

**Report on the impact of the Niigata-Chuetsu Offshore Earthquake on the Kashiwazaki-Kariwa Nuclear Plant
and response by Tokyo Electric Power Company (TEPCO), national and local governments and other bodies (progress in September 2007)**

Date	TEPCO and other power utilities and JANTI (Japan Nuclear Technology Institute)	National and local government																																
Tuesday 4 September		<p>NISA: Committee on investigation and countermeasures of the impact of the Chuetsu Oki earthquake on the nuclear power facility, Working Group on Management and Facility Safety Assessment (1st meeting)</p> <p><Objectives> To investigate management and administration of the Kashiwazaki-Kariwa nuclear power station at the time of the Niigata Chuetsu Oki earthquake, as well as facility safety and future considerations</p> <p><Scope of deliberation></p> <p>(1) Operational management directly after the earthquake 1) Evaluate actions taken by the operator directly after the earthquake; identify issues; order actions as required, such as revision of operating manuals</p> <p>(2) Facility safety 1) Conduct a general assessment of equipment and facilities at the nuclear power station; investigate inspection procedures; evaluate the operator's equipment inspection program and associated results 2) Investigate evaluation methodology used to assess equipment, and criteria for repair work 3) Investigate repair methodology based on inspection and evaluation results 4) Identify principles and standards for incorporation into the evaluation processes</p> <p><Issue 1> - Operational management at the time of the earthquake - Assessment of equipment</p>																																
Tuesday 6 September	<p>TEPCO Press release: Nonconformities in post-earthquake inspection and restoration program (weekly report dated 6 September) Progress report on inspection and restoration work (including nonconformities) at the Kashiwazaki-Kariwa nuclear power station following the Niigata Chuetsu Oki earthquake (from 2 to 29 September, 2007)</p> <p>1. Inspection/restoration process</p> <ul style="list-style-type: none"> - Inspection/restoration work completed in the period August 31 – September 6 2007 <ul style="list-style-type: none"> - Solid waste storage facility: first stage of restoration completed 31 August (cleaning up drums that had fallen over) - Operational check on residual heat removal system standby equipment: completed 31 August - Inspection of area in the vicinity of the transformer oil leak: completed 3 September - Inspection of No. 1 reactor internal pressure vessel (1A): completed 4 September - Inspection of No. 3 reactor internal pressure vessel (3A): completed 4 September - Inspection of No. 7 reactor building ceiling crane: to be completed by 6 September + Inspection work due to commence during the period 7 - 13 September 2007: <ul style="list-style-type: none"> - Inspection of Nos. 1 - 5 reactors main exhaust ducts - Inspection of service tools on the operating floor of the No. 7 reactor - Oil leak cleanup around the transformer in the No. 6 Unit and preliminary internal inspection procedures <p>2. Nonconformities identified during inspection/restoration work following the Niigata Chuetsu Oki earthquake Information about incidents in the period 30 August – 5 September 2007 and nonconformities (for discussion) in the period 23 – 29 August 2007</p> <p>1) Incidents (related to the Chuetsu Oki earthquake)</p> <table border="1"> <thead> <tr> <th colspan="2">30 August – 5 September 2007 (cumulative total since 10 August)</th> <th colspan="2">By classification (cumulative total since 10 August)</th> </tr> </thead> <tbody> <tr> <td rowspan="3">Incidents</td> <td rowspan="3">0 (1)</td> <td>I</td> <td>0 (0)</td> </tr> <tr> <td>II</td> <td>0 (0)</td> </tr> <tr> <td>III</td> <td>0 (1)</td> </tr> </tbody> </table> <p><Incidents occurring in the period 30 August – 5 September 2007 ></p> <table border="1"> <thead> <tr> <th>Classification</th> <th>Date</th> <th>Type</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>I</td> <td>-</td> <td>-</td> <td>-</td> </tr> <tr> <td>II</td> <td>-</td> <td>-</td> <td>-</td> </tr> <tr> <td>III</td> <td>-</td> <td>-</td> <td>-</td> </tr> </tbody> </table> <p>2) Nonconformities (related to Chuetsu Oki earthquake: As excluded)</p> <table border="1"> <thead> <tr> <th colspan="2">23 – 29 August 2007 (cumulative total since 16 July)</th> </tr> </thead> <tbody> <tr> <td>Incidents</td> <td>86 (2,641)</td> </tr> </tbody> </table>	30 August – 5 September 2007 (cumulative total since 10 August)		By classification (cumulative total since 10 August)		Incidents	0 (1)	I	0 (0)	II	0 (0)	III	0 (1)	Classification	Date	Type	Description	I	-	-	-	II	-	-	-	III	-	-	-	23 – 29 August 2007 (cumulative total since 16 July)		Incidents	86 (2,641)	<p>NISA Press release: Earthquake update (23rd report)</p> <ul style="list-style-type: none"> - Information received from TEPCO as per column on left - NISA will continue with internal inspection of Nos. 1 through 7 reactors for damage and/or significant deformation - Safety inspectors are currently in the process of an in-depth investigation to establish the causes of issues at the plant identified by TEPCO - No significant developments in the main exhaust stack radiation monitor or monitoring posts at present - NISA will check that TEPCO has taken appropriate action in relation to soil impregnated with insulating oil based on TEPCO's investigation of soil in the surrounding area
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	<p>3) Other</p> <ul style="list-style-type: none"> - An analysis of soil at the location of cracks in the transformer oil retaining walls in the Nos. 4, 5 and 7 reactors found that insulating oil had permeated the soil. Notification of an insulating oil leakage incident in electrical equipment was duly submitted on 6 September in accordance with Article 4 of the Electrical Reporting Regulations. <p>The soil will be subject to further analysis and all necessary action will be taken.</p> <p>JANTI: Mr. Ishikawa (president) delivered a presentation to the Denki Shimbun (Electricity Times) seminar entitled <i>Earthquakes and Nuclear Reactors Lessons Learned from the Chuetsu Oki Earthquake</i></p>																															
