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Citizens' Nuclear Information Center

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Complete Halt of All Nuclear Power Plants in Japan
But for how long can restarts be prevented?

May 5 is "Children's Day" in Japan, a holiday on which the happiness of children is celebrated. On this day in 2012, the children received the special gift of the total shutdown of all Japan's nuclear power plants. The one reactor that was online, Hokkaido Electric Power Company's Tomari Unit 3 (PWR, 912MW) was halted for regular maintenance.

At the time of the accident at Tokyo Electric Power Company's (TEPCO) Fukushima Daiichi Power Station, Japan's nuclear reactors numbered 54. A year later, on April 19, Fukushima Daiichi Power Station's Units 1 to 4 (BWR, Unit 1,460MW, Units 2 to 4,784MW each) were officially decommissioned, leaving the

Contents

Man wears a Japanese helmet (kabuto) to wish for the happiness and well-being of children at the "Goodbye to Nuclear Power Plants" Rally on May 5 in Tokyo.

number of reactors in Japan currently at 50. After the Fukushima nuclear accident, nuclear reactors that had been halted due to regular maintenance or problems before the Fukushima nuclear accident occurred, and those shut down for regular maintenance one after the other in the weeks and months following the nuclear accident could not be restarted. As a result, all of Japan's nuclear reactors are now shut down.

The government and the power companies have tried desperately to get even one or two reactors restarted in order to avoid this total shutdown scenario, and now that all the reactors have been halted their intention is to break out of this situation as soon as possible. But they are faced with strong resistance; that of gaining the approval of the local administrations of the areas in which the power plants are located. Legally, the local administrations have no power to prevent restarts. Under the safety agreements concluded between the power companies and Fukui Prefecture, Niigata Prefecture and the administrative units (cities, towns and villages) in which the power plants are located, when it is judged that there is a need for special measures to be taken following an on-site inspection by administrative body officials, the administrative body can demand that the power company take appropriate measures, including the shutting down of reactors, and it is specified that in the case of shutdowns consultations must take place before reactors are restarted.

In the case of Fukui, even when the state establishes a special commission to investigate an accident, there must be consultations prior to reactor restarts. Naturally, however, this is limited to the reactors in which the accident actually occurred. In addition, these are consultations, and it is considered that 'prior approval' is not in fact required. In agreements other than the Fukui and Niigata Prefecture agreements there is not even mention of prior consultations. That restarts cannot be implemented without the prior approval of local administrations is, of course, due to strong public opinion following the Fukushima nuclear accident. Moreover, because of the spread of nuclear contamination that took place as a result of the Fukushima nuclear accident, not only the local administrations where nuclear power plants are located but surrounding administrations are also insisting that the power companies seek their approval before reactor restarts (as well as the conclusion of safety agreements).

On April 13, the government, in a meeting of the Prime Minister, the Minister of Economy, Trade and Industry, the Minister of the Environment and for the Restoration from and Prevention of Nuclear Accidents, and the Chief Cabinet Secretary judged that proposed restarts of the Kansai Electric Power Company's (KEPCO) Ohi nuclear plant Units 3 and 4 (PWR, 1,180MW each) were appropriate. On the next day, April 14, the government explained this decision to the local administration, Ohi Town in Fukui Prefecture, and to adjacent Shiga Prefecture and Kyoto Prefecture on April 23, urging their 'understanding.' In response, Fukui Prefecture indicated that it would initiate verification of the decision in the prefecture's Nuclear Power Safety Specialist Committee and Shiga and Kyoto Prefectures each stated their intention of deliberating the matter in specialist committees of experts.

Prior to the government explanation, Shiga and Kyoto Prefectures submitted a seven-point proposal to the government on April 17 in which they demanded the early establishment of the Nuclear Regulatory Agency and a roadmap indicating a phase-out of reliance on nuclear power, showing that 'understanding' was still quite some way off. Further, on April 10, Osaka Prefecture and Osaka City, one step further away from Fukui Prefecture, announced eight conditions, including the conclusion of safety agreements with local administrations within 100 km of nuclear power plants, which was submitted to the government on April 24. Fukui Prefecture had already, on September 15, 2011, demanded that the government strengthen disaster prevention measures such as the early construction or improvement of roads for disaster control, as well as making restarts conditional on such matters as the public announcement of all information concerning the Fukushima nuclear accident. Opinion polls conducted by mass media companies also showed that opposition to restarts was running strong and that the hurdles to nuclear reactor restarts are, in fact, very high.

In spite of this, it is not easy to predict how long restarts can be prevented. **The most important thing is to prevent restarts from occurring for as long as possible and show for a fact that there is no non-nuclear power supply shortage problem in Japan, even in overcoming the summer peak power demand.** It is undoubtedly for this reason that the government and the power industry want to restart as many nuclear reactors as possible in order to be able to say that we were spared blackouts thanks to nuclear power. Concerning power supply, the government and the power industry are disseminating the propaganda that if nuclear reactors remain shut down demand will exceed supply, especially in KEPCO's generating region. However, with regard to KEPCO's estimated power demand, several experts have pointed out that KEPCO has underestimated both its supply estimates and the effect of power saving compared with other power companies, and that power supply compatible with demand is possible by purchase of power from other suppliers.

In any event, the implied notion that "power supply is more important than safety" is mistaken. Even though that may be so, over and above that, and with the background of the proof that there is no non-nuclear power supply shortage problem, we would like to bring about a phase-out of nuclear power through clear enshrinement in laws as the policy of the state and/or as the firm decision of the power companies. While a nuclear phase-out may be fraught with difficulties, it is not always clear exactly what those difficulties are. Once the country is determined to implement a nuclear phase-out policy, the difficulties will then become clear in a much more concrete form. It is, indeed, only in this way that appropriate countermeasures can be set up.

The government has said that it will initiate a national public discussion on energy policy. The new energy policy, entitled the "Innovative Energy and Environmental Strategy" is due to be finalized sometime this summer. Formulation of the "Strategy" is to be coordinated by an "Energy and Environment Council" consisting of the Minister for National Strategy as chairperson, and the Ministers of Economy, Trade and Industry; Education, Culture, Sports, Science and Technology; and the Minister for the Restoration from and Prevention of Nuclear Accidents. It is said that the "Strategy" will reflect discussions on a review of the Framework for Nuclear Energy Policy and the Basic Energy Plan.

