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Citizens' Nuclear Information Center

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Energy options proposed

"Goodbye to Nuclear Power Plants" Rally attended by 170,000 antinuclear protesters in Yoyogi Park, Tokyo. (July 16, 2012)

Due to the nuclear disaster in Fukushima in March 2011, it has become impossible for Japan to carry out its former energy policy, one that depended on nuclear power generation. The policy target was to cut the nation's carbon dioxide emissions by 25 percent from the 1990 level by the year 2020, partially by building 14 more nuclear power reactors. This target for carbon dioxide emmissions was Japan's pledge to the international community. Now that Japan has suffered extremely severe radiation damage from last year's nuclear accident, it is evident to everyone that it is no longer possible for the nation to achieve this goal.

For this reason, the Japanese government has been forced to review its energy policy.

The previous Cabinet, led by Naoto Kan, attempted to revise the policy from the viewpoint of Japan's departure from nuclear power generation. His successor Yoshihiko Noda, however, toned down Kan's policy and is set to review the former policy with the aim of reducing Japan's dependence on nuclear power. Noda claims that the

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reduction of Japan's dependence on nuclear power generation is his public pledge, but to what extent the dependence should be reduced will be decided upon by politicians after national debates are held on the issue. Although it has been the bureaucrats who have formulated policies most of the time up until recently, the current government, led by the Democratic Party of Japan (DPJ), is striving to alter this tradition, and introduction of the new decision-making system is one example of this change.

The Energy and Environment Council (EEC), which was set up within the National Policy Unit of the Cabinet, has proposed a national debate on the desirable energy-mix options.

The EEC says energy options will be presented to the public before they start the national debates. They therefore consulted the Ministry of Economy, Trade and Industry (METI) for energy options based on the share of various energy sources, the Japan Atomic Energy Commission (JAEA) for options concerning the nuclear fuel cycle, and the Environment Ministry (EM) for measures to cope with global warming.

Three options

Based on the reports from the two ministries and JAEA, the EEC formulated three options on the share of nuclear power generation in the total domestic power supply and released them on June 29. As the current basic energy plan lays out Japan's energy strategy heading towards 2030, the share of nuclear power in 2030 was proposed.

The current share of nuclear power

In Japan, the operation of all nuclear power stations was halted on or before May 5, and only one reactor at Ohi Nuclear Power Station resumed operations on July 4, despite a strong public outcry against the restart. A second reactor at the nuclear power station will probably restart operations at the end of July 2012 . As for other nuclear power stations, it will not be so easy to resume operation. Japan's new nuclear regulatory commission is to establish new safety standards based on the results of the official investigations into the Fukushima nuclear disaster and will determine the propriety of resuming operations of each reactor.

As things stand now, the proposed review of the share of nuclear power should have been based on the current situation where all nuclear power stations are shut down or only two reactors are operational. The fact, however, is that the options are based on the share of nuclear power in the pre-nuclear disaster period.

One of the three options is to cut the share of nuclear power in the nation's total power supply to zero. This option calls for realizing a total departure from nuclear power generation with strong determination and at as early a date as possible, while achieving a desirable energy mix that depends mainly on renewable energy sources. This is the only option that aims at the termination of nuclear power generation.

The second option is to cut the share of nuclear power to 15% by 2030. This figure is based on two factors. One of them is the plan to decommission nuclear reactors after 40 years of service, which was decided upon in negotiations on the establishment of the new nuclear power regulatory commission. If nuclear reactors are shut down after 40 years of service, and no new ones are built, the ratio of nuclear power will be reduced to 15 percent by 2030 (calculated on the assumption that the average operation rate stands at 80%), and to zero by around 2050. The second option will also call for reinforcement of safety and anti-disaster measures at nuclear power stations.

However, this option is to be reviewed sometime around 2030, taking into account the speed of expansion in the use of renewable energy. This may make leeway for extending the period of operation of old nuclear reactors, or for building new ones.

The third option is to maintain the current 20-25% share of nuclear power. This figure is based on the 2010 data that nuclear power generation accounted for 26% of the nation's power supply. Whether or not this option is appropriate depends on the operation rates of nuclear reactors. Should power shortages occur, this is likely to pave the way for construction of new nuclear reactors that have already been planned by electric power suppliers.

The three options do not fully reflect the views of the people who are demanding a nuclear phase-out. For example, they have proposed that more radical energy-saving measures be introduced to achieve the 25% cut in carbon dioxide emissions that Japan has pledged. But all three options estimate the cut to be achieved by the electric power generation sector at a much smaller 10%. In the meetings of the Advisory Committee for Natural Resources and Energy, where the three options were discussed, the anti-nuclear members proposed discussions on this issue many times in an attempt to expand the size of the reduction, but in vain.

Methods of national debates on energy mix options

The government says it will listen to public opinion on the three options via various means, such as public opinion polls conducted by the mass media, public hearings to be held at 11 sites across the country, the public comments system, and the nation's first deliberative poll, in which the public will submit their opinions and discuss the issue in debate sessions to be held across the nation. The government plans to grasp the trend of public opinion through these efforts. In the deliberative poll, around 3,000 people will be randomly selected, and asked to respond to questionnaires. Of these, 120 will be chosen and divided into groups of several persons each for the debate session. There are, however, some concerns about this scheme. The government plans to adopt one of the three options by the end of August, and so there is not much time left. Whether or not the deliberative poll will be held as projected remains uncertain under these circumstances. Another concern is that the

period for accepting public comments is limited to one month, and this may be too short to allow for a substantial number of public opinions to be submitted.

What about options for the nuclear fuel cycle?

It is no exaggeration to say that the nuclear fuel cycle has been left out of the options for national debates. If all nuclear power stations were to be decommissioned, it would become impossible to recycle spent nuclear fuel, and all spent fuel would then have to be disposed of directly. In this case, there would be no need to put the issue to a national debate. But if other options are selected, three different plans can be proposed; to recycle the spent fuel, to dispose of the spent fuel directly, or to do both at the same time. These plans are mentioned in the energy-option proposal, but are not proposed as "options."

Motohisa Furukawa, State Minister of National Strategy, Economic and Fiscal Policy, said in a recent press conference that the consideration of options on the recycling of spent nuclear fuel is not an issue that should be determined by vote. His position that the energy policy should be put to the vote (national debates) because it will serve as the nation's basic policy, while the policy on spent nuclear fuel does not fall within this framework is not convincing. However, a non-official study group led by Japan's Nuclear Disaster Minister Goshi Hosono, and with the participation of Tetsuya Endo, Kenji Yamaji and other lawmakers, had earlier proposed a number of plans that included the use of the Rokkasho reprocessing plant in Aomori Prefecture jointly with other nations. Furukawa probably made the above remark because he was influenced by this proposal.

There is another possibility. A secret meeting of the Japan Atomic Energy Commission (JAEC) was held on April 24, at which the government officials and people from the power industry jointly discussed Japan's nuclear fuel cycle policy. This disclosure by the media spurred public distrust of the commission's report and Furukawa may have presumed that the JAEC-proposed options on the spent nuclear fuel cycle should not be presented to the public.

Nevertheless, JAEC presented its report concerning options on the spent nuclear fuel cycle that matched with the energy mix options to the Energy and Environment Council on June 29. The report proposed that all spent nuclear fuel be directly disposed of in the case of Japan's total departure from nuclear power generation. In the case where the share of nuclear power is reduced to 15%, the report said part of the spent fuel should be recycled and the rest should be disposed of directly, and in the case where the share of nuclear power is higher, all spent fuel should be recycled or part of it disposed of directly.

Secret meetings disclosed

The Mainichi Shimbun disclosed the existence of the secret meetings in its May 24 issue. According to media reports, the secret meetings, dubbed 'study meetings,' were held 23 times at a conference room on the seventh floor of the Central Government Building No. 4, in which JAEC has its office. Each time, more than 30 people participated in the meeting, including officials from electric power suppliers, Japan Nuclear Fuel Ltd., JAEA, the Ministry of Education, Culture, Sports, Science and Technology, and the Ministry of Economy, Trade and Industry. The fact that the electric power suppliers attended all of the 23 meetings became the target of public criticism. In the meetings, the contents of the JAEC report were reportedly revised in line with the intentions of the electric power suppliers.

Although JAEC admitted that it held meetings attended by electric power suppliers, it insisted that the purpose of the meetings was limited to contacting the parties concerned in preparation for compiling the report that was to be presented to the JAEC subcommittee. Moreover, JAEC denied the allegation that the commission revised the report to reflect the views of electric power suppliers.

The conference materials that were later made public indicate that the organizer allotted the work of drafting responses to the proposals presented by the technical sub-committee members. This means that the secret meetings virtually served as occasions to discuss the contents of the report.