<p>Tuesday 11 September</p>	<p>TEPCO Press release: Inspection of main exhaust ducts (above-ground portion)</p> <p><Summary of nonconformities></p> <ul style="list-style-type: none"> - The main exhaust ducts in the Nos. 1 – 5 Unit were shifted out of alignment by the earthquake (already notified July 17 2007). These were inspected starting 10 September. As of today, the covers have been removed from the above-ground portions of those exhaust stacks where misalignment was identified, and inspection of the bellows sections has been completed. - The inspections identified deformation of the bellows in 16 of the 18 locations inspected. However none of the deformities was considered serious. Cracks were identified in two locations in the No. 1 Unit. The crack located in the vicinity of the bellows weld (upstream of the weld) measured approximately 1 cm, while the crack located in the vicinity of the duct weld (downstream of the weld) measured approximately 40 cm. (NB: Duct diameter = 4 m approx, perimeter = 13 m approx.) - Prior to removal of the duct covers in the 18 inspection locations, radiation tests were performed on samples of the air, along with surface contamination density and radiation dosage measurements. Surface contamination density was also tested in the locations where the duct covers were removed. No radiation was detected in any of the tests, and there was no radioactive emission into the atmosphere. - The main exhaust stacks of the Nos. 6 and 7 units are located on the reactor building rooftop. Since inspections thus far have not identified any serious issues, these will be excluded from future testing. <p><Response></p> <ul style="list-style-type: none"> - Provisional repairs have been made to cracks in the vicinity of the bellows and duct welds of the No. 1 unit as of today. Provisional repairs will be made to cracks in the vicinity of the bellows welds today. - The underground portion of the main exhaust ducts will be inspected at some stage 	<p>NISA Press release: Earthquake update (24th report)</p> <ul style="list-style-type: none"> - Information received from TEPCO as per column on left - Safety inspectors have been testing main exhaust stack samples from the No. 1 unit since the date of the earthquake and have not found any evidence of radiation; therefore, the cracks are not believed to have any effect - The issue of the main exhaust duct of the No. 1 unit will be discussed by the Committee to Investigate Impact of Chuetsu Oki earthquake on Nuclear Power Plant Facility - No significant developments in the main exhaust stack radiation monitor or monitoring posts have been identified since the earthquake 																														
<p>Wednesday 12 September</p>		<p>NISA: Committee on investigation and countermeasures of the impact of the Chuetsu Oki earthquake on the nuclear power facility (3rd meeting)</p>																														
<p>Tuesday 13 September</p>	<p>TEPCO Press Conference: Nonconformities in post-earthquake inspection and restoration program (weekly report dated 13 September)</p> <p>Progress report on inspection and restoration work (including nonconformities) at the Kashiwazaki-Kariwa nuclear power station following the Niigata Chuetsu Oki earthquake (from 9 September to 6 October, 2007)</p> <p>1. Inspection/restoration process</p> <ul style="list-style-type: none"> + Inspection/restoration work completed in the period 7 – 13 September 2007 <ul style="list-style-type: none"> • Inspection of service tools/trolleys on the operating floor of the No. 1 reactor: to be completed by 13 September + Inspection work due to commence during the period 14 – 20 September 2007 <ul style="list-style-type: none"> - No. 1 reactor internal inspection (Phase 2) - Exterior inspection of Nos. 2, 4 and 5 reactor main exhaust ducts (inside trench) - Preliminary restoration work on No. 3 reactor building blowout panels - Inspection of No. 5 reactor fuel exchanger - Oil leak cleanup around the main transformer in the No. 6 reactor and internal inspection - Oil leak cleaning around the internal transformer (A) at the No. 6 reactor and internal inspection - Oil leak cleanup around the main transformer in the No. 6 reactor and internal inspection etc <p>2. Nonconformities identified during inspection/restoration work following the Niigata Chuetsu Oki earthquake</p> <p>Information about incidents in the period 6 – 12 September 2007 and nonconformities (for discussion) in the period 30 August – 5 September 2007</p> <p>1) Incidents (related to the Chuetsu Oki earthquake)</p> <table border="1"> <thead> <tr> <th colspan="2">6 – 12 September 2007 (cumulative total since 10 August)</th> <th colspan="2">By classification (cumulative total since 10 August)</th> </tr> </thead> <tbody> <tr> <td rowspan="3">Incidents</td> <td>0</td> <td></td> <td>0 (0)</td> </tr> <tr> <td>(1)</td> <td></td> <td>0 (0)</td> </tr> <tr> <td></td> <td></td> <td>0 (1)</td> </tr> </tbody> </table> <p><Incidents occurring in the period 6 – 12 September 2007></p> <table border="1"> <thead> <tr> <th>Classification</th> <th>Date</th> <th>Type</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td></td> <td>—</td> <td>—</td> <td>—</td> </tr> <tr> <td></td> <td>—</td> <td>—</td> <td>—</td> </tr> <tr> <td></td> <td>—</td> <td>—</td> <td>—</td> </tr> </tbody> </table>	6 – 12 September 2007 (cumulative total since 10 August)		By classification (cumulative total since 10 August)		Incidents	0		0 (0)	(1)		0 (0)			0 (1)	Classification	Date	Type	Description		—	—	—		—	—	—		—	—	—	<p>NISA Press Conference: Earthquake update (25th report)</p> <ul style="list-style-type: none"> • Information received from TEPCO as per column on left • No. 1 reactor internal inspection (Phase 2) due to commence on 14 September • NISA will continue with internal inspection of Nos. 1 through 7 reactors for damage and/or significant deformation • Safety inspectors are currently in the process of an in-depth investigation to establish the causes of issues at the plant identified by TEPCO • No significant developments in the main air stack radiation monitor or monitoring posts at present
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2) Nonconformities (related to Chuetsu Oki earthquake: As excluded)