The Framework for Nuclear Energy Policy is a document drawn up and approved by the Atomic Energy Commission, and the task of drawing up a revised version began in late 2010. The Basic Energy Plan is drawn up by the Advisory Committee for Natural Resources and Energy, a consultative body of the Minister for Economy, Trade and Industry, is approved by cabinet decision and takes the form of policy drawn up by the government. The Plan was revised recently, in 2010, and since it has a very strong bias towards the promotion of nuclear power, following the Fukushima nuclear power plant earthquake disaster it is due to be reviewed "from scratch."

The review of the Basic Energy Plan will indicate options for the composition of power supply from different sources (nuclear power, thermal, renewables, etc.), and the revision of the Framework for Nuclear Energy Policy will show options for the nuclear fuel cycle (reprocessing of all used fuel, direct disposal, and storage), data such as costs and CO_2 emissions being given for each of these options. The options for the new energy policy will then be the subject of national discussion. The options themselves look as if they will present problems, since the effect of energy conservation and other efforts are likely to be underestimated for each of the options, leading to a higher estimate for total power demand. CNIC's Hideyuki Ban is participating as a committee member in both reviews and is struggling to ensure that at least some meaningful options are taken up. In the end, however, it is crucial that it is the people of the nation who decide energy policy and that the solicitation of opinions does not become a mere exercise in formality.

(Baku Nishio, CNIC Co-Director)

Labor Standards Inspection Office in Yokohama recognizes death of Fukushima nuclear worker as eligible for compensation

On February 24, the Yokohama Minami Labor Standards Inspection Office (LSIO) determined that the fatal heart attack of a worker, Nobukatsu Osumi, at the Fukushima Daiichi Nuclear Power Station in May 2011 was caused by overwork, and recognized his death as a workplace accident eligible for workers' compensation. This is the first time in which compensation has been recognized for the illness or death of a worker at the nuclear accident site.

Mr. Osumi was hired as a temporary worker by a construction company, a fourth-level subcontractor under the prime contractor Toshiba Corp., in Omaezaki City, Shizuoka Prefecture, and was dispatched to the Fukushima Nuclear Power Station. At around 2:30 a.m. on May 13, he left the workers' dormitory, quite a long distance from the nuclear accident site, and began his first three-hour shift, from 6:00 to 9:00 a.m., working on piping and other work for installing waste processing equipment in a radioactive waste disposal facility at the complex.

On the second day, at around 6:50 a.m. on May 14, he collapsed while carrying a special kind of saw. He was rushed to the plant's first-aid room, but the doctor was off duty, and at 8:10 he was transported to J Village, a sports facility about 20 kilometers away from the plant now being used as a logistical base for workers at the Fukushima nuclear accident site, which did not have sufficient medical equipment. He was then taken to a hospital in Iwaki City by ambulance, where he died at 9:33 a.m..

It took more than two hours from the time when Mr. Osumi complained of not feeling well to his arrival at the Iwaki hospital. Following his death, some experts criticized the deficiencies in the plant's emergency care system for workers. In response, plant operator Tokyo Electric Power Co. (TEPCO) has at last placed a doctor on standby 24 hours a day. While working at the plant, Mr. Osumi received only a small radiation dosage, 0.68 millisieverts (mSv). According to some media reports, when Mr. Osumi's family applied for workers' compensation TEPCO commented that the company did not believe there was a strong connection between the work and his death. Meanwhile, Toshiba said the relationship between the work and his heart attack was not clear, and that, at that stage it was difficult to judge whether or not it was a workplace accident. To date, neither Toshiba nor TEPCO have offered consolatory money or other compensation, customary in Japan when a worker dies at the workplace, to his bereaved family.

LSIO attaches importance to the extremely severe working environment at Fukushima plant

Although Mr. Osumi only worked for a total of just under four hours on the two days, the work was carried out in a harsh environment, wearing a mask and protective clothing, and entailed traveling a long distance late at night followed by work in the early morning. LSIO concluded that the extremely severe working environment placed heavy mental and physical burdens on the worker, resulting in the heart attack, and therefore recognized his death as due to overwork for a short period of time, which is eligible for compensation.

The Ministry of Health, Labor and Welfare (MHLW) says it will recognize brain or heart disease as a 'workplace accident eligible for compensation' only when the patient was involved in one of the following three cases immediately before the development of the symptom, 1) a long period of overwork, 2) extremely hard work for a short period of time, or 3) an abnormal occurrence (e.g. an accident).

Up to now, however, it has proven very difficult for nuclear power station workers to win LSIO recognition for workplace accidents. The recent government recognition of the working environment at the nuclear power station as extremely severe is, therefore, a landmark admission, and is expected to pave the way for relief for workers who have become ill or who have been involved in an accident at the site.

Mr. Osumi is not the only worker to have died while working at the Fukushima Daiichi Nuclear Power Station. Three others have lost their lives while working there, including a male worker engaged in the management of radiation exposure doses of other workers using the resting station. He died of leukemia despite the fact that he was engaged in this work for only seven days in early August last year. His cumulative radiation exposure was 0.5 mSv, and his internal exposure is said to have been zero.

Another male worker in his 50's, who began work at the site on August 8, collapsed and died on October 6 while working on the installation

Medicare room at J-Villege (Photo by TEPCO)

was found unconscious in a truck during lunch break. He was in a state of respiratory arrest and died in hospital about one hour later. The cause of his death is yet to be announced.

The Nuclear Disaster Countermeasures Headquarters of the Cabinet Office and the Japan Atomic Energy Agency jointly announced on January17, 2012 that another male worker involved in

of a tank for storing contaminated water from the crippled reactor units. The cause of his death was shock from blood poisoning resulting from a retroperitoneal abscess. On the previous day, at around 7 a.m., he became unable to walk and complained of feeling ill as he was heading for a regular morning work meeting. His cumulative radiation exposure was 2.02 mSv.

The third worker was engaged in pouring concrete in the sludge waste storage facility, under construction at the time, on January 9, 2012 when he complained of feeling unwell. He was rushed to the emergency care room at Units 5 and 6, but he fell into a state of respiratory arrest and was taken to a hospital in Iwaki City.

As of the end of February 2012, a total of 35 applications for workers' compensation had been filed by workers at the nuclear accident site. In September 2011, MHLW Minister Yoko Komiyama stated that she intended to relax the conditions for granting workers' compensation to nuclear power station workers so that workers suffering from various types of cancer would become eligible for compensation. We hope this plan will be implemented and that more nuclear power station workers will be able to receive such compensation.