Among others, Chairman Shunsuke Kondo promised to take the following measures;

1) to not hold secret meetings again,
2) to make public the materials which were discussed at the meeting,
3) to return all officials dispatched to JAEC from electric power suppliers by around the end of June, and
4) to present plans for the reform of JAEC and its deliberation councils.

When this writer met Chairman Kondo on July 3, he said the return of the officials of electric power suppliers to their offices at the end of June had made it difficult for JAEC to carry out desk work without delay. His remark indicates that JAEC was taking advantage of its cozy relationship with electric power suppliers in order to draft its policies. With regard to the reform of JAEC, rules for handling information and for creating the minutes of its meetings were decided upon, but no proposals have been presented yet on the appropriate role of JAEC in the future. The commission says it will discuss this issue from now on.

Because of the mass media's revelations regarding JAEC's secret meetings, deliberations on nuclear power policy by JAEC's New Nuclear Policy Planning Council, previously held in parallel with the discussions on the energy-mix options, were suspended.

Hideyuki BAN (Co-Director of CNIC)
Reported on July 4, 2012

The Koodankulam Struggle

S. P. Udayakumar *
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* People's Movement Against Nuclear Energy (PMANE)
* National Alliance of Anti-nuclear Movements (NAAM)

Photo of Mr. S. P. Udayakumar

We have been fighting against the Koodankulam Nuclear power Project (KKNPP) since the late 1980s. This Russian project was shelved right after the Soviet Union's collapse and taken up again in 1997. The Indian government and Russians have constructed two huge reactors of 1,000 MW each without any consent of or consultation with the local people. We have just obtained the outdated Environmental Impact Assessment (EIA) report after 23 years of long and hard struggle. The Indian nuclear authorities have not shared any basic information about the project with the public. They do not give complete and truthful answers for our questions on the 'daily routine emissions' from these reactors, the amount and management of nuclear waste, fresh water needs, impact of the coolant water on our sea and seafood, decommissioning costs and effects, Russian liability and so forth. We are deeply disturbed by all this.

Our people watched the Fukushima accident of March 11, 2011 on TV at their homes and understood the magnitude and repercussions of a nuclear accident. Right after that on July 1, 2011, the KKNPP announced the 'hot run' of the first reactor that made so much noise and smoke. Furthermore, the authorities asked the people, in a mock drill notice, to cover their nose and mouth and run for their life in case of an emergency. As a result of all these, our people in Koodankulam and Idinthakarai villages made up their minds and took to the streets on their own on August 11, 2011. Then we all together decided to host a day-long hunger strike on August 16 at Idinthakarai and a three-day fast on August 17-19 at Koodankulam. On the 17th itself authorities invited us for talks and asked us to postpone our struggle to the first week of September because of the upcoming Hindu and Muslim festivals. In a few days' time, the chief of the Department of Atomic Energy (DAE) announced that the first reactor would go critical in September 2011.

So we embarked upon an indefinite hunger strike on September 11, 2011 and our women blocked a state road on September 13 for a few hours when the state and central governments continued to ignore us. The state Chief Minister invited us for talks on September 21 and passed a cabinet resolution the next day asking the central government to halt all the work until the fears and concerns of the local people were allayed. We ended our hunger strike on the 22nd but went on another round of indefinite hunger strike from October 9 to 16 when the talks with the Indian Prime Minister failed. We laid siege in front of the KKNPP on October 13-16, 2011 when the KKNPP authorities did not halt work at the site as per the Tamil Nadu state cabinet resolution. We ended both the indefinite hunger strike and the siege on October 16 in order for our people to participate in the local body elections on the 17th. From October 18, 2011, we have been on a relay hunger strike continuously. We have been carrying out massive rallies, village campaigns, public meetings, seminars, conferences, and other demonstrations such as shaving our heads, cooking on the street, burning models of the nuclear plants, etc. When the state government of Tamil Nadu arrested some 200 of our comrades on March 19, 2012, 15 of us embarked on an indefinite hunger strike until March 27. This struggle has been going on for more than 260 days and the morale of the people is still very, very high.

There is no foreign country or agency or money involved in this classic people's struggle to defend our right to life and livelihood. Our fishermen, farmers, workers and women make small voluntary donations in cash and kind to sustain our simple Gandhian struggle. Our needs are very few and expenses much less. We only provide safe drinking water to the hunger strikers and visitors. People from all over Tamil Nadu (and sometimes from other parts of India) come on their own arranging their own transportation. For our own occasional travel, we hire local taxis.

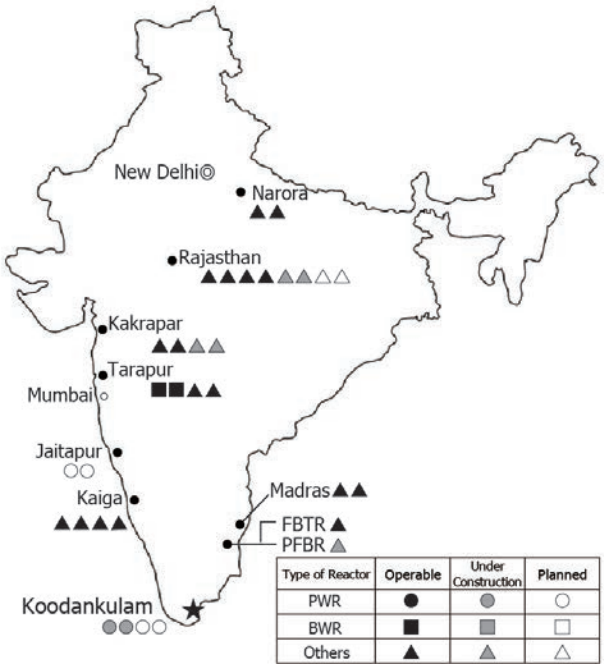
Instead of understanding the people's genuine feelings and fulfilling our demands, the government has foisted serious cases of 'sedition' and 'waging war on the Indian state' on the leaders of our movement. There

are more than 200 criminal cases on us. There have been police harassment, intelligence officers' stalking, concocted news reports in the pro-government media, abuse of our family members, hate mail, death threats and even physical attack.

Although India is a democracy, our Delhi government has been keen on safeguarding the interests of the multinational corporations (MNCs) and pleasing some powerful countries such as the United States, Russia, France, etc. The welfare of the 'ordinary citizens' of India does not figure on their list of priorities. The central government and the ruling Congress party stand by the secretive nuclear agreements they have made with all different countries and consider us as stumbling blocks on their road to development. The main opposition party, Bharatiya Janata Party (Hindu nationalist party) is interested in the nuclear weapons program and making India a superpower and hence loves everything nuclear. It is ironic that these two corrupt and communal forces join hands with each other against their own people. They bend backwards to please their American and other bosses but question our integrity and nationalist credentials.

Our leaders and the group of 15 women were physically attacked on January 31, 2012 at Tirunelveli by the Congress thugs and Hindutva Fascists when we had gone for talks with the central government expert team. Now the government cuts the electricity supply so often and so indiscriminately in order to drive home the message that nuclear power plant is needed for additional power. They try to create resentment and opposition among the public against our anti-nuclear struggle.

To put it all in a nutshell, this is a classic David-Goliath fight between the 'ordinary citizens' of India and the powerful Indian government supported by the rich Indian capitalists, MNCs, imperial powers and the global nuclear mafia. They promise foreign direct investment, nuclear power, development, atom bombs, security and superpower status. We demand risk-free electricity, disease-free life, unpolluted natural resources, sustainable development and a harmless future. They say the Russian nuclear power plants are safe and can withstand earthquakes and tsunamis. But we worry about their side-effects and after-effects. They speak for their scientist friends and business partners and have their eyes on commissions and kickbacks. But we fight for our children and grandchildren, our progeny, our animals and birds, our land, water, sea, air and the skies.



Right now, the Indian government is trying to commission the KKNPP reactors without conducting the mandatory disaster training and evacuation exercises to the people in the 30-km radius. The government and the Department of Atomic Energy have not told the people anything about the Koodankulam nuclear waste and its management, the secretive liability agreement between New Delhi and Moscow, and the geology, hydrology, oceanography and seismology issues with regards to the Koodankulam reactors.

Since May 1, some 300 women and 35 men have been on an indefinite hunger strike with 11 demands. Neither the Indian government nor the state government has come forward to talk to the people on our demands. Instead, they have embarked upon an intimidating campaign. And the struggle continues.

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Of the seven nuclear power plants identified in this paper as having striking irradiation embrittlement, the Fukushima Daiichi Unit 1 reactor has been transformed into a hideous mess and will not operate again. We believe the other six aging reactors should be permanently shut down forthwith.

A bill to wind up NISA and NSC and establish a new Nuclear Regulatory Commission is now being debated in the Diet. The bill proposed by the government contains a clause saying, "The life of nuclear power plants will in principle be 40 years." This condition allows a life extension of 20 years in exceptional circumstances, so there is the possibility that the 40-year condition will be gutted of meaning. It should state that nuclear power plants will, without exception, be decommissioned after 40 years.

