KK-7: to restart or not to restart

Will science be sacrificed for the sake of national policy?

1. Moves to restart KK-7

Of the seven reactors at the Kashiwazaki-Kariwa Nuclear Power Plant (KK), all of which have been shut down since the Chuetsu-Oki Earthquake in July 2007, Unit 7 (ABWR, 1356 MW) is said to have suffered least damage. On February 18 the Nuclear Safety Commission (located within the Cabinet Office) approved the restart of this reactor. The following day Tokyo Electric Power Company (TEPCO) applied to Kashiwazaki City, Kariwa Village and Niigata Prefecture for permission to restart the reactor. It appears that it wants all the necessary approvals in place by March 31, the end of the fiscal year.

However, things are not going as TEPCO planned. A fire in Unit 1 on March 5 increased the concerns of the local residents. This is the eighth fire since TEPCO began work in preparation for restart. The cause on this occasion was that workers had not received training about the danger of inflammable vapor in the area. Residents are very critical of TEPCO. They say that TEPCO's claim that it places top priority on safety is an empty slogan and that it is not qualified to operate nuclear reactors. On March 11 Niigata Governor, Hirohiko Izumida, said that he would not give his approval for restart of KK Unit 7 until the appropriateness of TEPCO's plan to revise its fire prevention system is accepted. He indicated that he did not think public understanding for restart had been obtained. Kashiwazaki Mayor, Hiroshi Aida, and Kariwa Mayor, Hiroo Shinada expressed similar sentiments.

2. Jumping the gun

On March 8 Niigata Prefecture's technical committee on safety control of nuclear power plants held its third meeting since the Chuetsu Oki Earthquake. It agreed that a chairman's opinion supporting restart should be presented at the next meeting, scheduled for March 18. However, the March 8 meeting was sadly lacking in scientific and technical debate and failed to answer scientifically based questions raised by committee members opposed to restarting KK-7. The reason for the unscientific nature of the discussion was that it was based on a sloppy summary of issues debated in two technical subcommittees, when the deliberations of these subcommittees have not even been concluded.

3. Unresolved problems

At this stage, debate over three serious problems has not been resolved.

(1) KK's seismic safety

TEPCO, the Nuclear and Industrial Safety Agency (NISA) and the Nuclear Safety Commission (NSC) argue that it is sufficient to set the magnitude of the design-basis earthquake at M7.0. NISA and NSC approved restart of Unit 7 on this basis. (By comparison, the Chuetsu-Oki Earthquake was M6.8 on the Japanese scale.) However, some scientists have said that this is inadequate. They believe a M7.5 earthquake should be chosen. Although they have provided clear scientific evidence, their arguments have been ignored.

The issue relates to questions about the seismic fault plane that caused the Chuetsu-Oki Earthquake and the form of the marine terrace running from Kashiwazaki to Niigata. The critics claim that the F-B fault was not the source of the Chuetsu-Oki Earthquake. They say the source was the much longer Eastern Boundary Fault of Sado Basin. Historically, this fault has moved repeatedly and it has had a fundamental influence on the form of the marine terrace in the region. There is no scientific basis for refuting this argument.

The basic earthquake ground motion was set at 2,300 Gal for Units 1~4 and 1,209 Gal for Units 5~7 on the basis of a M7.0 earthquake, but these levels are clearly inadequate.

(2) Irregular movement of reactor and turbine buildings

The ground level has been measured on three occasions since the earthquake, but each time the direction and size of the inclination of the buildings was different. This shows that the plant was not built on firm ground. The fact is that the ground beneath the buildings is moving. As explained in NIT 128, it is as if the nuclear power plant was "floating on a cup of starch".

The seismic safety guidelines in force when the plant was constructed (the old guidelines) required that nuclear power plants be constructed on firm ground. The construction of KK violated these guidelines. The excuse is given that the inclination is within the permitted limits and will not interfere with insertion of the control rods, but this avoids the real issue. Can the plant withstand the next earthquake? Why does the ground continue to move in this irregular way? As long as scientific answers to these questions are not found, residents will not have confidence in the safety of the plant.