Two persons have also died in decontamination work

Decontamination work is currently being carried out in many parts of Japan, and two people have already died while engaged in such work. On December 12, 2011, a male worker participating in a model decontamination project in Shimo-oguni, Ryozen-machi, Date City, Fukushima Prefecture,

a model decontamination project in Hirono Town, Fukushima Prefecture, collapsed while working and died in hospital of a myocardial infarction.

In the short space of just two months from October last year, a new regulation on decontamination was enacted and went into full effect on January 1, 2012. This regulation applies to the whole area of Fukushima Prefecture, and to some areas of Iwate, Miyagi, Ibaraki, Tochigi, Gunma, Saitama, and Chiba Prefectures in which radiation doses are expected to exceed 0.23 microsievert per hour (µSv/hr). These areas are designated as "special decontamination zones" where decontamination work should be carried out under direct government control, or "priority areas for contamination surveys," where the decontamination of land plots, including the removal and collection of contaminated soil, is to be carried out. The annual radiation exposure limit for decontamination workers is 50 mSv and the five-year limit 100 mSv, the same level as that for nuclear power station workers.

As for decontamination work to be conducted in other places, such as in company premises and branch offices, the government calls on volunteer workers, the self-employed, or local residents participating in the work to observe the new regulation. We will keep a close watch on the development of this problem of the radiation exposure of decontamination workers, in addition to the exposure problems of nuclear power station workers.

(Mikiko Watanabe, CNIC)

Inspections of vitrified HLW returning from Britain reveal radioactive contamination on canister surfaces

What is the cause of this and how should Japan respond?

On Aug. 3, 2011, 76 canisters of vitrified high-level waste (HLW) were shipped from Sellafield in Britain, arriving at the port of Mutsu-Ogawara, Aomori Prefecture, on Sept. 15. Japan Nuclear Fuel Ltd. (JNFL) announced on Oct. 12, 2011 that radioactive contamination was discovered on the surface of three of the 28 canisters which were contained in the No.1 transport flask. The HLW in these canisters originated from the Kyushu Electric Power Company.

Before storing the returned HLW in the high-level radioactive waste storage control center (in the Rokkasho Reprocessing Plant in Aomori Prefecture) its condition was checked for heat output, external appearance, size, weight, radiation emissions, confinement of radiation, and contamination of the surface. When a smear test revealed that the surface of some of the vitrified HLW canisters were contaminated with radioactive substances and that the contamination level was higher than the reference level, decontamination measures (wiping) were taken repeatedly. The reference level for the concentration of total alpha radiation is 0.4 Bq/cm^2, and that for total non-alpha radiation 4 Bq/cm^2. If repeated wiping of the surface reduces the contamination level to below the reference level, the canisters pass the test.

The table below shows the results of the tests that began on Sept. 21. We asked for these data in mid-November. Repeated wiping was conducted on two of the three canisters whose surface was found to be contaminated. With regard to the remaining canister (B05144), an extremely high level of concentration of non-alpha radiation, 400 Bq/cm^2, was detected in the initial test, a contamination level 100 times higher than the reference level. Since then, a total of 29 tests have been carried out on the canisters. Some of the tests revealed a decline in the contamination level, while other tests showed higher levels. This may indicate that radiation is leaking from the canisters.

This accident is serious. The inspection jointly conducted by JNFL, Kyushu Electric Power Co. (KEPCO) and Nuclear Fuel Transport Co. in Britain prior to the shipment of the vitrified HLW revealed no radioactive contamination on the surface of the canisters. If the contamination emerged during the transportation period, only a matter of several weeks, this means that there must be a serious problem with the integrity of the canisters. Possible causes of this flaw are defective welding on the canister and damage to the surface of the canisters. Unless full-fledged investigations into the cause of this problem are carried out, including the re-examination of the whole process of HLW vitrification, and sufficient measures taken to prevent a recurrence of the problem, the transport of vitrified HLW must be halted.

(Reported on Nov. 19, 2011)

This is a follow-up report on the radioactive contamination on the surface of the vitrified HLW canisters returned from Britain to Japan on Sept. 15, 2011. The canister (B05144), whose surface was found to be contaminated with an extremely high level (400 Bq/cm^2) of non-alpha radiation, 100 times higher than the reference level, was wiped several tens of times and was said to have cleared the reference level. On Dec. 26, the canister was stored in the storage pit at the high-level radioactive waste storage control center in the Rokkasho Reprocessing Plant in Aomori Prefecture.

Three months later, on March 23, 2012, JNFL and KEPCO, the owner of the vitrified HLW, jointly announced the suspected cause of the contamination of the canister surfaces and measures to prevent a recurrence of the problem. As to the cause, they claimed that in the production process, fine glass powder containing radioactive substances became attached to the surface of the canister where the lid fits onto the body of the canister. The worker, however, welded the lid on without removing the glass powder stuck on the surface of the canister, and as a result of this, the glass powder melted and formed a thin film of glass on part of the surface. The vitrified HLW was then shipped to Japan. According to the two companies, in the JNFL inspection conducted prior to the storage

Canister Number: B04773

Test number	1	2	3
Alpha Radiation (Bq/cm^2)	0.071	0.038	0.021
Non-Alpha Radiation (Bq/cm^2)	8.8	4.9	1.9

Canister Number: B04851

Test number	1	2	3	4	5	6	7	8	9
Alpha Radiation (Bq/cm^2)	0.17	0.11	0.034	0.022	0.017	0.013	0.011	0.009	0.027
Non-Alpha Radiation (Bq/cm^2)	22	13	4.0	2.5	1.8	1.3	1.1	0.76	2.0

Canister Number: B05144

Test number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Alpha Radiation (Bq/cm^2)	3.1	1.4	0.64	0.22	0.70	0.40	0.18	0.14	0.11	0.076	0.066	0.048	0.046	0.034	0.028
Non-Alpha Radiation (Bq/cm^2)	400	190	83	29	91	52	23	18	14	10	8.2	5.8	5.6	4.0	3.3

	16	17	18	19	20	21	22	23	24	25	26	27	28	29
	0.073	0.040	0.042	0.043	0.045	0.039	0.040	0.039	0.034	0.029	0.026	0.026	0.026	0.025
	9.1	4.9	5.1	5.2	5.5	4.7	4.9	4.7	4.3	3.4	3.5	3.1	3.0	2.9

Table showing results of tests on the three contaminated HLW canisters of the glass blocks, the crane that lifted the glass blocks came into contact with the contaminated surface, crushing the glass film into small pieces, thereby exposing the contamination.