All nuclear power plants that began operations in the 1970s will be over 40 years old by 2019. All these early reactors have numerous problems with manufacturing technology and quality of materials, and they are deteriorating. Of course Tsuruga-1 and Mihama-1&2, which are already over 40 years old, should be closed down, and Genkai-1 and Takahama-1, which have extreme irradiation embrittlement, should be closed down without waiting for them to turn 40.

Acknowledgement: Much of this paper is based on discussions of the Nuclear Aging Research Team. I express my thanks to Chihiro Kamisawa, Yuuta Aono and all the members of the Team.

We oppose the restart of Ohi Nuclear Power Plant

From 5th May this year, all of Japan's 50 nuclear reactors were shut down. However, stating that Japan's economy would not be able to survive without nuclear power, and that he would personally take the responsibility for ordering the restart of nuclear power plants, PM Noda agreed to the restart of Ohi NPP Units 3 and 4, which was officially decided at a meeting of the four relevant cabinet ministers on 16th June. On 2nd July it was reported that Ohi-3 had reached criticality. Despite the fact that the Fukushima accident it is not yet over no matter how you look at it, PM Noda and the government, who proclaimed in December 2011 that the accident was over, have made yet another blunder. We at CNIC believe that PM Noda and the government's judgment is fundamentally flawed.

What should we have learned from the accident at the Tokyo Electric Power Company (TEPCO) Fukushima Daiichi nuclear plant? It is that if we see some sign of possible danger in a nuclear power plant it should be thoroughly investigated and all appropriate measures taken to ensure safety. It is totally unacceptable to say things such as, "I don't understand the science, but from the engineering assessment it looks as if it's probably OK." Even having taken every possible precaution, a catastrophic accident might still occur.

The Diet Fukushima Nuclear Accident Independent Investigation Commission will soon be releasing its report. However, it is unlikely that the degree of damage to the nuclear power plant and its causal relation to the accident will all be revealed. The problem of 'how to ensure the safety of nuclear plants' is one that has no 'right answers.'

'Safety' cannot be assured by stress tests

All of this began on 11th July 2011, with the three cabinet ministers at the time, Edano, Kaieda and Hosono, declaring that "the condition for restarts will be the primary assessment of the stress test." Four days before that, the then PM Kan had stated in the budget committee of the House of Councilors that "all nuclear power plants will be subject to a stress test." In contrast to the stress tests that originated in Europe, the Japanese version divides the test into a primary and secondary evaluation, and moreover it was decided that the primary evaluation would be the condition for restarting nuclear plants down for regular maintenance. It is hard to believe that at this stage the politicians understood what a stress test is. They probably just had the idea planted in their heads by the bureaucrats, nuclear industry people and their friendly academics in the infamous 'nuclear village.'

The formal name of the so-called "Stress Test Hearing" that began on 14th November 2011 was "The Hearing on the Comprehensive Evaluation of Safety in Power Generating Nuclear Reactor Facilities." A total of 11 members sat on the Hearing panel. It was not the kind of event where citizens who live near or who might be affected by a nuclear plant come and listen to the opinions of experts. The process of the Hearing was that the Nuclear and Industrial Safety Agency (NISA) would first hear the opinions of the members. NISA would then make a judgment on the appropriateness of the report submitted by Kansai Electrical Power Company (KEPCO) , which would then be passed up to the Nuclear Safety Commission (NSC) for a final check.

The aim of the primary evaluation is to identify a nuclear plant's weak points. It is not a set of evaluation criteria for judging the safety of a nuclear plant. The test is simply a computer simulation to assess the tolerance of a number of selected crucial pieces of equipment in the case that a large earthquake or tsunami should occur. That is not a "Comprehensive Evaluation of Safety." KEPCO itself has still not carried out the secondary evaluation. The NSC approved NISA's judgment on Ohi-3 and 4, but the NSC Chairman Madarame is reported to have said that "this is not something that can be used to judge safety."

It has been confirmed recently by Professors Mitsuhisa Watanabe and Yasuhiro Suzuki that there is a fracture zone (i.e. an active fault) beneath Ohi NPP. New discoveries should, of course, be taken into account immediately. The reality is that it is inconceivable that a nuclear power plant should exist in the current location.

The former establishment must take responsibility for the Fukushima nuclear accident

Those officials who continued to push the safety myth and the agencies they worked for should take responsibility by resigning or by being dismantled. In spite of this, the fact that the same old people in the same positions as they were in previously are screening and passing judgment on the safety of Ohi NPP with no evaluation criteria in place is truly outlandish and farcical. At each meeting of the Stress Test Hearing, the members Masashi Goto and Hiromitsu Ino submitted question papers and uncovered doubts concerning KEPCO's report, but in this totally abnormal Hearing, having three members with conflicting interests, one of whom was the chair and facilitator of the Hearing, these crucial matters were simply ignored.

Incomprehensible events have been taking place one after the other. Two examples are, 1) NISA, responsible for enforcing safety standards at nuclear power plants, rejecting instructions from its

superior organization, the NSC, which is responsible for approval of the safety standards, and 2) the Japan Atomic Energy Commission continuing to hold secret meetings consisting only of nuclear proponents to chew over the contents of discussions in the drafting committee for the new Nuclear Policy Planning Council of the Japan Atomic Energy Commission, selecting the agenda items and rewriting the report.

In the current session of the Diet, it has been decided to establish a Nuclear Regulatory Commission (with five members) and a Nuclear Regulatory Agency as its secretariat. The independence of these bodies is expounded on as "Article 3 commissions."* NISA will slide laterally into the Nuclear Regulatory Agency, and it is being said that the 'no return' rule will be observed. But how will the selection for the five members of the Commission be possible? Moreover, we also doubt that the people who have made the lateral slide (from NISA to the Agency) will now suddenly be capable of carrying out robust regulatory activities.

With these concerns in mind, we believe that discussions on the issue of Ohi NPP restart should at least wait for the publication of the Diet Investigation Commission's report and the launch of the new nuclear regulatory arrangements.

Yukio YAMAGUCHI (Co-Director of CNIC)
Reported on July 2, 2012

** Article 3 commissions: Commissions established under Article 3 of the National Government Organization Act. Since impartiality is essential and since the issues deliberated upon require specialized knowledge, these commissions are given a certain degree of independence from the Cabinet while existing as external organs of the Cabinet Office.*

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

Dates: August 30 & 31, 2012. 9:30 ~ 18:00
Venue: Tokyo University Komaba Campus, JAPAN

Opening remarks

Steering Committee: ***Kotaro Kuroda*** *(Chair)*

Session 1: What Happened at the Fukushima Daiichi Nuclear Power Plant

August 30, 9:40 ~ 12:00
Speakers
Mitsuhiko Tanaka *(Former nuclear power plant designer, member of the Diet Investigation Commission on the Accident at the Fukushima Nuclear Plants)*
Arnie Gundersen *(Chief engineer of Fairewinds Associates)*
Coordinator ; Hiromitsu Ino

August 30, 13:00 ~ 15:00
Speaker
Katsuhiko Ishibashi *(Seismologist, member of the Diet Investigation Commission on the Accident at the Fukushima Nuclear Plants)*
Coordinator ; Yukio Yamaguchi

Session 2: Current Status of Radioactive Contamination

August 30, 15:30 ~ 18:00
Speaker
Tetsuji Imanaka *(Kyoto University Research Reactor Institute)*
Coordinator ; Komei Hosokawa

18:30 ~ : Social gathering

Session 3: Japan's Nuclear Policy and Formation of the Safety Myth

August 31, 9:30 ~ 12:30
Speakers
Hitoshi Yoshioka *(Science historian, member of government Investigation Committee on the Accident at the Fukushima Nuclear Power Station of Tokyo Electric Power Company)*
Philip White *(PhD student at Adelaide University (Australia), former International Liaison Officer of Citizens' Nuclear Information Center)*
Coordinator ; Harutoshi Funabashi

Session 4: The State of Nuclear Science and Technology

August 31, 13:30 ~ 16:30
Speakers
Tetsuya Takahashi *(Philosopher)*
Miranda Schreurs *(Professor of Freie Universität Berlin)*
Satoru Ikeuchi *(Physicist)*
Coordinator ; Makoto Maruyama

Session 5: Summing Up – from the Perspective of Scientists and Technologists

August 31, 17:00 ~ 18:00
Steering Committee: ***Kotaro Kuroda*** *(Chair),*
Tamotsu Sugenami *(Secretary General)*

Organizer
Steering Committee of "International Symposium on the Truth of the Fukushima Nuclear Accident and the Myth of Nuclear Safety"

Cooperating Groups
Group of Concerned Scientists and Engineers Calling for the Closure of the Kashiwazaki-Kariwa Nuclear Power Plant, Citizens' Nuclear Information Center (CNIC),
Center for Sustainable Development Research, Graduate Program on Human Security, University of Tokyo, Union for Alternative Pathways in Science & Technology (APAST), The Takagi Fund for Citizen Science

Contact information*: symposium@takagifund.org*

Clean-up operation at the nuclear accident site at Fukushima Daiichi Nuclear Power Station.