30 August – 5 September 2007 (cumulative total since 16 July)	
Incidents	117 (2,758)

Tuesday Sep 20

Power companies: Summary of outcomes from investigation into the impact of the Niigata Chuetsu Oki earthquake on key safety equipment and facilities at the nuclear power station

During the Niigata Chuetsu Oki earthquake, the Kashiwazaki-Kariwa nuclear power station recorded seismic movement in excess of the design standards. Consequently, all the power companies conducted their own independent investigations (as opposed to the seismic safety assessment process) which involved **comparing the seismic records from the foundation mat of the reactor buildings at the Kashiwazaki-Kariwa nuclear power station with seismic data from their own nuclear power stations in order to determine the impact on the key reactor safety functions: stop, cool, and containment.** The power companies delivered their findings on August 20. The power companies today presented **the Ministry of Economy, Trade and Industry with a summary report of the outcomes from their investigations** into the aftermath of the Niigata Chuetsu Oki earthquake.

<Example: TEPCO press conference>

- The investigation found that the **key safety functions stop, cool and containment functioned correctly** at the Fukushima No. 1 and No. 2 nuclear power stations.
- Fukushima No. 1 and No. 2 nuclear power stations will be subject to seismic safety assessments in accordance with the Seismic Safety Assessment Program* which was revised on August 20.
- Geological investigations in the aftermath of the recent earthquake will continue at the Kashiwazaki-Kariwa nuclear power station, along with seismic safety evaluation particularly with respect to analysis of observation data from the earthquake.

* Seismic Safety Assessment Program

This is a summarized version of the seismic safety assessment program based on the seismic design guideline for nuclear power generation facilities, which was amended in September 2006. The assessment procedure involves calculating the standard seismic movement based on parameters such as geological formation and the results of seismic investigations, then analyzing the seismic response of machinery and reactor buildings to the standard seismic movement in order to determine the seismic safety levels of machinery, equipment and piping systems.