Thus far, no detailed data on this incident have been disclosed, and no explanation has been given for the details of the contaminated canister surfaces, the vitrification process in Britain, or why (or how) the lid was the cause of the contamination.

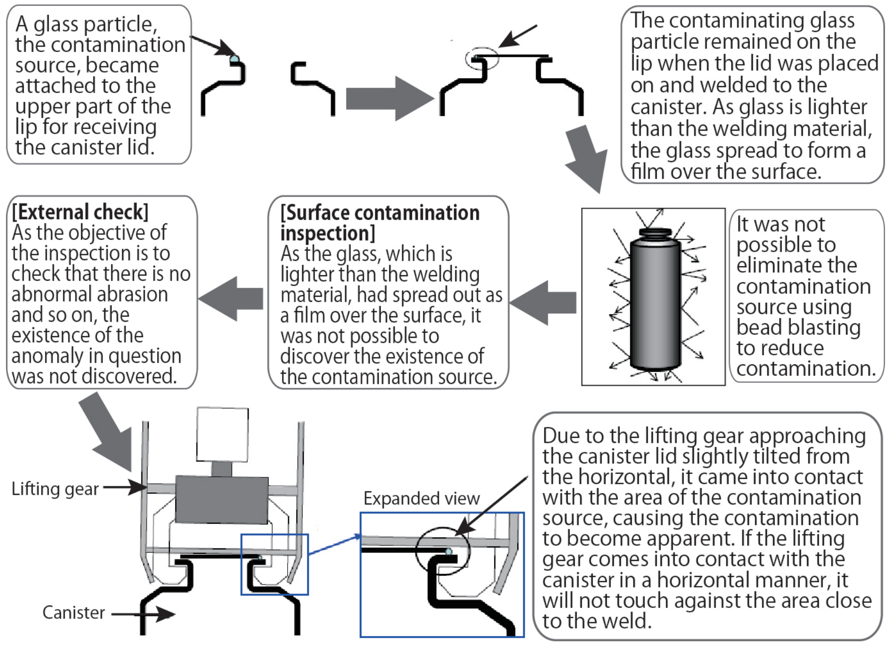


Diagram outlining inferred cause of contamination (Based on Japan Nuclear Fuel Limited website)

Referring to preventive measures, it has been suggested that there will be more frequent visual inspections using cameras in Britain. Should radioactive contamination be discovered on the canister surface during physical inspections, additional bead blasting, a process for removing surface deposits by spraying fine stainless-steel beads at a high pressure, will be carried out. However, the fact remains that beat blasting was conducted in Britain after the vitrified HLW was loaded into the canisters, and inspections did not detect contamination on the canister surface.

Under the current circumstances, the only measure that can be taken when contamination is discovered in the pre-storage inspection is to apply more bead blasting to the surface of the vitrified HLW canisters produced in Sellafield. Bead blasting, however, has a number of shortcomings, for example, that it will create more nuclear waste, and that it will aggravate the contamination of the canister surface if the beads themselves become contaminated. As things stand now, JNFL is considering the quite natural response of refusing to accept the return of the vitrified HLW to Japan if it is impossible to decontaminate the canisters.

(Reported on April 11, 2012)

(Masako Sawai, CNIC)

International Symposium on the Truth of the Fukushima Nuclear Accident and the Myth of Nuclear Safety

The March 11, 2011 Fukushima Daiichi nuclear disaster showed the tragic consequences that may occur when nuclear technology gets out of control.

The causes and the process by which the accident occurred have still not been determined, but some people associated with the nuclear power industry continue to promulgate the nuclear safety myth. Arguing that the Fukushima accident was the result of lax management and a larger-than-predicted tsunami, they blithely claim that as long as nuclear power plants are properly managed they can be operated safely.

From a scientific and technical perspective, and to the extent currently possible, this international symposium will attempt to get to the bottom of the Fukushima Daiichi nuclear accident. The symposium will look at Japan's nuclear energy policy and how it trivialized safety, and, by analyzing the facts, show how this led to such a massive nuclear accident.

Dates: August 30 & 31, 2012

Venue: Tokyo University Komaba Campus, Building 18,
First Floor Hall (seats 200), JAPAN

Draft Program

What Happened at the Fukushima Daiichi Nuclear Power Plant
Current Status of Radioactive Contamination
Japan's Nuclear Policy and Formation of the Safety Myth
The State of Nuclear Science and Technology
Summing Up – from the Perspective of Scientists and Technologists

Speakers

Mitsuhiko Tanaka, Arnie Gundersen, Katsuhiko Ishibashi, Tetsuji Imanaka, Hitoshi Yoshioka, Philip White, Tetsuya Takahashi, Miranda Schreurs, Satoru Ikeuchi and more…

15th No Nukes Asia Forum in South Korea

“No Nukes”: Residents speak out in Samcheok and Yeongdeok, proposed sites for new nuclear power plants

Photo by A. Kobayashi

Since the Fukushima nuclear accidents, there have been moves around the world to reconsider nuclear energy policies, but, as always, there are also counter moves which ignore the fervent cries of the people. In March several pro-nuclear conferences were held in South Korea in quick succession. The Pacific Basin Nuclear Conference was held in Busan from March 18 to 23, the Nuclear Industry Summit was held in Seoul on March 23, and the Nuclear Security Summit was held on March 26 and 27. It was in this context that Energy Justice Actions and other South Korean NGOs organized the 15th No Nukes Asia Forum (NNAF) from March 19 to 24. A total of 42 people attended the forum, 32 of these from Indonesia, the Philippines, Thailand, Taiwan and Japan.

Due to the Nuclear Security Summit, the atmosphere at the airport was very tense. Without giving any reason, the South Korean Government refused entry to one of the Japanese NNAF participants. On the morning of March 19 a press conference was held in front of the Sejong Center to protest the denial of entry to Shin Kurumizawa from Osaka and the deception of the Nuclear Security Summit.

After that we attended an assembly of Catholic priests in Samcheok, Gangwon-do. Along with Yeongdeok in Gyeongsangbuk-do, Samcheok was selected last December by Korea Hydro & Nuclear Power as the site of a new nuclear power plant. There were banners everywhere saying “No Nukes!”

