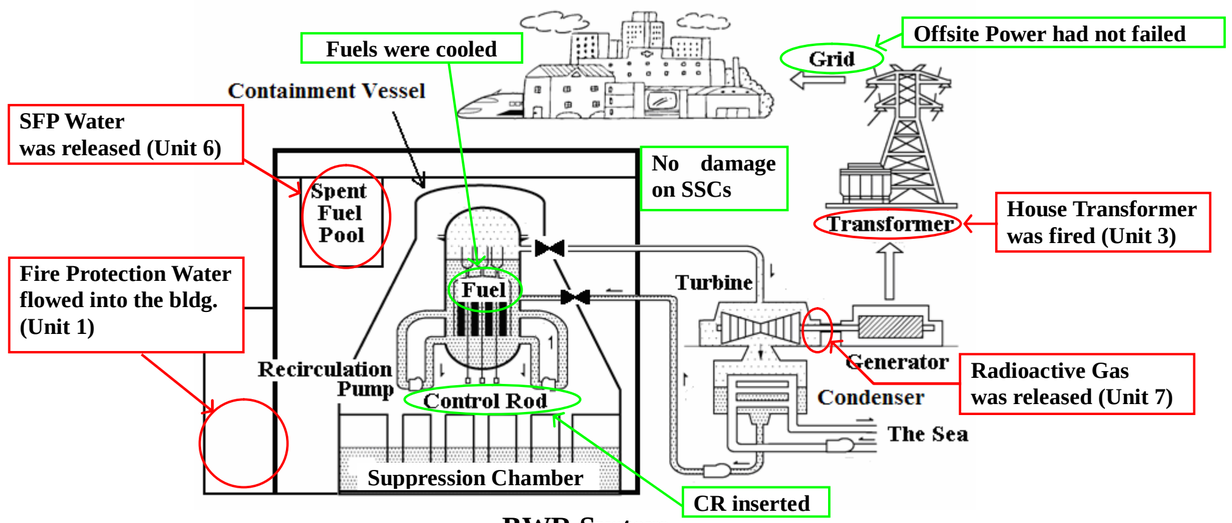
(1)Actions during and after the earthquake

a. Operating/Starting up Units were Scrammed automatically by earthquake signal according to design plan (scram value=120 gal).

b. Emergency DG had not started, since offsite power was maintained.

c. All units were cooled down in a safe manner and maintaining stable condition.

d. No radioactive abnormal indication was revealed (except for the negligible release of radioactivity)



BWR System

(2)Major Incidents

Damage was not observed on safety-related structures, systems, and components (SSCs). Some incidents of non-safety grade SSCs were as follows.

a. The House Transformer of Unit3 was on fire, and the fire was extinguished 2 hours later.

b. Negligible radioactive materials were released from Unit 6 and 7, but now are stopped.

c. Internal flooding of Unit 1 building by water for fire protection was occurred.

d. Bolts for the foundation of some big water tanks and transformers were cut off.

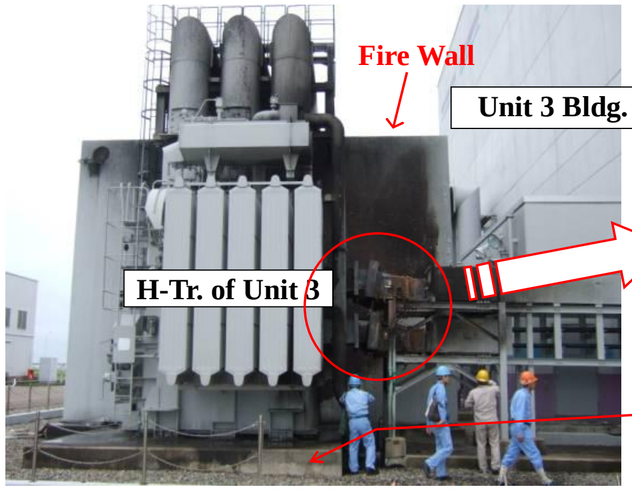
Niigata-Chuetsu-Oki Earthquake in Japan
- Incidents at Kashiwazaki-Kariwa Nuclear Power Station(I) -