Presence of subcontractors affiliated with crime syndicates and their employees

Two local newspapers in Fukushima Prefecture have recently reported that businesses affiliated with crime syndicates are involved in the clean-up operation at the crippled Fukushima Daiichi Nuclear Power Station. One of them is the Fukushima Min-yu Shimbun, which reported in its May 23 issue that on May 22 the Koriyama City police and the Futaba Gun (County) police arrested leading members of a gangster group affiliated with the Sumiyoshi-kai crime syndicate based in Nihonmatsu, Fukushima Prefecture. According to the newspaper, they were charged with violation of the Temporary Staffing Services Law by dispatching five to six members of the group to the nuclear power station for the clean-up operation.

Prior to this, another local newspaper, the Fukushima Mimpo, reported on May 15 that the president of Watanabe Kogyo Ltd. in Naraha Town was arrested on suspicion of illegally possessing a gun. He was deeply involved in the staffing of the nuclear power station and was the president of the local chamber of commerce and industry, as well as a member of the Fukushima Prefecture Nuclear Power Plant Town Information Council [(1)], the newspaper said.

These incidents indicate that the businesses based near the nuclear power station and run by people linked to the *yakuza* (crime syndicate gangs) are deeply involved in the staffing of the nuclear power plant for the purpose of making profits for their executives and employees. At the same time, Tokyo Electric Power Co. (TEPCO) is also making the most of such people, despite its position as a public utility company. In other words, TEPCO and the *yakuza* have built up a structure of mutual interdependence. In Japanese workplaces where dangerous, tough and demeaning jobs have to be done, there is a tradition that crime syndicates are involved in the recruitment of workers. Nuclear power stations are no exception. In the extremely difficult clean-up operation at the Fukushima Daiichi Nuclear Power Station, it is highly probable that businesses affiliated with crime syndicates and their employees will increase their presence.

As Table 1 shows, approximately 350 businesses are participating in the clean-up operations at the Fukushima Daiichi plant. They form a pyramid-shaped, multi-layered subcontractor system with TEPCO at the top of the pyramid. Under the utility, there are plant makers, subsidiaries of TEPCO and the plant makers, large, medium- and small-sized construction and repair companies, independent master carpenters and plumbers, and so on.

Japanese nuclear power stations are required to conduct a regular inspection once every 13 months. Originally, it took around three months to carry out the inspection, which included changing the nuclear fuel rods, thorough checks of facilities and equipment, replacement of old parts and consumables with new ones, remodeling of some facilities, and inspection by the government. Three plant makers, Hitachi Ltd., Toshiba Corp. and Mitsubishi Heavy Industries Ltd., received orders from TEPCO, and then allocated the orders to their subcontractors. However, the partial liberalization of the Japanese electric power generation market in 1997 brought a number of changes to this practice.

Taking advantage of the occasion, TEPCO designated its subsidiaries as the principal subcontractors and slashed repair and other costs as much as possible. At the same time, the company pressed the subcontractor to shorten the time required for a regular inspection, triggering competition within the market. It is said that the smaller and weaker companies dropped out of the race in this process, and the pyramid-shaped system of subcontractors was reduced by several layers. The result of this was that workers hired by higher-level subcontractors enjoyed favorable conditions concerning the type of employment, working conditions, working period, and type of

Tokyo Electric Power Company (TEPCO)	
▼	
A (Main Contractor)	30,000 – 40,000 yen
Hitachi Ltd., Toshiba Corp, Mitsubishi Heavy Industries Ltd., General Elctric, Mitsui & Co., Ltd., Ishikawajima-Harima Heavy Industries Co., Ltd.	
▼	
B (Principal Subcontractor)	20,000 – 30,000 yen
Hitachi Plant Ltd., Toshiba Plant Ltd., Kandenko Ltd., Tokyo Denki Komuten Ltd., Toden Kogyo Ltd., Toden Kankyo EN Ltd., Toso Real Estate Ltd.	
▼	
C	10,000 – 20,000 yen
D	9,000 – 12,000 yen
E	8,000 – 10,000 yen
F	7,000 – 9,000 yen
G	6,000 – 8,000 yen
H	5,000 – 7,000 yen
I	4,000 – 6,000 yen
J	5,000 yen -

Converted to daily wages. Prepared by Ishimaru based on evidence from an F rank company president

Table 1. Multi-layered structure within the nuclear power station and wages in 2000
350 companies were involved in Fukushima Daiichi Nuclear Power Station

1) The scandal over falsified inspection records and concealed problems by TEPCO at its nuclear power plants came to light in 2002. This 23-member conference, set up in the wake of this incident, was composed of five residents each from four towns where nuclear power plants are located, one intellectual, and the managers of the No.1 and No.2 nuclear power stations in Fukushima Prefecture. The Nuclear and Industrial Safety Agency, the Agency for Natural Resources and Energy, and the Fukushima Prefectural government joined the organization as observers. The first meeting was held on February 1, 2005, subsequent meetings being held continuously until immediately before the nuclear accident in Fukushima in March, 2011.

work, while those working for the lowest-level subcontractors were forced to accept the worst working conditions. Workers hired by the lowest-level subcontractors were paid only around 5,000 yen per day, and were not covered by social insurance or employment insurance.

In the case of the workers currently employed by the lowest-level subcontractor and engaged in the clean-up operation at the Fukushima nuclear power station, the current average daily wage is said to be 8,000 yen, although TEPCO pays 60,000-70,000 yen per capita to the principal subcontractor. This is because each of the subcontractors from the top to the bottom of the subcontracting pyramid takes a cut from the workers' wages.

Koshiro Ishimaru has been participating in the Futaba Region Anti-Nuclear Power Plant Federation since the 1970's, supporting the nuclear power plant workers' efforts to win workers' compensation. "Because I couldn't bear the situation where workers could not stand up against the power of the companies and openly tell the truth, I established the Anti-Nuke Information Center in 1979," he said. Mr. Ishimaru launched activities to support nuclear power plant workers' attempts to win official recognition for their injuries and sicknesses as those eligible for official compensation, and conducted surveys on radiation damage to their health.

Although he himself was affected by the severe accident at the Fukushima Daiichi Nuclear Power Station in March 2011 and is currently evacuated to Iwaki, Fukushima Prefecture, he is serving as the representative of the organization. We have learned a lot from Mr. Ishimaru's activities and surveys. The following are noteworthy comments he has made in negotiations with TEPCO, and the pledges he and his group have obtained from TEPCO.

The late Nobuhiro Sato, who worked at the nuclear power plant for a long time said the severe, dangerous and demeaning working conditions at the plant are a magnet for the increased presence of crime syndicates and their front companies. According to Mr. Sato, there are no other workplaces better fitted to the *yakuza* than nuclear power plants. Their strict hierarchical relationship between the group leader and the members works effectively for getting jobs done at the plant. The plant workers change into protective garments before they enter the radiation-controlled areas, and this is the time when gangster group members show off their tattoos to the other workers. Thus, troubles in workplaces can be suppressed by force, said Mr. Sato.

Mr. Ishimaru and his group, together with Mr. Sato, complained to TEPCO in October 2005. They claimed that the multi-layered subcontractor system was causing a great deal of trouble at the nuclear power plant. According to them, some of the workers were *yakuza* group members and had tattoos, which was an abnormal situation for a public utility.

"Illegal acts, such as the forgery of health reports and registered seal impressions (the equivalent of forging a signature or an official rubber stamp), and not allowing workers to subscribe to health insurance and employees' pension plans, are rampant," they said. In response, TEPCO said the work contract refers to quality control, methods of construction, completion of the work, etc., and that the problems with the worker's body or personality are not mentioned.

TEPCO also said the company summoned the deputy chief of the Tomioka Town Police and asked him to give the subcontractors a lecture on how to deal with crime syndicates in staffing the Fukushima Daiichi nuclear plant in an attempt to raise their awareness of such problems. This remark indicates that TEPCO implicitly admitted the presence of crime syndicates in the plant, but used the work contract as an excuse for evading a direct response to the workers' demands.

Furthermore, Mr. Sato accused TEPCO of poor management of the plant workers. "Worker accidents are usually covered up inside the nuclear plant. Even if workers suddenly fall ill, they are not allowed to call an ambulance. In my case, after having been left unattended for three hours, I was taken to hospital in a colleague's car. I therefore suffered aftereffects later and became physically handicapped. Of all accidents occurring in the nuclear power station, 90% were concealed."