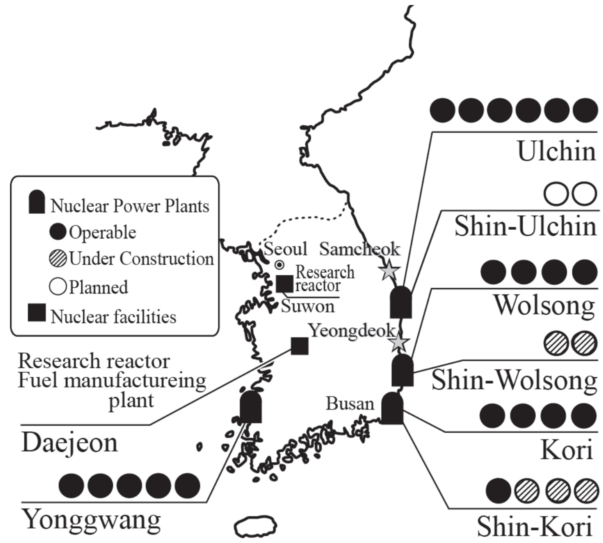
One of the participants was Kenichi Hasegawa, a dairy farmer from Iitate Village in Fukushima Prefecture. He told how after the accident he was forced to destroy all his cows and how the eight members of his family were scattered. He said, “The mountains and farmland of my home town were contaminated with radioactivity. I want Fukushima to be the last place where people have to go through this kind of experience.” At a demonstration of about 1,500 people we chanted “Absolutely no nukes!” and “Recall the mayor,” while onlookers joined in the chanting.

At the meeting in the evening, Mr. Hasegawa showed photos. “Iitate was a place where everyone cooperated to make the village beautiful. After the accident we had to escape, leaving behind our cows, who were like family to us.” There were sighs from the audience as we heard stories of women saying goodbye to their cows which were being led off to the slaughter, of a suicide note from a despairing friend, and of cows dying of starvation.

Emily Dela Cruz from the Philippines gave a report on how in 1986 they prevented operation of the Bataan Nuclear Power Plant, which was built in 1984. Behind their success was a persistent movement from the mid 1970s along with citizens' education. The civil society movement reached its peak at the end of the Marcos era in the mid 1980s. I was moved once again to hear how a strong people's movement was able to prevent a nuclear power plant from being started up. I am sure it gave courage to the people of Samcheok.

The following day, after a tour of the proposed site of the Samcheok nuclear power plant we went to Yeongdeok. Lee Byeong-hwan, the leader of the Stop Yeongdeok Nuclear Power Plant Committee expressed his opposition, saying, "The proposed site is in a region of active faults. The nuclear power plant will destroy the marine ecology." Yeongdeok has on three occasions repelled nuclear-related facilities, including a radioactive waste dump.

At the forum Setsuko Kuroda from Koriyama City in Fukushima Prefecture explained the painful situation that the people of Fukushima find themselves in. Lai Fenlan from Taiwan's Green Party said, "Taiwan's anti-nuclear movement developed in close association with the fight for democracy. We learned from the renewable energy policies of Germany and grew the movement in solidarity with Green Parties throughout the world." Pan Han-Shen, who was a Green Party candidate, said, "Our national support rate is not that high, but on Orchid Island, the site of a radioactive waste dump, our support rate is 36%, making us the second strongest party." After that, Lin Shih-Lan, an indigenous person from Orchid Island, gave a report about the staggering situation on the island. "At first we were told that a canned fish factory would be built. At the disposal site people don't wear any protective clothing. The windows are left wide open, so radioactive materials and radiation are released to the outside. This is happening because there is no strict regulation of operations." He also said, "70% of the workers at the disposal site are indigenous people. There is a big pay difference between the indigenous people and the other workers," indicating that indigenous people are discriminated against in terms of wages



Nuclear Facilities in South Korea

On March 21 in Busan we carried out a protest action against the Pacific Basin Nuclear Conference. At a meeting about the Fukushima nuclear accident I reported on the situation of workers at the Fukushima Daiichi Nuclear Power Plant. Setsuko Kuroda and Saeko Uno, an evacuee from Fukushima, reported on the difficult conditions of the disaster victims.

On March 22 we participated in an international meeting at Sogang University in Seoul. The meeting was held in opposition to the Nuclear Security Summit and several NNAF participants gave presentations.

On March 23, on the way to a press conference opposing the Nuclear Industry Summit, hoards of police blocked the subway station passageways. We quickly unfurled our placards and chanted "No more Fukushimas! No more Fukushimas! No more nuclear energy in Asia!" Mass media cameras flashed, lighting up the protesters, who did not budge in spite of harassment from the police. Our subway press conference was a great success. In the afternoon, NNAF participants released a joint statement and decided that the next NNAF meeting would be held in Indonesia.

It was the first time for me to participate in NNAF. It was a very moving experience and a tremendous inspiration for me to take action and exchange opinions with the participants, who came from many countries. I hope to make the most of the experience in my future activities. I also hope that as friends united by a common goal, we can continue to deepen our solidarity.

(Mikiko Watanabe, CNIC)

Aging Nuclear Power Plants focusing in particular on irradiation embrittlement of pressure vessels

Hiromitsu Ino

Outline of Neutron Irradiation Embrittlement in Aging Nuclear Power Plants

Destruction of a reactor pressure vessel due to neutron irradiation embrittlement should be called an *extreme* severe accident. If the pressure vessel breaks, there is almost no way of preventing a runaway chain reaction. Such extreme damage must be avoided at all costs.

The benchmark for irradiation embrittlement is the ductile-brittle transition temperature (DBTT). If an extreme situation arises, such as pipe rupture due to an earthquake, it is necessary to cool the core using the emergency core cooling system (ECCS). However, if the DBTT is high, this becomes a dangerous operation. When cooled suddenly, a temperature difference arises between the inner and outer walls of the pressure vessel and strong tensile stress is brought to bear on the inner wall. If such tensile stress is applied when the temperature is below the DBTT, there is a danger that cracks could occur in the pressure vessel wall, leading to failure of the pressure vessel and a severe accident.

Table 1 shows Japanese nuclear power reactors in descending order of the DBTT of their pressure vessels. The table shows seven reactors in which DBTT exceeds 50ºC. They are all old reactors that began operating in the 1970s.