A Fire on the House Transformer of Unit 3

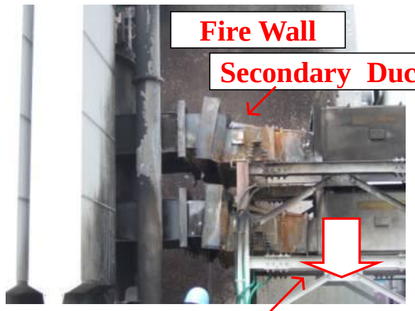
*The House-Transformer (H-Tr.) of Unit 3 which supplies only non-safety-related SSCs with electricity was on fire after the earthquake.
*TEPCO's fire brigade hurried to the scene of the fire, but could not extinguish the fire because of the damage of fire protection piping.
*The fire was extinguished by the municipality fire brigade with fire engines 2 hours after it began.
*No damage appears in the Main-Transformer and the turbine building around the H-Tr. by fire walls and interspaces.

Internal Flooding of Unit 1

*The fire protection (FP) piping near the building of Unit 1 was damaged, and the FP water flowed into the Reactor Combination Building of Unit 1.
*Approximately 2,000m^3 FP water accumulated at the bottom floor.
*Many of equipment for the waste disposal are installed on the bottom floor of the Reactor Combination Building. However, it seemed that the flood didn't submerge the safety-related equipments such as Emergency Core Cooling System (ECCS) of the Reactor Building.



Overview of the fired transformer

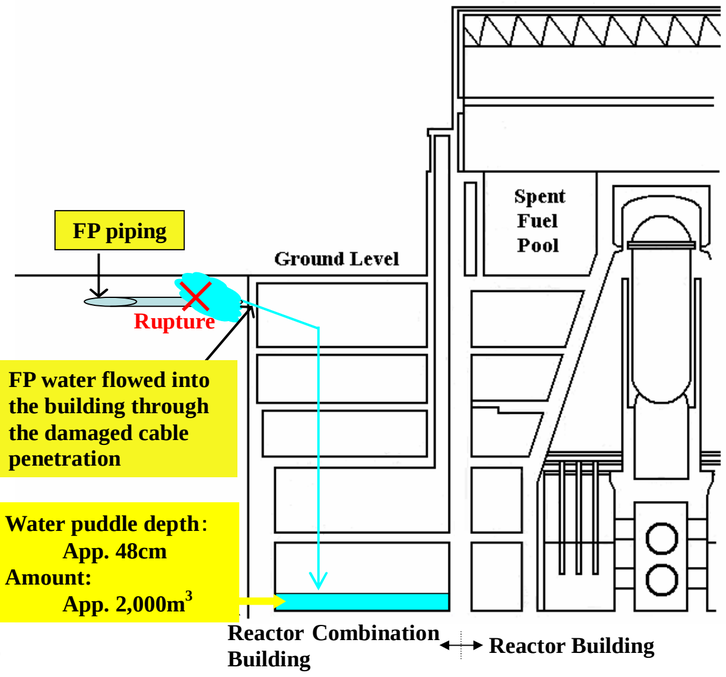


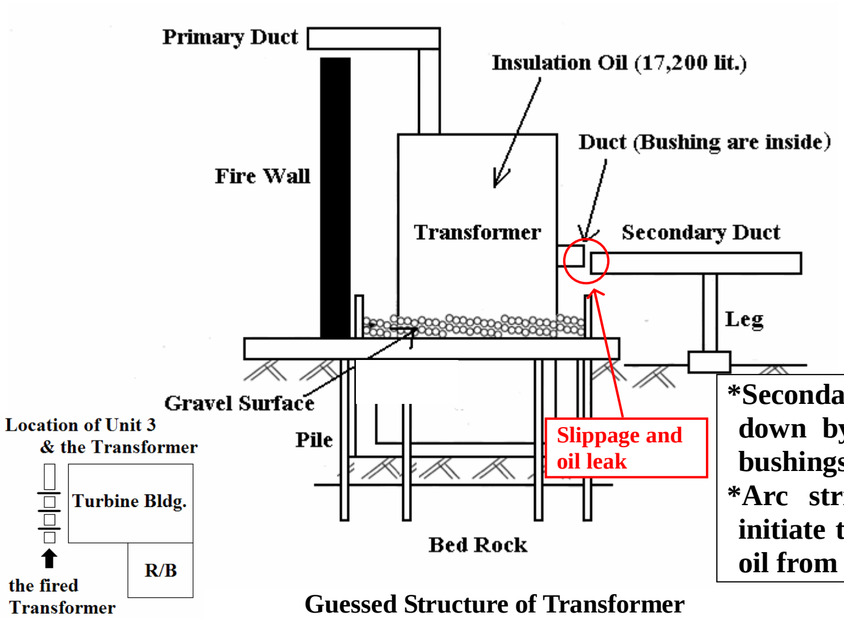
The ground including the base of Second Duct sank down, but the bases of transformer and Unit 3 Bldg. on the bedrock kept the same level.