Referring to the presence of *yakuza* in the plant, he asked TEPCO, "Do you know that gangsters and their affiliated-company employees are working at the plant with impunity, betting on baseball games and gambling with *Hanafuda* (Japanese playing cards) in the workplaces? TEPCO is responsible for the management of the plant workers." TEPCO officials tend to fall silent when something disadvantageous to their position and hard to respond to is mentioned. That is the attitude they took in this case.

One year later, in 2006, TEPCO reportedly attempted to drive the gangsters and their affiliated companies out of the plant, but gave up because these people took a defiant attitude and threatened TEPCO by saying, "Do it if you think you can." Asked about the truth of this incident in further negotiations TEPCO refused to admit that the incident had occurred.

Apparently, TEPCO had a great deal of trouble dealing with two major problems. One of them was illegal conduct and the cover-up of worker accidents, and the other was crime syndicates and their affiliated companies. As for the former problem, the situation has improved considerably. Currently, ambulances are allowed to come into the nuclear power station and there is a doctor onsite 24 hrs a day. However, the latter problem is still beyond TEPCO's control because the subcontractor system is deeply multi-layered and complex, and because the *yakuza* are so deeply entrenched in the system.

(Mikiko WATANABE, CNIC)

- Continued from p.10, Nuke Info Tokyo No. 148-

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

Hiromitsu Ino

We must first understand the data on which this is based. Table 2 shows the results for the first to fourth monitoring tests. The amount of neutron irradiation is the amount for the specimens, not for the pressure vessel itself. The specimens were placed deeper inside the reactor than the reactor walls, so they were irradiated by more neutrons. Since the specimens have been irradiated by more neutrons than the reactor walls in the same time, operating years are converted to "effective operating years".

Monitoring test	Sample taken	DBTT* (ºC)	Neutron fluence (× 10^{19}n/cm²)	Effective years of operation
Initial value prior to irradiation	Operation began in October 1975	-16	0	0
#1	Nov-76	35	0.5	Approx. 5 years
#2	Apr-80	37	2.1	Approx. 20 years
#3	Feb-93	56	3.5	Approx. 33 years
#4	Apr-09	98	7.0**	Approx. 66 years

Source: Prepared from Technological Assessment of Aging in Nuclear Reactors 2003 (December 2003) p.15, Table 2.3-1, and materials distributed at the Karatsu City Conference (25 October 2010).
* Ductile-brittle transition temperature ** Authors' estimation.

Table 2: Results of monitoring tests on mother material of Genkai-1 reactor pressure vessel

Effective operating years for the fourth monitoring test specimen was 66 years, meaning the reactor walls would be irradiated by the same amount of neutrons after 66 years. Since the reactors do not operate continuously, this amount of irradiation would not actually be reached until 85 years after the reactor began operating. How then are the present ductile-brittle transition temperature (DBTT) and the DBTT after 60-years estimated? Since DBTT is 98℃ after 85 years, bringing it back to 35 years and 60 years Kyushu Electric comes up with the lower temperatures of 80℃ and 91℃ respectively.

The method used to derive this estimate is to redraw the prediction curve, adding a margin of error so that it passes through data point "×" in the top right corner of Figure 1 (see Nuke Info Tokyo No. 148), then to read off the DBTT corresponding to the amount of irradiation after 35 years and 60 years respectively. But for such a method to have a basis, the embrittlement prediction curve in Figure 1 must have some legitimacy. However, as discussed above, the formula used in the past has been pronounced invalid.

So can the new 2007 prediction formula explain the DBTT of Genkai-1? The answer is no.

Figure 2 shows the irradiation embrittlement prediction curve drawn by us on the basis of the 2007 prediction formula, and the observed DBTT. Like Figure 1, this diagram shows both the scale for DBTT and also for the increase in DBTT, the difference from the initial DBTT of minus 16℃.

It can be seen that the observed data of 98℃ is 42℃ above the predicted curve. This cannot be explained in terms of margin of error. Compared to Figure 1, if anything the deviation is greater. Thus the 2007 prediction formula fails completely to reproduce the irradiation embrittlement behavior of Genkai-1. Hence, there is no explanation why a high DBTT was observed in Genkai-1. Given that such high DBTTs are observed when there is a high amount of copper impurity, or there is phosphorous grain boundary segregation, we cannot rule out the possibility that the Genkai-1 pressure vessel contains, depending on the location of the monitoring specimens, low quality steel with high levels of impurities. In regard to Genkai-1, both the 2004 formula (Figure 1) and the 2007 formula (Figure 2) have lost their predictive power. It is meaningless to estimate based on these formulas that the current DBTT is 80℃, or that after 60 years operation it will be 91℃.

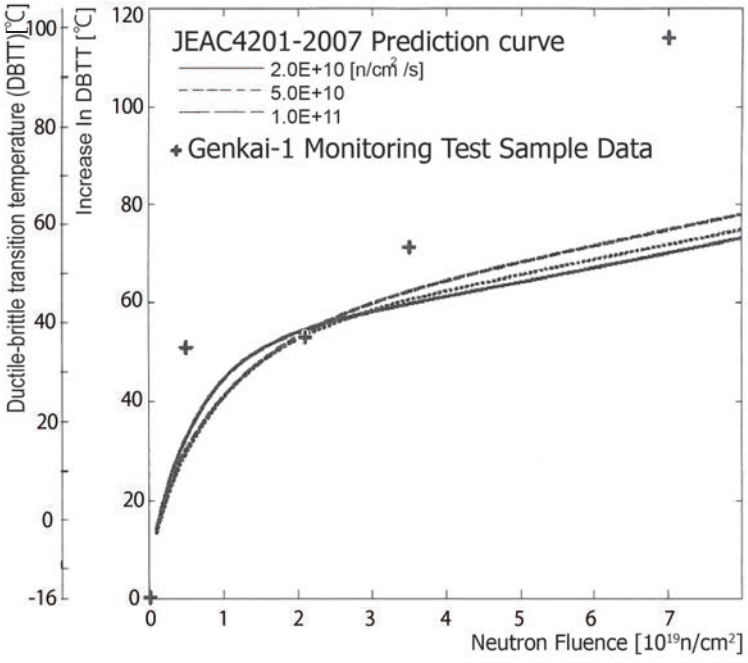

Figure 2: Genkai-1 Monitoring Data and JEAC-2007 Prediction

So what should we suppose the DBTT to be now? There is no sound method of estimating it. In that case, Kyushu Electric should respect the observed data of 98℃, assume that the pressure vessel itself has already reached this high DBTT (that being a true safety margin) and consider what response should be taken. The response should be to carry out the abovementioned PTS assessment based on a DBTT of 98℃, reconsider the operating sequence based on the 98℃ figure, and also carry out pressure tests based on 98℃.

NISA's Response and Public Comments

We were surprised at the observed high DBTT for Genkai-1. As soon as we

found out about it we requested Social Democratic Party leader Mizuho Fukushima to arrange a hearing with officers of Nuclear Industrial and Safety Agency (NISA) to find out about the monitoring test methodology, etc. To our amazement, at that point in time (December 15, 2010) NISA had received no information about the results of the fourth monitoring test for Genkai-1. The first they heard of it was from the questions in our letter. Kyushu Electric had not informed NISA of the strikingly high DBTT and NISA said they did not know because they had no obligation to inquire. What a careless and lax safety monitoring system. At the hearing we demanded that NISA pay great attention to Genkai-1's DBTT, and that it publish raw data for the Charpy test.

It is a matter of great significance that the results of the fourth monitoring test for Genkai-1 cannot be accounted for by either the former prediction formula (JEAC 4201-1991), or the current formula (JEAC 4201-2007), and that the high DBTT is totally unpredictable. NISA called for opinions regarding the 2010 supplement to JEAC 4201-2007, so, in light of this serious situation, the Nuclear Aging Research Team submitted a public comment to NISA articulating fundamental questions about the monitoring test methodology.

The essence of our public comment was as follows (abbreviated):

- The 2007 prediction formula is totally unable to reproduce the results of the monitoring test on mother material in the Genkai-1 reactor and metal welds in the Tsuruga-1 reactor, so the monitoring test system cannot be implemented based on the 2007 prediction formula.
- It is necessary to make a decision to permanently shut down nuclear reactors in which a high DBTT that cannot be explained by the prediction formula is observed.
- A fundamental review of JEAC-4201 is necessary, including whether prediction is possible.

This public comment calls for a fundamental review of JEAC-4201, which stipulates the monitoring test methodology for steel in pressure vessels, and for an explicit statement in the rule that there are cases where the option of permanent shutdown should be selected.

NISA's response to our public comment was published on its web site on May 6, 2011. There was no direct response to the points we made. The response made no reference to the striking deviation in the Genkai-1 data. It simply stated that where there is a deviation the margin for error should be reset and that there was no problem. NISA's reply was an insult to our intelligence. What needs to be corrected is the thinking behind the monitoring test methodology that uses margin for error to paper over problems.