Genkai-1 is the worst. The DBTT for this reactor was announced in October 2010. The figure comes from the most recent test of monitoring specimens in April 2009. The DBTT rose 42ºC since the previous test result of 56ºC in February 1993. This is a new record for Japan. This reactor will be discussed in detail in NIT 149.

All the reactors listed from second to fifth place in the table are located in Fukui Prefecture and are owned by Kansai Electric Power Company (KEPCO). In particular, we have been concerned about the continued operation of Mihama-1&2, where high DBTTs have been observed since the beginning of the 1990s. KEPCO asserts that results of pressurized thermal shock (PTS) analysis show that even if the ECCS was used in the event of a pipe rupture the pressure vessel would not fail. However, the evaluation methodology for the stress arising, K_I, has not been released, so it is impossible to know whether this analysis is reliable.

PTS analysis assesses the pressurized thermal shock to the core of PWR pressure vessels in the case of accidents such as loss of coolant accidents and main steam pipe ruptures. It is necessary to confirm that the critical stress intensity factor K_I does not exceed the fracture toughness K_{IC}.

The reactors listed in sixth and seventh places in Table 1 are BWRs. The inner diameter of BWR pressure vessels is large compared to PWRs and the amount (flux) of neutron irradiation received in a given time is one or two orders of magnitude less than in PWRs. From the table it can be seen that the total amount (fluence) of irradiation received by Tsuruga-1 is about one thirtieth of that of Mihama-1, even though they began operating at much the same time. (There is a slight difference in operating time and also in the date the specimens were taken.) Consequently, it was thought that neutron radiation embrittlement was not such a big problem in BWRs as it was in PWRs. (Even now many researchers and engineers are still in the grips of that "common sense.") However, after many years of operation, as we came to know the reality of irradiation embrittlement in BWRs, this "common sense" has been overturned. The total amount (fluence) of irradiation is not the only determining factor for irradiation embrittlement. It has become clear that the rate (flux) at which irradiation occurs is also a determining factor. As will be discussed in part two, this led to an amendment to the monitoring specimen method

Table 1: Reactor Pressure Vessel Ductile-Brittle Transition Temperature (DBTT) – Worst 7

Rank	Reactor Unit	Type	Startup	Classification	DBTT	Neutron fluence (10^{19} n/cm^2)	Date of experiment (removal)
1	Genkai-1	PWR	Oct. 15, 1975	Mother material	98ºC	7.0	April 2009
2	Mihama-1	PWR	Nov. 28, 1970	Mother material	74ºC	3.0	May 2001
				Weld material	81ºC		
3	Mihama-2	PWR	July 25, 1972	Mother material	78ºC	4.4	Sep. 2003
4	Ohi-2	PWR	Dec. 5, 1979	Mother material	70ºC	4.7	March 2000
5	Takahama- 1	PWR	Nov. 19, 1974	Mother material	68ºC *	1.3	Nov. 2002
6	Tsuruga-1	BWR	Mar. 14, 1970	Mother material	51ºC	0.094	June 2003
				Weld material	43ºC		
7	Fukushima Daiichi-1	BWR	Mar. 26 1971	Mother material	50ºC	0.09	Aug. 1999

Source: Prepared by the author from "Results of Monitoring Tests on Steel in Nuclear Reactor Pressure Vessels," CNIC
*As of July 2011. A DBTT of 95℃ was later observed in Takahama-1.

JEAC-4201 and to the situation where two BWRs are now listed among the worst seven and other BWRs are also known to have high levels of irradiation.

Why Does Irradiation Embrittlement Occur? - Basic Concept

Metal materials become degraded for all sorts of reasons. One reason is "radiation damage." This phenomenon is investigated at the atomic level though the study of lattice defects. The Physical Society of Japan has had a section on lattice defects for over 50 years. As a personal note, I have devoted myself to this field of research since becoming interested in it as a university student. I became a tutor at Osaka University and experienced the student uprisings of the 1960s. In hindsight I can see that this field of research, which originated in the United States, developed in tandem with nuclear energy. Nevertheless, that fact did not lead me to abandon the field. I carried out materials research using radiation as a guest researcher at the Kyoto University Research Reactor Institute. However, it was difficult to see a connection between this research and the social problems associated with nuclear energy.

The reason why irradiation defects became an important research theme was because when neutrons generated by nuclear fission hit reactor vessels and pipes they damage the metal materials. This is called "neutron radiation damage." If this causes materials to become brittle, it is called "neutron irradiation embrittlement." Of particular importance is neutron irradiation embrittlement of the steel of the reactor pressure vessel, which is the heart of a nuclear power plant. If this is damaged it can lead directly to a severe and uncontrollable accident.

What type of lattice defects arise from neutron radiation? In crystals, atoms are precisely aligned in lattices, but if they are struck by a neutron they are displaced, leaving a hole. This is called a "vacancy." Displaced atoms are called "interstitial atoms." This phenomenon is called a "lattice defect." In addition, secondary defects result when vacancies and interstitial atoms move about and accumulate, creating "vacancy clusters" and "interstitial atom clusters," respectively. Impurities within the metal (copper atoms etc.) move to form "impurity clusters." These "secondary lattice defects" cause metals to lose their characteristic ductility (plasticity) and become brittle. To compare it to the human body, it is like the hardening of the arteries which makes blood vessels vulnerable to rupture.

Usually, when a force is applied to steel it simply deforms without breaking, but below a given temperature, if the slightest force is applied, rather than deforming plastically it shatters like pottery. This critical temperature is called the ductile-brittle transition temperature (DBTT). This brittleness of steel used to be the bane of shipbuilders. Many ships sank due to this phenomenon. The Titanic, which sank exactly 100 years ago in 1912 when it struck an iceberg while crossing the North Atlantic Ocean, is a famous example. Subsequent studies showed that poor quality steel plate was used and that the DBTT was 27ºC.

When reactor pressure vessels are bombarded by neutrons the DBTT rises. When designing nuclear reactors it is necessary to predict how high the DBTT will rise and whether they can survive for the period of their design lives. However, assuming a design life for nuclear reactors of 40 years, it is impossible to know what condition they will be in after 40 years until the 40 years has actually elapsed. That presents a problem, so accelerated experiments are conducted. Accelerated experiments are tests that are commonly used to assess endurance by, for example, applying forces beyond the normal load, or operating plants at greater than normal speed.