NISA press release: Reports from power companies on general investigations into the impact of the Niigata Chuetsu Oki earthquake based on observation data from the Kashiwazaki-Kariwa nuclear power station

1. The Ministry ordered power companies to investigate revisions to seismic back checking programs in the aftermath of the Niigata Chuetsu Oki earthquake on July 16, 2007. The power companies submitted their reports on the revisions on August 20, 2007.
2. In conjunction with the revision reports, the power companies pledged to conduct their own voluntary studies of the impact on equipment and facilities of the Niigata Chuetsu Oki earthquake, based on observation data from the Kashiwazaki-Kariwa nuclear power station. These studies, to be completed within one month, are in addition to the seismic back checking.
3. The power companies submitted their reports on the findings of the voluntary studies to the Ministry today.
4. **Based on the reports received today, the Ministry can confirm that the power companies have correctly selected the key facilities responsible for key safety functions for the purpose of evaluation, and have adopted appropriate methodology for the evaluation of the safety functions of these facilities.**
5. The Ministry will scrutinize the reports of the seismic back checking evaluations conducted by the power companies, based on new information provided by the earthquake incident.

TEPCO press release: Nonconformities identified in post-earthquake inspection and restoration program (weekly report September 20)

Update on nonconformities identified during inspection and restoration work at the Kashiwazaki-Kariwa nuclear power station in the aftermath of the Niigata Chuetsu Oki earthquake (from September 16 to October 13, 2007)

1. Inspection and restoration

- + Inspection and restoration work completed during the period September 14 – 20, 2007
 - Inspection of ceiling crane in No. 1 reactor building: completed September 18
 - Inspection of exhaust ducts in Nos. 1 and 3 units: completed September 14
 - Inspection of ceiling crane in No. 3 reactor building: completed September 14
 - Inspection of main exhaust ducts (external sections) in Nos. 2, 4 and 5 units: completed September 14
 - Investigation, inspection and provisional restoration of transformer oil retaining wall: to be completed by September 20
- + Inspection and restoration work to commence during the period September 21 – 27, 2007
 - Inspection of fuel exchange at No. 6 reactor
 - Preparations for transportation of No. 6 reactor internal transformer to factory

2. Nonconformities identified during inspection and restoration work following the Niigata Chuetsu Oki earthquake

Report of issues identified in the period 13 – 19 September 2007 and nonconformities (as per discussions) identified in the period 6 - 12 September 2007

1) Issues related to the Chuetsu Oki earthquake

September 13 – 19, 2007 (cumulative total since 10 August 2007)		By category (cumulative total since 10 August 2007)	
No. of issues	0 (1)	I	0 (0)
		II	0 (0)
		III	0 (1)

<13 – 19 September, 2007>

Category	Date identified	Name	Description
I	-	-	-
II	-	-	-
III	-	-	-

NISA press release: Earthquake update (26th report)

- Information received from TEPCO as shown on left
- Internal inspection of No. 1 reactor (Phase 2) to commence on September 14
- NISA will conduct internal inspections of the Nos. 1 through 7 units to check for damage and significant deformation
- NISA safety inspectors are currently investigating the causes and other details at the plants based on TEPCO findings
- There is no significant change in the main exhaust stack radiation monitor and monitoring posts

WG on internal fire protection systems and liaison structures

NISA **directive on upgrading internal fire protection systems**

2) Nonconformities (related to Chuetsu Oki earthquake: As excluded)

6 – 12 September, 2007 (cumulative total since 16 July 2007)	
No.	41 (2,799)

3) Other

- Cracks were identified at two sites during inspection of the main exhaust duct (above ground section) of the No. 1 Unit: a 1-cm crack upstream of the weld joint, and a 40-cm crack downstream of the weld joint. Measurement of surface concentration of contamination found no traces of radioactive substances at either site, and no radiation emission into the atmosphere. Repairs to both cracks were completed on 11 September.

Tuesday 25
September

Nuclear Safety Commission: Sectional meeting on nuclear safety standards and guidelines Sub-committee for Fire Protection (first meeting)

<Agenda items>

- Establishment of the Sub-Committee for Fire Protection
- Investigation into fire protection

Wednesday 26
September

First meeting of the Committee for Evaluating Operational Safety at Nuclear Reactors After the Chuetsu Oki Earthquake

Tuesday 27
September

TEPCO press release: Nonconformities identified in post-earthquake inspection and restoration program (weekly report September 27)

Update on nonconformities identified during inspection and restoration work at the Kashiwazaki-Kariwa nuclear power station in the aftermath of the Niigata Chuetsu Oki earthquake (from September 23 to October 20, 2007)