Discussion and Issues in the "NISA Advisory Committee on the Technological Assessment of Aging in Nuclear Reactors"

Launch of the "NISA Advisory Committee on the Technological Assessment of Aging in Nuclear Reactors"

Last November the Nuclear Industrial and Safety Agency (NISA) initiated the NISA Advisory Committee on the Technological Assessment of Aging in Nuclear Reactors. As it turned out, I was invited to become a member of the committee. Hitherto, NISA has ignored our ideas. I decided to participate in the Hearings because I believed it was necessary to have a forum in which to communicate our thoughts about the issue of aging nuclear power plants, in particular concerning the extraordinary embrittlement of the Genkai-1 plant. However, these Hearings are, as their name implies, a forum in which committee members' views are heard and debate takes place, but in the end NISA takes responsibility for writing the report. I was aware of this limitation when I decided to become a committee member.

The following three issues have been considered during the Hearings:

(1) Assessment of the aging of individual plants:
(2) Relation between aging and the Fukushima Daiichi accident:
(3) Cause of the greater than predicted embrittlement of Genkai-1:

Consideration of how to interpret the results of the monitoring tests of the Genkai-1 DBTT, which exceeded the predicted 98℃, and whether the equation for predicting embrittlement is appropriate.

Theme (3), which relates to irradiation embrittlement in Genkai-1 and whether the existing prediction equation is appropriate, is the issue that interests me most. Debate about the cause of the high DBTT (98℃) observed in the Genkai-1 pressure vessel monitoring tests revolved around two theories: **[i]** was it caused by poor quality pressure vessel material or a bad manufacturing method, or **[ii]** was it because the embrittlement prediction equation does not accurately reflect reality in the high irradiation range?

Kyushu Electric claimed that the results of a chemical analysis of the steel materials showed that there were no irregularities and that uniformity was maintained. They also claimed that examinations carried out by the Central Research Institute of Electric Power Industry (CRIEPI) and others into micro-organization in the monitoring samples showed a good correlation between embrittlement and the formation of impurity clusters, so there was no abnormal embrittlement. However, to confirm the accuracy of this judgment and form a conclusion about whether or not the material of the pressure vessel is sound, instead of getting a research organization like CRIEPI, which is part of the nuclear industry, to assess the samples, they should be given to fair and trustworthy university researchers to examine their micro-organization.

To support Kyushu Electric's claim, a report entitled "Preliminary Consideration towards Improvement of the Accuracy of the Embrittlement Prediction Method " jointly produced by CRIEPI and the Federation of Electric Power Companies (FEPC) was submitted to the eighth meeting (February 22, 2012, document 10). It concluded that it is not necessary to change the thinking behind the embrittlement model and the reaction rate equation, which form the basis of the current prediction equation, and that the variation from reality arose due to the lack of data in the high irradiation range. Further, by giving importance to the high irradiation range data (applying a weighting) and resetting the parameters of the equation (impurity cluster formation rate equation coefficient) the Genkai-1 data fit was improved. In fact, however, the fourth data point of 98℃ is still above the standard deviation margin and the second and third data points drop below, making the curve look very suspicious. In other words, they were

unable to draw a meaningful curve connecting the third (56℃) and fourth (98℃) data points.

It is problematic that in order to improve the fit in the high irradiation range the coefficients for the reaction rate equation, etc. were greatly changed. These reaction rate equations are the master equations that determine the whole method, so for the parameters to change greatly depending on the data sets that are used indicates the brittleness of the model itself. The reliability of the embrittlement prediction equation model, which is the basis of JEAC4201-2007, is therefore called into question. The problem goes beyond the Genkai Nuclear Power Plant. It extends to all aging nuclear power plants.

Looking at the diagram in which NISA compared the prediction equation for aging nuclear power plants with the observed data (Hearing number 5, 23 January 2012, document 2), a large gap between the predicted figure and the observed figure can be seen in the high irradiation region. It is a fact that the prediction equation is unable to predict reality. However, the inaccuracy for Genkai-1 is particularly striking. The inaccuracy for other reactors is within 20℃, but the data from the fourth monitoring sample for Genkai-1 is out by 42℃. Besides the fact that the embrittlement prediction equation does not match the pressure vessel of Genkai-1 (see **[ii]** above), we must consider that the extraordinary embrittlement is due to the materials or the manufacturing method (**[i]**).

Another surprising thing was that when we investigated CRIEPI's embrittlement prediction equation, we discovered an elementary but important error in the equation itself. This prediction equation expresses changes in the micro-organization, namely the formation of impurity clusters and lattice defect clusters, which are the cause of irradiation embrittlement, as a reaction equation set, by tracing impurity atoms (copper atoms, etc.) and point flaw reaction (combination and disappearance) processes, and relating this to the rise in DBTT. This can be said to be an epoch-making change, compared to the rough and ready 2004 equation that just tried to fit the data, ignoring the rate of irradiation. However, there was a vital error in the reaction rate equation.

The main cause of irradiation embrittlement is the formation of copper clusters (or impurity clusters in general). In the model there are two types, irradiation induced clusters and irradiation promoted clusters. Irradiation induced clusters are accumulations of copper atoms in lattice defects caused by neutron irradiation. The rate of formation is proportional to the concentration of copper atoms and the rate of diffusion of copper atoms (the speed at which they move). Physically this is an appropriate assumption. However, CRIEPI's report says, "Because the formation of irradiation-enhanced clusters is a process in which copper atoms that exceed the solid solubility limit form a nucleus together, it is described by the square of the quantity of copper above the solid solubility limit and also the square of the diffusion coefficient." It must be said that this is a mistake. Because two (or more) copper atoms come together to form a cluster, it is appropriate to the think that it is proportional to the square of the concentration of copper atoms, but it is a mistake to say that it is proportional to the square of the dispersion coefficient*. Because two atoms move, at first sight it might seem that it would be proportional to the square of the speed, but that is not the case. Whether one atom is moving or stationary at one point, the rate at which they come together is the same. This can be proved mathematically. For example, the chance of two people meeting in a crowd in a stadium is the same whether one of the two is moving or stationary.

As stated above, there is an error in the basic model of CRIEPI's prediction equation. Naturally, any arithmetical calculation using this equation will produce the wrong result. Since the JEAC4201-2007 embrittlement prediction equation includes this fundamental error, it is a useless equation for predictions.

In addition to the abovementioned brittleness of the embrittlement prediction equation, a mistake in the derivation of the equation itself was discovered. The JEAC4201-2007 embrittlement prediction equation must be discarded. The current situation is that there is no reliable prediction equation.

Is Genkai-1 Pressure Vessel Sound? NISA's Predictable Assessment

At the 12th Hearing, held on March 29, NISA submitted a draft report entitled "Concerning Neutron Irradiation Embrittlement of Reactor Pressure Vessels (Draft)" (referred to hereon as "Draft Report"). The purpose was to bring to a close the debate since January this year about "the cause of embrittlement in excess of predictions in the Genkai-1 reactor." I strongly opposed the Draft Report and listed the problems. In the end the report was not finalized in March as planned and debate continued.

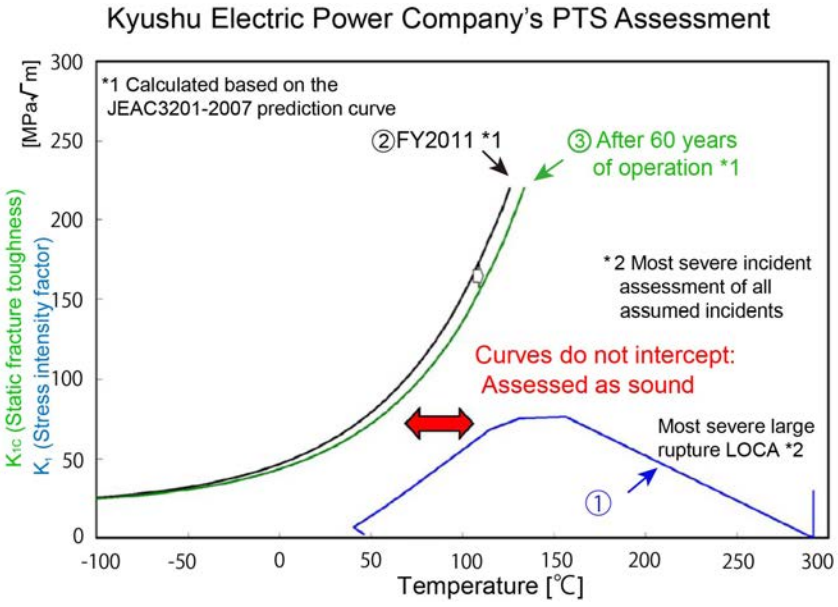

Figure 3: Kyushu Electric's Pressurized Thermal Shock (PTS) Assessment for Genkai-1 Pressure Vessel.