Likewise, when conducting tests for neutron irradiation embrittlement, the amount (flux) of neutron exposure in a given period of time is increased far above normal amounts. Materials test reactors can radiate materials at a rate of $10^{12}n/cm^2s$ (neutrons/square centimeter). This rate (flux) of exposure is between 100 and 10,000 times the rate of exposure in normal reactors, given that the rate of exposure for PWRs is $10^{10}n/cm^2s$, while the rate for BWRs is $10^8n/cm^2s$. That means the amount of irradiation a BWR would sustain in 40 years can be applied in one or two days. Using such data a formula predicting embrittlement was produced. Furthermore, besides the normal monitoring specimens, accelerated monitoring specimens are also placed in BWR reactor vessels. They are placed not on walls of the vessel itself, but closer to the core, where the rate (flux) of radiation is an order of magnitude higher. The idea is to predict the future state of the reactor. Likewise, monitoring specimens are placed deeper inside PWRs than the walls of the reactor vessel. For example, in the case of Genkai-1, discussed in part two, the rate of radiation is about double the normal rate. This is an attempt to read the future.

However, there is an assumption underlying the notion that the future can be predicted. That is, regardless of the rate (flux) of irradiation, or, to put it another way, regardless of the period of exposure, if the total amount (fluence) of radiation is the same, the result will be the same. The formula for this assumption is as follows:

Rise in DBTT = material factor x F(*f*)

The material factor is determined by the type and the concentration of impurities in the steel. For example, if the steel contains a large amount of copper, the material factor will rise. F(*f*) is the irradiation factor. It is postulated to be a function of the fluence of neutron irradiation "*f*" alone.

With accumulated experience of operating nuclear power plants, it became possible to obtain long-term monitoring test data in real life conditions, and it became clear that this formula was suspect. In particular, with regard to BWRs, for which the rate of irradiation is slower, it became clear that the results for the normal monitoring specimens and the accelerated monitoring specimens placed in reactors did not agree. This trend is particularly pronounced in reactors like Tsuruga-1 and Fukushima Daiichi-1 where the steel of the reactor pressure vessels contains large amounts of copper impurity. It can be seen from this that the irradiation factor F(*f*) is dependent not only on the fluence (total amount) of neutron irradiation "*f*", but also on the flux (amount in a given time) of irradiation.

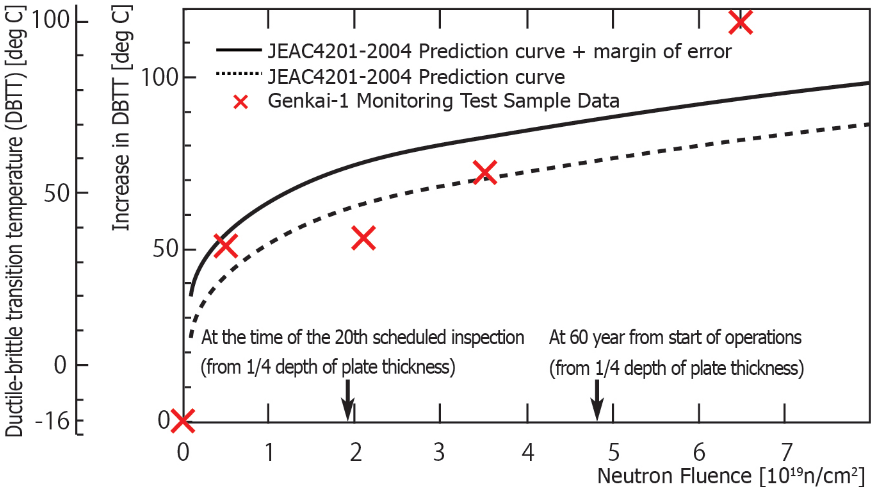


Figure 1.
Genkai-1 Monitoring Test Sample Data and JEAC 4201-2004 Prediction Curve

We noticed this over ten years ago and alerted researchers to the issue. However, at the time, the results of American research refuting dependence on the flux of irradiation held sway, so Japanese researchers refused to take the matter seriously and did not alter the embrittlement prediction formula. Faced with data from Tsuruga-1 showing unpredicted high levels of DBTT, METI's Aging Response Review Committee dismissed the results saying they were due to data scatter.

Thereafter, analysis of the micro-formation of copper progressed, and it became clear that when the rate of radiation is slow mainly clusters of copper atoms (obstructions) form, whereas in accelerated irradiation tests mainly clusters of vacancies form, so the cause of the hardening (embrittlement) is different. The results of this micro-analysis backed up our computer simulations. The outdated thinking described above was forced to give way and now the dependence of radiation embrittlement on the flux of irradiation is the shared academic understanding. The irradiation embrittlement prediction formula used in monitoring test methodology was changed and a new methodology (JEAC 4201-2007) was produced*. Assessment of pressure vessels shifted to the 2007 formula from mid-2011, but when the increase of DBTT using this formula is smaller than that using the previous 2004 formula, the 2004 formula is included as a reference.

However, even the 2007 formula cannot explain the high DBTT for metal welds in Tsuruga-1 that we have drawn attention to. The metal welds in Tsuruga-1 have low levels of copper impurities, unlike the parent metal, and thus should not show a high DBTT. The amended JEAC-2007 was not adequately able to explain the complex nature of the reality of the metal materials.

** Recently the author's group found that the formulation contains a fatal misunderstanding.*

Unpredicted Embrittlement in Genkai-1 Reactor Pressure Vessel

Further "unpredicted" monitoring specimen data were observed; these were the results from Genkai-1. At the October 25, 2010 meeting of Karatsu City Municipal Assembly's Pluthermal Special Committee, Kyushu Electric Power Company announced that the DBTT observed in Genkai-1's fourth monitoring test specimen, taken during a periodic inspection in April 2009, had reached 98ºC. Previously, the highest DBTT for a reactor pressure vessel had been 81ºC for metal taken from a weld at Mihama-1 (see Table 1). The Genkai-1 specimen exceeded this, so it would be fair to conclude that Genkai-1 is the most dangerous reactor pressure vessel in Japan.

It is also very significant that this embrittlement was unpredicted. The DBTT observed in the previous (third) monitoring test (February 1993) was 56ºC. That had increased by 42ºC, which was contrary to the predicted result. Figure 1 is a diagram submitted by Kyushu Electric in its December 2003 Aging Technical Assessment, with a "×" added to the top right corner to show the result of the fourth monitoring test. Up until the third monitoring test the data points could be more or less plotted onto the predicted curve, but the latest data point is way above that curve. If you look closely at the diagram you will see that the broken line is the predicted curve and that a line is added above that showing the upper limit of the margin for error. However, actual embrittlement is way above that upper limit.