damaged fire protection piping


After repair

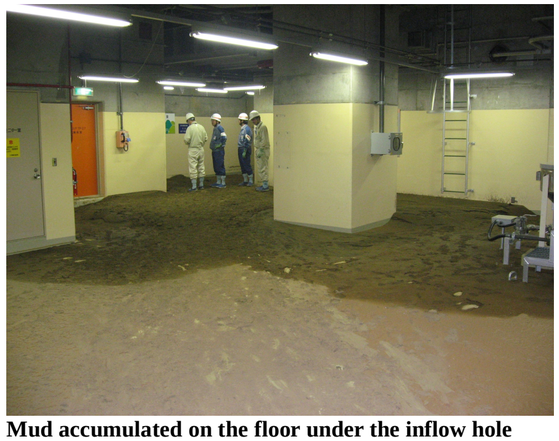
Photo: Courtesy of the Tokyo Electric Power Company, Inc

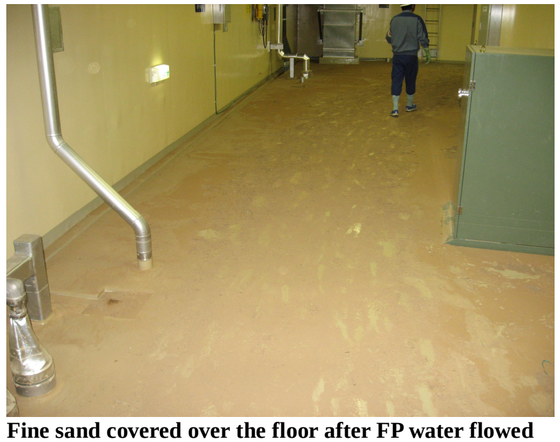




Guessed Structure of Transformer

*Secondary Duct sank down by 30cm and the bushings were broken.
*Arc strike assumed to initiate the fire of leaked oil from transformer.

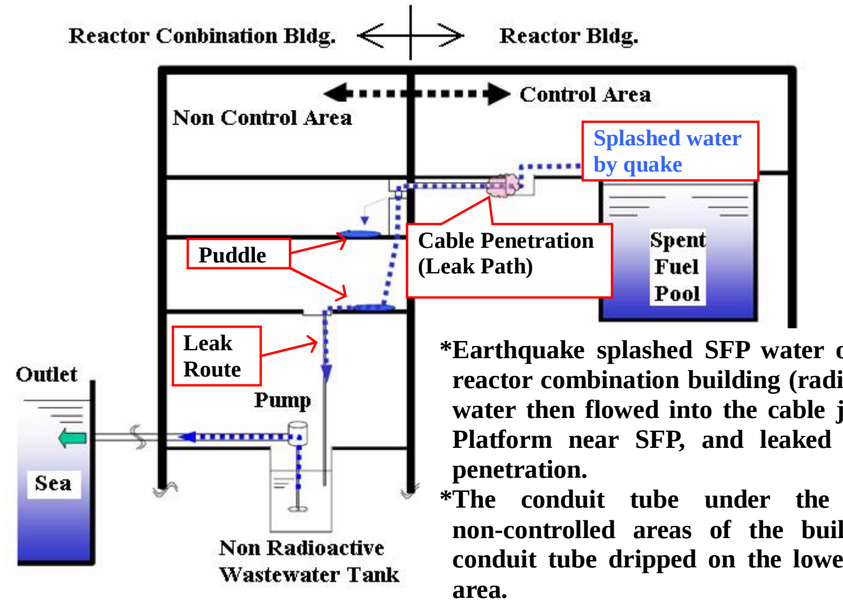

Mud accumulated on the floor under the inflow hole


Fine sand covered over the floor after FP water flowed

Niigata-Chuetsu-Oki Earthquake in Japan
- Incidents at Kashiwazaki-Kariwa Nuclear Power Station (II) Radioactive Material Release -