∗ The equation is: Formation rate of irradiation-enhanced clusters = A × (quantity of copper above the solid solubility limit × its diffusion coefficient)^2

I strongly opposed the report because even though the reason why a high DBTT of 98℃ was observed was hardly explained, the conclusion was drawn that the pressure vessel of Genkai-1 was sound, and the fact that the DBTT failed to agree with predictions was blamed on flaws in the prediction equation. Furthermore, NISA concluded that the pressurized thermal shock (PTS) assessment carried out by Kyushu Electric was appropriate and that the pressure vessel was in sound condition. However this type of assessment is totally inappropriate.

Figure 3 shows the results of Kyushu Electric's PTS assessment. The curve that looks like a mountain in the bottom right hand corner is called the PTS state transition curve (K_1 curve). In the case of a sudden large loss of coolant (Loss of Coolant Accident = LOCA), the Emergency Core Cooling System (ECCS) kicks in and coolant is fed into the reactor. The K_1 curve shows the change over time in the force (strictly speaking the stress intensity factor K_1) applied under those circumstances to the leading end of cracks that are presumed to exist in the inner surface of the pressure vessel. As a result of inserting cooling water, the temperature of the internal surface drops. At the same time, a temperature difference arises across the thickness of the pressure vessel and tensile stress is applied to the inner wall. Eventually the temperature difference of the pressure vessel becomes smaller and the value of the K_1 curve decreases towards the bottom left.

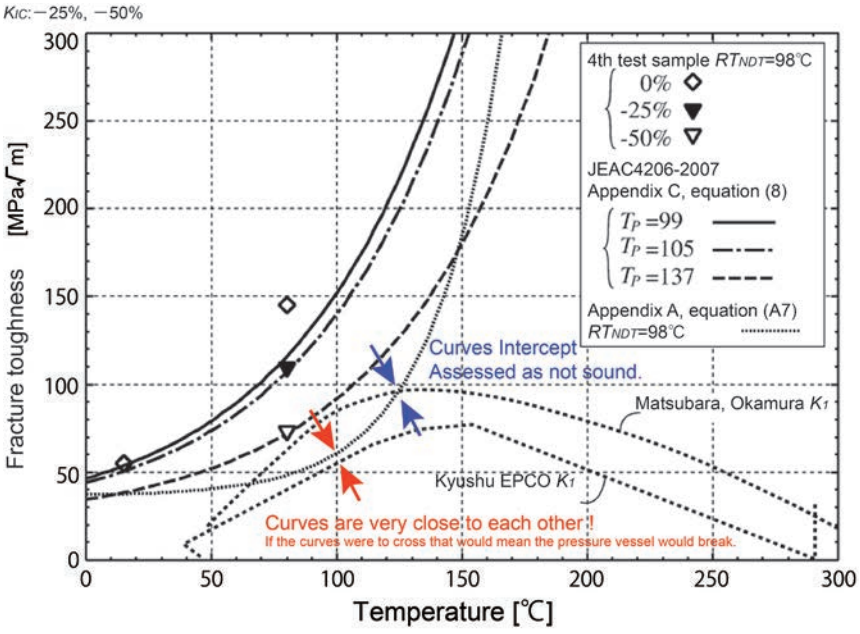

Figure 4: Results of Authors' Examination of Genkai-1 Pressurized Thermal Shock (PTS) Assessment. JEAC4206-2007 Appendix C and Appendix A, using references (a) and (b).

On the other hand, the curve rising to the right from the bottom left of Figure 3 is called the fracture toughness transition curve (K_{1C} curve). It shows how the fracture toughness K_{1C} changes depending on the temperature. If the material becomes brittle the curve shifts to the right. How is this curve derived? Besides Charpy shock test specimens, specimens are placed inside the pressure vessel to measure fracture toughness. These are extracted and the fracture toughness is measured at various temperatures. A curve is drawn as an envelope around the bottom limit of the measurements, in other words below which there is no data. In the Japan Electric Association's standard JEAC4206-2007 this curve is derived using the following equation:

$$K_{1C}=20.16+129.9\exp[0.0161\ (T-T_p)]\ldots(C8)$$

Parameter T_p is determined so as to draw an envelope around the measured data (i.e. so that all the data falls above the curve).

As the amount of neutron irradiation increases, the fracture toughness is reduced and breakage due to embrittlement occurs at higher temperatures. In order to derive a fracture toughness transition curve that corresponds to amounts of irradiation embrittlement other than those given by the measurement test specimens, with the measurement data on the horizontal axis the curve is shifted an amount ΔT_{K1C} parallel to this axis in the higher temperature direction. In that case, ΔT_{K1C} is said to hold. ΔRT_{NDT} is the difference in the DBTT (the amount by which DBTT shifts). In other words, it is assumed that if the temperature at which the fracture toughness value was measured is shifted by the same amount that the DBTT increased, the same fracture toughness value will be obtained. There is no theoretical basis for this relationship, but since it more or less works experimentally, JEAC4206 used this assumption.

Theoretically, an enveloping curve can therefore be drawn using all the observed test data from the first to the fourth test at Genkai-1, as well as data measured before irradiation. Also, for an arbitrary amount of neutron irradiation, a fracture toughness transition curve (C8) can be drawn. In this way the two curves in Figure 3 show the current K_{1C} curve and the K_{1C} curve 60 years after commencement of operation for estimated amounts of irradiation of the inner surface of the pressure vessel.

According to NISA's draft, "The fracture toughness measurement for accumulated irradiation equivalent to that in 22 years from now (60 years from commencement of operations) was approximately double (over 50℃ in terms of temperature) the critical stress intensity factor. This fracture toughness measurement is a directly measured value not related to the accuracy and correlation equations of the prediction method. Even bearing in mind that in general there is a variation of ±25% in fracture toughness for materials within the transition temperature range, it was confirmed that at this point in time there is sufficient margin for operation of Genkai-1." (p. 11)

(a) Nuclear Industrial and Safety Agency, "Concerning Neutron Irradiation Embrittlement of Reactor Pressure Vessels (Draft)," Hearings on Technological Assessment of the Aging meeting 12 document 5, March 29, 2012.
(b) Kyushu Electric Power Company, "Responses to Committee Member Comments", Hearings on Technological Assessment of the Aging meeting 8 document 6, February 22, 2012, pp. 3-5.

Is this true?

The first problem is the qualification, "Even bearing in mind that … there is a variation of ±25% in fracture toughness." Is not the variation in the fracture toughness larger within the transition temperature range? Is it not said that it is from double to half? If there is a variation of 50% in the 80℃ measurement of the fourth monitoring test, what will happen to the K_{1C} curve? I drew this in Figure 4. The result is that the K_{1C} curve approaches much closer to the K_1 curve.

The second problem follows on from the above quote, "In regard to the variation in the monitoring measurement values, although the measurements each time are few in number, they are carried out continuously for fracture toughness for temperatures which take into account the increase in temperature (which can be thought of as the DBTT) for each monitoring test and it is considered rational to take the overall lower limit." This is also on p. 11 of NISA's draft report. This sentence refers to a shift in the fracture toughness ΔRT_{NDT} based on the abovementioned assumption that $\Delta T_{K1C}=\Delta RT_{NDT}$. However, I submitted an opinion to the Hearings with an analysis that specifically showed that for Genkai-1, at least, this assumption does not hold. It is unacceptable that NISA compiled this draft with no reference to my analysis.

If this assumption does not hold, the shifted data point is not valid and the only two data points that can be used to draw the K_{1C} curve are those from the fourth monitoring test. With such limited data it is hard to claim that a reliable value for fracture toughness can be derived. I therefore presented the curve in Figure 4 taking into account a variation of 50%.

However, in appendix A to JEAC4206-2007 there is a rule about what should be done "in the case where the value for fracture toughness is not derived." This is an instruction to use the following equation to derive the K_{1C} curve from the DBTT values.

$$K_{1C}=36.48+22.78\exp[0.036(T-RT_{NDT})]\ldots(A7)$$

Figure 4 shows the curve derived by inserting the fourth monitoring test values for DBTT RT_{NDT} = 98℃ into equation A7. This curve approaches almost to the point of touching the stress curve K_1. If the curves were to cross that would mean the pressure vessel would break.

Next I would like to consider the PTS state transition curve (K_1 curve), which shows the size of the stress arising. Are Kyushu Electric's calculations sufficiently conservative? The assumption in JEAC4206 is for a semi-elliptical 10mm deep and 60mm long crack in the inner surface. It calculates the stress applied to the leading edge of this crack (stress intensity factor K_1). Figure 3 shows the PTS state transition curve derived by Kyushu Electric for Genkai-1. According to document 20 presented to the Hearings by Kyushu Electric, for the PTS assessment the most severe large rupture LOCA (loss of coolant accident) is assumed. Kyushu Electric said that it is a conservative assessment in which, without considering the temperature conditions of the inner surface or mixing with cooling water, the temperature would fall in steps from 291℃ to 27℃. (Kyushu Electric gave a confusing explanation implying that the temperature of the inner surface also falls in steps.)