1. Inspection and restoration

- + Inspection and restoration work completed during the period 21 – 27 September, 2007
 - Oil spill cleanup and internal inspection of No. 6 Unit in-house transformer (6A): completed 25 September
 - Oil spill cleanup and internal inspection of No. 6 Unit in-house transformer (6B): completed 26 September
 - Oil spill cleanup and internal inspection of No. 7 Unit main transformer: completed 21 September
 - Inspection of fuel exchange at No. 7 reactor: to be completed by 27 September

+ Inspection and restoration work to commence during the period September 28 – October 4, 2007

- Preliminary preparations for internal inspection of No. 1 reactor (Phase 3)
- Inspection of main exhaust ducts of Nos. 2, 4 and 5 Units (inside trench)
- Restoration of blowout panel of No. 2 turbine building
- Inspection of stud bolt tensioner and other service tools on operating floor of No. 5 reactor
- Oil spill cleanup and internal inspection of main transformer in No. 6 Unit
- Reactor opening work at No. 7 reactor
- Removal of work platform inside the fuel pool of the No. 7 Unit (scheduled for 27 - 30 September)

2. Nonconformities identified during inspection and restoration work following the Niigata Chuetsu Oki earthquake

Report of issues identified in the period 20 – 26 September 2007 and nonconformities (as per discussions) identified in the period 13 - 19 September 2007

1) Issues related to the Chuetsu Oki earthquake

September 20 - 26, 2007 (cumulative total since 10 August 2007))		By category (cumulative total since 10 August 2007)	
No. of issues	0 (1)	I	0 (0)
		II	0 (0)
		III	0 (1)

<20 – 26 September, 2007>

Category	Date identified	Name	Description
I	-	-	-
II	-	-	-
III	-	-	-

2) Nonconformities (related to Chuetsu Oki earthquake: As excluded)

13 - 19 September, 2007 (cumulative total since 16 July 2007)	
No.	27 (2,826)

3) Other

NISA press release: Earthquake update (27th report)

- Information received from TEPCO as shown on left
- Although the confirmed instances of deformation have no effect on the safety of the nuclear facility, they will need to be addressed by TEPCO along with the other nonconformities. NISA will check that appropriate action has been taken
- NISA is still in the process of conducting internal inspections of the Nos. 1 through 7 units to check for damage and significant deformation
- NISA inspectors are currently investigating the causes and other details at the plants based on TEPCO findings
- There is no significant change in the main exhaust stack radiation monitor and monitoring posts

- The No. 3 reactor internal transformer (3B) was sent to the factory on 20 September.

TEPCO press release: Internal inspection of the No. 1 reactor (Phase 2)

Progress report of the internal inspection of the No. 1 reactor (Phase 2) which commenced on September 14

<Period>

September 14 – 18, 2007: excluding upper section of reactor inspected in Phase 1)

September 19 onwards: middle section of reactor and temporary equipment storage pool

<Scope>

Upper section of reactor: reactor pressure vessel flanges, guide rods, water feed sparger, reactor core supply pipes, reactor core spray sparger, upper shroud ring, upper lattice

Middle section of reactor: reactor core support plate, fuel holding frame, jet pump, low-pressure reactor core injection pipes, local area output monitor

Temporary equipment storage pool: steam dryer, steam separator

<Results>

- The steam dryer was removed and placed in the temporary equipment storage pool to allow inspection of the upper and middle sections of the reactor as well as for scheduled maintenance. As of yesterday, **inspection of the steam dryer had not identified any problems such as damage, deformation or loose parts.**
- The steam separator was also removed and placed in the temporary equipment storage pool for the purpose of scheduled maintenance. **An inspection conducted today discovered deformation in all four of the temporary supports as well as both of the guide pins used to position the steam separator inside the reactor.** The temporary supports and the guide pins constitute **auxiliary equipment and do not have any direct bearing on the functionality or structure** of the steam separator.
- In addition to the deformation of the temporary supports of the steam separator, the inspection found **scratch damage on the floor of the temporary equipment storage pool**; however there were **no signs of water leaking** from the damaged areas



Friday 28
September

Annual convention of the Atomic Energy Society of Japan (AESJ), Autumn 2007

The *Report of the Chuetsu Oki earthquake and safety issues at the Kashiwazaki-Kariwa nuclear power station* noted that **the nuclear facility had continued to function safely despite the earthquake being of unprecedented magnitude** and offered the following reasons as explanation:

- 1) The facility was built to high strength and durability specifications in order to cater not only for seismic protection but other requirements such as shielding and internal pressure retention
- 2) The facility was designed with generous safety margins in terms of seismic protection and mechanical design
- 3) Based on acceleration testing, the actual safety margin may in fact be over ten times greater than what we know