At the beginning of March a research team from Niigata University carried out a second boring

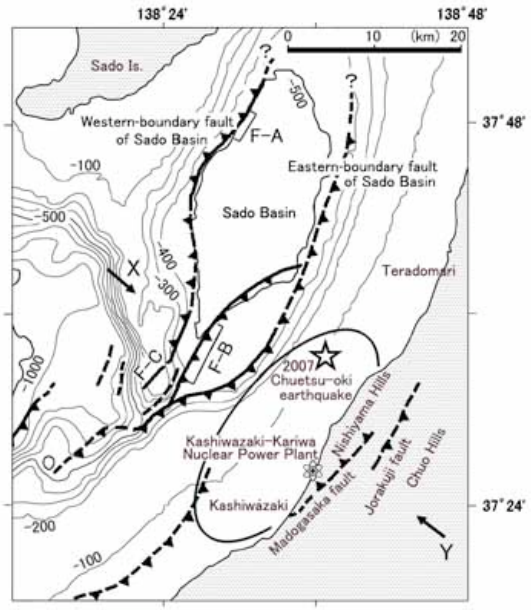

Fig. 1 Major active faults in the vicinity of the Kashiwazaki-Kariwa Nuclear Power Plant

near the plant. (A photo of the first boring is shown on page 1 of NIT 128.) Results have just come in and there is a difference of 20 meters between the Niigata University team's measurement and TEPCO's measurement of the Nishiyama stratum. This suggests fault activity, contrary to the analysis of the ground structure around the KK plant carried out by TEPCO and accepted by the government. My view is that this is because KK is indeed "a nuclear power plant floating on a cup of starch".

Kariwa Nuclear Power Plant
The star shows the epicenter of the 2007 Chuetsu-oki earthquake. (Underground rupture along the seismic fault plane began directly beneath this point.) Slip on the fault plane spread to almost the whole area where aftershocks occurred (ellipse). Thick lines show active faults. (Broken lines are inferred ones.) Black triangles on the lines show dip-directions of the faults. The sea area is based on Watanabe et al.. F-A, F-B and F-C are faults after TEPCO's application for a license variation for Units 6 & 7. The Madogasaka fault is after Watanabe et al.. The Jorakuji fault is after Nihon no Katsudanso (New Edition) (Research Group for Active Faults of Japan (Ed.), University of Tokyo Press, 1991).

(3) Can the casing of the reactor coolant recirculation pump motor survive the next earthquake?
KK-6&7 are Advanced Boiling Water Reactors (ABWR). This type of reactor has internal recirculation pumps. ABWR reactors have 10 recirculation pumps, which are welded onto the bottom of the wall of the reactor vessel. There are concerns that during an earthquake in excess of M7 the casing within which the recirculation pump motors are contained could buckle and break.

The stress applied by a M7 earthquake is calculated to be 195 megapascals. By comparison, the design standard is 207 megapascals. That means there is a leeway of just 6%, suggesting that the casing would not withstand a M7.5 earthquake. There is a danger that it could break off. In such a case, the reactor coolant would drain out leading to a major accident.

Considering the abovementioned unresolved issues, TEPCO should not be allowed to restart KK Unit 7. To restart the reactor would be a huge gamble. It would fly in the face of the safety-first principle.

4. Radioactive pine needles
Measurements commissioned by CNIC of radioactive carbon-14 in the needles of pine trees growing by the Kashiwazaki-Kariwa Nuclear Power Plant raise questions about how much radioactivity was actually released during the Chuetsu-Oki Earthquake. Pine needles which grew in 2007, the year of the Chuetsu-Oki Earthquake, on trees in TEPCO's public relations center had elevated specific activity of carbon 14 (294.8 mBq/gC from 2007 pine needles compared to 251.2 mBq/gC for 2008 pine needles). This suggests that more radioactivity was released during the earthquake than TEPCO claimed. (For TEPCO's figures see NIT 119.) It is unclear where the carbon 14 came from, but it is conceivable that it could have leaked from damaged fuel assemblies. This is further evidence that the full effects of the earthquake are still not properly understood.

TEPCO failed to carry out measurements of environmental samples to assess radioactivity released during the earthquake. As it happened, CNIC already had a project to measure radioactivity around Rokkasho (see NIT 111), so we decided to measure carbon 14 in pine needles from KK at the same time.

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1. Watanabe Mitsuhisa, Suzuki Yasuhiro, Nakata Takashi: Programme and Abstracts, Japan Association for Quaternary Research, No. 37, Suppl., 4(2007).

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