On the other hand, in Figure 4 the K_1 curve referred to as 'Matsubara and Okamura' shows the results of a PTS assessment for a pressure vessel of the same dimensions as Genkai-1 (plate thickness 168mm, diameter 3.37). It is a diagram showing the case of a 10mm deep crack (a ratio of crack depth to plate thickness of 0.06). This curve gives a much larger K_1 curve than the curve in Kyushu Electric's assessment. Matsubara and Okamura's paper assumes a sufficiently long crack, so compared to assuming a crack of 60mm length the values are rather large, but that variation is about 15% based on stress calculations (personal correspondence from Dr. Aono). Even if that amount is subtracted it is above Kyushu Electric's K_1 curve. There is therefore a possibility that Kyushu Electric's assessment is not sufficiently conservative in regard to pressure conditions, etc.

On this point, committee member Meshii said that the K_1 curve changes greatly depending on the heat transfer coefficient h of the inner surface. If the equation is taken as h=1kW/m^{2}K the result is close to Kyushu Electric's analysis, but if it is taken as h=2kW/m^{2}K the result is about the same as the Matsubara and Okamura analysis, and for $h=\infty$ it crosses the K_{1C} curve. From this result, Meshii concluded, "The PTS assessment carried out by Kyushu Electric was judged to be close to realistic, but not so conservative that it was not necessary for variation in the fracture toughness value to be taken into account." He is saying that the curve in the assessment is at the limit and that Kyushu Electric's analysis does not have sufficient leeway .

Seen in this light, the conclusion in NISA's draft report that it has been confirmed that Genkai-1 is "sound enough" in regard to pressurized thermal shock must be seen as lacking foundation. At the sixteenth meeting of the Hearings NISA submitted a new draft which to some extent took into account the various critical views expressed. Debate on this draft is set to begin. However, even though the wording is slightly changed and the data reinforced, the arguments and the conclusion in this draft are the same as before. The conclusion that the Genkai-1 pressure vessel is sound was there from the beginning. The new draft does no more than add all sorts of considerations.

For reactors with such extreme irradiation embrittlement that the conclusion concerning whether or not they are safe varies depending on the analytical method and point of view, there is no other way to ensure people's sense of security than to make a decision to shut these reactors down.

The dangers of nuclear power plants are not limited to earthquakes and tsunamis. Aging is another big problem. In this context, the irradiation embrittlement discussed in this paper is the most fundamental problem requiring attention. Operating for 60 years nuclear power plants which were assumed to have a life expectancy of 40 years is just increasing the danger.

Destruction of the pressure vessel due to embrittlement is an accident that must not be allowed to happen. If the pressure vessel is destroyed the nuclear fuel will be spread over a wide area and there will be no way of cooling the nuclear fuel to remove the decay heat. Emergency response fire trucks and power supply trucks will all become ineffective. Reactors with even a small risk of being destroyed due to embrittlement should be shut down.

Continued on page 5

Anti-Nuke Who's Who

Hiraku Yamami of the Hinodeya Institute for Ecological Lifestyle

by Haruka Ozeki*

In spring 2002, Hiraku Yamami, at the age of 22, had his first direct contact with three organizations—the Takagi School, the Citizens' Nuclear Information Center, and the Society for Studies on Entropy–almost simultaneously. More specifically, he began to participate in the seminars and lectures held by these organizations in order to meet with the authors of the books he had read. He made many long day trips to the eastern or central regions of Japan, where such gatherings were organized, from his hometown of Nara City, located in western Japan. The frequent participation of the young man from a distant region must have been welcomed. Today, Mr. Yamami works for the Hinodeya Institute for Ecological Lifestyle in Kyoto as a researcher, while engaging in his lifelong commitment to social action.

Mr. Yamami's main work at the institute is to promote energy conservation to small businesses and shops. "Even if a piece of machinery saves energy, people can increase energy consumption and 'trade-off' the reduction if neither society nor citizens understand the significance of energy conservation," he says. "For example, suppose nuclear power is completely replaced with natural energy. Will society be better in a real sense? If humans continue to consume prolific amounts of energy, as we do today, our society will eventually collapse. Unless people's attitudes change along with changes in energy, the problems we have today will emerge again."

Regarding the March 11, 2011 disaster, Mr. Yamami says firmly: "Our society will break down unless we steer it in a different direction now. We must change."

As a schoolchild, Mr. Yamami loved science. "Technology is really wonderful!" He hoped to find a job related to technology in the future. As a senior high school student, he had an experience that swayed his trust in technology. In class, he participated in a debate about whether recycling PET bottles was good or bad. "If it is technically possible to recycle the bottles, it should be promoted positively," he argued. He was met by counterarguments such as: "Who will pay the recycling cost?" and "If we can recycle the bottles, can we use PET bottles limitlessly?"

The pedal-power bicycle generator is lighting the lamp. Mr. Yamami is involved in the development of pedal power generators.

After this experience, he became able to examine issues from many angles, including social viewpoints, not only technological ones.

"Technology may not be the universal solution." About the time he had this experience, Mr. Yamami started to think of technology from a critical point of view. In response to his questions, his father recommended books by Jinzaburo Takagi. The process of trying to find something that might undermine the values of science and technology he loved, such as learning about the negative aspects of nuclear power generation, must have been a tough task that consumed a great deal of physical and mental power for a susceptible youth, who was lost, confused and puzzled.

Since then, Mr. Yamami has been placing importance on the point of view of citizens and on fostering approaches that are accessible to all. "I believe we can make our lives richer and even more joyful by using less energy than we do today. In the future, I'd like to see more people getting involved with energy-saving opportunities." he says firmly.

* Staff of the Hinodeya Institute for Ecological Lifestyle

NEWS WATCH

Hitachi-GE to Accept Order for Lithuanian Nuclear Plant

On June 21, the Lithuanian Parliament approved a construction contract between its government and Hitachi-GE for an ABWR (1,384 MW).

Construction plans for the Visaginas Nuclear Plant, close to the border of Latvia and Belarus, aim for completion in 2021. Latvia and Estonia will also receive electricity and are being requested to bear a part of the cost burden. It is planned to conclude the official contract after the investment amounts are approved. Hitachi, the nuclear plant's operating company has also become an investor, and should the investment figure for the three countries decrease then Hitachi's burden will increase. Some of the surrounding countries also have anti-construction movements, and thus this is a major risk for Hitachi.

Demands for Nuclear Plant Decommissioning: A Succession of Lawsuits

Following the Fukushima nuclear accident, new lawsuits demanding nuclear plant decommissioning are being filed in various areas.

Lawsuits filed this year include: Kyushu Electric's Genkai Nuclear Plant on January 31, Tokyo Electric's Kashiwazaki-Kariwa Nuclear Plant on April 23, Kyushu Electric's Sendai Nuclear Plant on May 30, and Hokuriku Electric's Shika Nuclear Plant on June 26. It seems as though lawsuits are about to be filed against all of Japan's nuclear plants.

Around 7.5 Million Signatures for Nuclear Phase-out Submitted to Government and Diet

Eminent writers and critics such as Kenzaburo Oe have called for a petition named "Goodbye to Nuclear Power Plants", and have obtained around 7.5 million signatures. The petition was submitted to both the Chairman of the Lower House on July 12th, and to the Chief Cabinet Secretary on July 15th. On July 12th, eighty Diet members participated in a report meeting in the Diet Member's building to listen to Mr. Oe's appeal.

New Law Establishes Nuclear Regulatory Commission

In NIT Issue 147, News Watch reported that a bill for restructuring Japan's nuclear regulatory organizations had been submitted to the Diet. In the bill, the Nuclear Regulatory Agency was to be created under the Ministry of the Environment, but the LDP and Komeito parties submitted a counterproposal stating that there should be a Nuclear Regulatory Commission. The ruling DPJ party met the opposition parties halfway and withdrew its first plan. The three parties submitted to the Diet a revised plan based on a new agreement, which was enacted on June 20. Accompanying this enactment, the provision "contribute to Japan's national security" was added to the three laws, the Nuclear Regulatory Commission Establishment Act, the Nuclear Reactor Regulation Law and the Basic Law on Atomic Energy, raising concerns that this may lead to the abrogation of the principle of peaceful use of nuclear power.

Demand for a Citizens' Referendum Ordinance Fails to Pass

The demand in Osaka City and the Tokyo metropolis for a citizens' referendum ordinance for a vote on the restart of nuclear plants was rejected both in the Osaka Assembly on March 27 and in the Tokyo Assembly on June 20. At the same time, movements with a similar claim have started in Shizuoka and Niigata Prefectures.

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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