Water of Spent Fuel Pool released from Unit 6

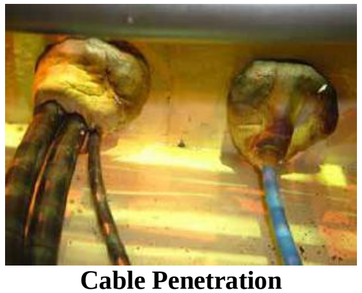
*Water of Spent Fuel Pool sloshed by earthquake, and splashed on the operating floor.
*Splashed water was released through the cable penetration of the Refueling Platform to the Sea.
*Exposure dose would be 2 x 10^{-9} mSv and substantially lower than 1 mSv, the legally-defined limit of radiation dose to the public per annum.



*Earthquake splashed SFP water on the operation floor of the reactor combination building (radiological controlled area). The water then flowed into the cable junction box of the Refueling Platform near SFP, and leaked into the path of the cable penetration.
*The conduit tube under the operating floor, leads to non-controlled areas of the building. Leaked water of the conduit tube dripped on the lower floor of the non-controlled area.
*The puddles on the floor flowed into the non-radioactive wastewater tank along the drain, and pumped out into the sea.

Overview of Operating Floor

Cable Junction Box

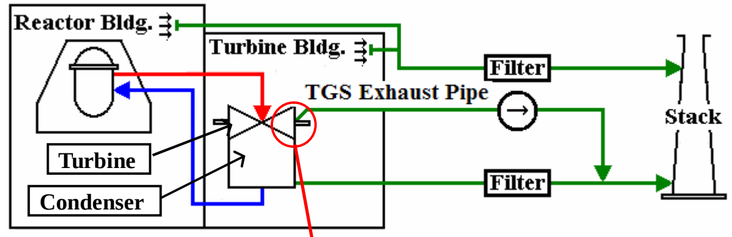


Cable Penetration

Photos and Pictures: Courtesy of the Tokyo Electric Power Company Inc.

Radioactive Gas in Low Pressure Turbine released from Unit 7

*Turbine Gland Steam (TGS) which seals Turbine System is specially supplied from the Auxiliary Boiler (Aux. Boiler).
*Aux. Boiler stopped to supply TGS for the turbine system due to the earthquake, and radioactive gas in the turbine and condenser released into the atmosphere through the TGS exhausted pipe.
*Exposure dose would be 2 x 10^{-7} mSv and substantially lower than 1 mSv, the legally-defined limit of radiation dose to the public per annum.



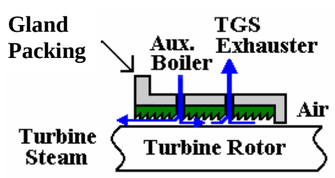


Fig 1.In Normal Operation

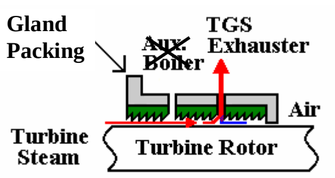


Fig 2. In This Incident

Turbine Isolation System

*The cause of the leakage is believed delay of the stop of the TGS exhauster after automatic reactor shutdown.
*The TGS exhauster normally exhausts supplied TGS (blue line of Fig 1). But in this incident, TGS exhauster was continuously in operation, though TGS was stopped to supply.
*It is suspected that the iodine and radioactive gas in the turbine, were blown out by the TGS exhauster (red line of Fig 2), and released into the atmosphere through the stack.

Summary of the radioactive materials Release

Items	Unit 6	Unit 7
Release Cause	Degradation of cable penetration which was the path of release	Delay of the stop of the TGS exhauster after automatic reactor shutdown.
Amount	Approx. 9E4 Bq (in the sea)	Approx. 4E8 Bq (in the atmosphere)
Exposure dose	Approx. 2E-9 mSv	Approx. 2E-7 mSv
	Substantially lower than 1 mSv, the legally-defined limit of radiation dose to the public per annum	
Current Condition	*Splashed water on the operation floor was wiped up. *The release of radioactive materials has stopped	*TGS exhauster of unit 7 was stopped and the release of radioactive materials had stopped. *The radiation monitors of all Units don't indicate unusual measurements