Kyushu Electric says that 98ºC is the value predicted for 2060 (85 years after the start of operations), while the predicted DBTT for 2035 (60 years after the start of operations) is 91ºC and for August 2010 (35 years after the start of operations) is 80ºC. In part two, let us consider whether this is correct or not.

(To be continued in the next issue of Nuke Info Tokyo)

Group Introduction

Japan Occupational Safety and Health Resource Center (JOSHRC)

by Iida Katsuyasu*

The Japan Occupational Safety and Health Resource Center (JOSHRC), which exists to protect the health and lives of workers, is an NGO network established for the sake of eradicating occupational diseases.

JOSHRC and citizens' groups negotiating with the government regarding the worker radiation exposure problem at Fukushima Daiichi Nuclear Power Station.

Until now, our friends in the network have handled the occupational problems of nuclear plant workers. Since 1976, however, there have been only ten examples of recognized cases of work-related cancer among nuclear plant workers. Nuclear plant workers suffering health damage from radiation continues to be an issue shrouded in darkness.

Since the 3/11 Fukushima Nuclear Accident occurred, TEPCO's sloppy radiation countermeasures have resulted in the appearance of a series of highly irradiated workers. Directly after the accident, the government raised radiation exposure limits from 100 mSv to 250 mSv for emergency work employees as a special exception to the regulation regarding the prevention of ionizing radiation disorders. In addition, the government also took measures to loosen the annual 50 mSv limit for workers active at some distance away from the emergency work.

Was it acceptable to simply relax worker radiation exposure regulatory limits in the name of emergency work? We believe the worker radiation exposure is a problem that can no longer be overlooked, and from May last year we began negotiations with the government. Originating with CNIC, citizens' groups as well as labor unions have called on the government to engage in negotiations seven times since March of this year. Through utilization of the freedom of information system we have also sought to elucidate the process by which the radiation exposure limits were raised within the government. These efforts have revealed that the nuclear-power promoting Nuclear and Industrial Safety Agency (NISA), fearing impediments for Japan's nuclear operations, made a special case for the Fukushima Daiichi Nuclear Power Station's emergency worker radiation exposure limits, and changed the lifetime limit to 1 Sievert.

Meanwhile, the Tokyo Occupational Safety and Health Center is holding seminars together with the NGO Toxic Watch Network (T-Watch), and we are studying the nuclear accident and the effects of radiation. T-Watch is measuring the radiation in food, water, and soil with an NaI scintillation detector.

Last summer, in cooperation with T-Watch, we investigated radiation in Tokyo's sewage treatment and water purification facilities, and proposed risk evaluations and countermeasures for worker radiation exposure. In April, we held a gathering in Tokyo to create an activist network for considering the problems of worker radiation exposure.

We will continue to tackle the problems of radiation spread through communities and workplaces, and by developing campaign movements and negotiations with the government, we would like to work towards a change in the government and industry's position of radiation neglect.

*Japan Occupational Safety and Health Resource Center Liaison Conference
Director-General of Tokyo Occupational Safety and Health Center

NEWS WATCH

Abolition of Fukushima Daiichi Reactor Units 1-4

As of April 19, TEPCO decommissioned Fukushima Daiichi reactor units 1-4 (BWRs, Unit 1: 460 MW, Unit 2-4: 784 MW each). Consequently, Japan's nuclear reactors were reduced from 54 units totaling 49,112 MW to 50 units totaling 46,300 MW.

Fiscal Year 2011 Facility Utilization Rate 23.6%

In FY2011 (April 2011 - March 2012), Japan's fifty-four nuclear reactor units set a record low utilization rate of 23.6%. Of the 54 units, 28 units did not operate at all within the year.

New Standards for Radioactive Cesium in Food

On April 1, new regulatory standards became effective for radioactive cesium contained in food. The 500 becquerel per kilogram (Bq/kg) for general foods such as vegetables, grains, meat, and fish was lowered to 100 Bq/kg, 50 Bq/kg for baby foods. The standard of 200 Bq/kg for milk was lowered to 50 Bq/kg, and likewise the drinking water standard was lowered to 10 Bq/kg. For rice and beef, interim measures were set through the end of September, and the new values are to be applied from October.

Apart from these regulation values, co-ops and retail stores have created independent standards that are more stringent, but on April 20 the Ministry of Agriculture issued a notice requesting that the use of independent standards cease. Opposition from consumers on 23rd forced the Minister of Agriculture to defend the notice by stating that "it is not compulsory and does not negate independent standards."

Tokai Mayor demands Minister of Economy decommission Tokai-2

On April 4, mayor Tatsuya Murakami, who has been requesting the decommissioning of the Tokai-2 Nuclear Power Plant (BWR, 1,100 MW) since the Fukushima Nuclear accident, handed a written statement demanding the permanent shutdown and decommissioning of the Tokai plant to the Minister of Economy, Trade and Industry, Yukio Edano.

Inaugural Meeting of Mayors for Nuclear Abolition

With Tatsuya Murakami, Mayor of Tokai Village in Ibaraki Prefecture, and Katsunobu Sakurai, Mayor of Minami Soma in Fukushima Prefecture, as organizers the founding meeting for the "Heads of Local Governments Seeking to End Japan's Reliance on Nuclear Power" was held on April 28. The Conference consisted of 69 members at its inauguration. Only Tokai Village Mayor Murakami is situated in a municipality hosting a nuclear plant (though there were two or three such observers at the inaugural meeting). However, there were many heads of municipalities located within thirty kilometers of a nuclear plant present at the meeting, as well as four or five heads of municipalities from which planned nuclear power plants or recycling factories have been forced to withdraw.

The Conference is planning to make efforts for the clarification of a road map toward a nuclear phase-out and the promotion of regional renewable energy use, as well as to put forward policy proposals to the government and Diet. Also adopted at the inaugural meeting were a "Resolution requiring consensus from local governments and municipality citizens regarding the restart of nuclear plants such as the Ohi Nuclear Power Plant," and a "Resolution demanding the determination of a new basic energy plan that will include a nuclear phase-out."

Nuke Info Tokyo is a bi-monthly newsletter that aims to provide foreign friends with up-to-date information on the Japanese nuclear industry as well as on the movements against it. It is published in html and pdf versions on CNIC's English web site: http://cnic.jp/english/

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