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Aging Reactors: Symposium in South Korea

From left, Seok Kwanghoon, Kim Yongguk, chair Kim Sung Kuk, Mitsuhiko Tanaka and interpreter Kim Bonnyo

On October 24th I attended a symposium in Busan, South Korea, concerning the life extension of Kori-1 nuclear power plant (NPP). Mitsuhiko Tanaka, a member of CNIC's Citizens' Research Group on Nuclear Power Plant Aging Issues, was one of the panelists.

Kori NPP is located 30 kilometers north-east of Busan City, which has a population of over 3 million people. Kori-1 (587 MW) is South Korea's oldest NPP. It commenced operation on 29 April 1978. The plant was imported from the US (Westinghouse) and is operated by Korea Hydro and Nuclear Power Company (KHNP). Its original design life of 30 years runs out in June 2007. By rights it should be closed down at that point, but the Nuclear Energy Law was revised in May 2005 to allow extensions beyond the design life and in June this year KNHP applied for a further 10-year license extension. The Ministry of Science and Technology will consider the application and make a decision within 18 months.

The original intention was that the symposium would take the form of a debate between the government (Ministry of Commerce Industry and Energy, Ministry of Science and Technology), KHNP and citizens. The debate would address the following three issues: safety, need and social acceptance. However, immediately before the symposium, KHNP and the government pulled out giving various excuses, including the commotion surrounding the North Korean nuclear test. As a consequence all the panelists came from the citizens' side.

Mitsuhiko Tanaka explained the Japanese situation. The system in Japan was revised in

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The Deepening Puzzle of Steel Used in Reactor Pressure Vessels

Degradation cannot be predicted

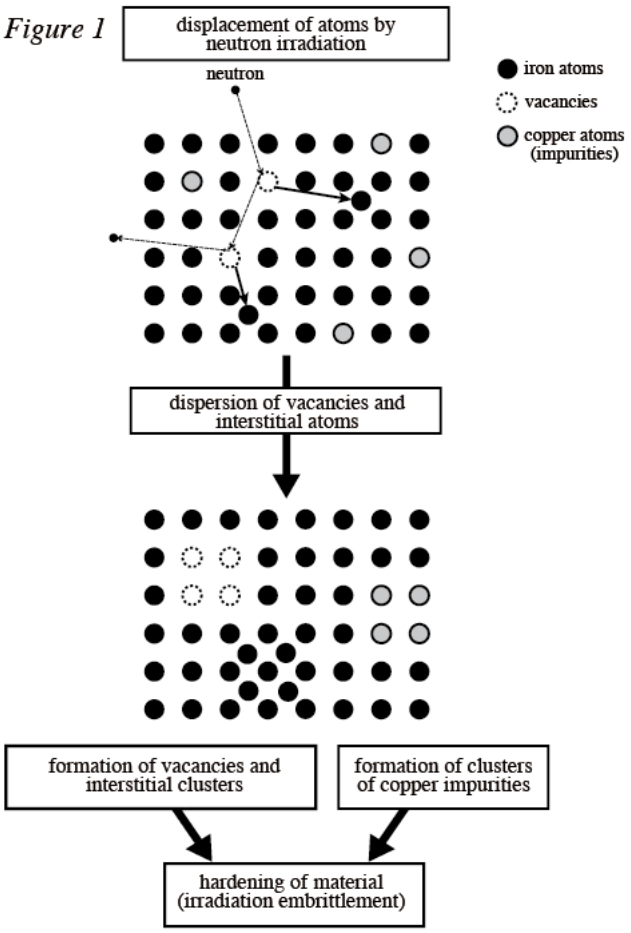
One of the most frightening type of nuclear accidents is a sudden break-up of the reactor pressure vessel as a result of embrittlement. The pressure vessel of a boiling water reactor (BWR) is between 4 and 6.5 meters wide and about 20 meters tall and is made of low-alloy steel. Like carbon steel, low alloy steel is very strong. Its main component is iron, but it also contains 0.2% carbon, 1.35% manganese, 0.66% nickel and 0.5% molybdenum. Copper is also present as an impurity. If the pressure vessel were to suddenly break up, fragments of steel would fly like missiles into the containment vessel. The containment vessel is only a few centimeters thick, so these fragments would open holes through which radioactive substances would escape from the pressure vessel to the surrounding environment. This disastrous scenario must be avoided at all costs. Consequently, people involved in the nuclear industry get nervous about the condition of pressure vessels, in particular in aging reactors.

The Japan Institute of Metals and the Iron and Steel Institute of Japan held their autumn meeting from September 16th-18th at Niigata University. One of the symposiums was about the latest research into the mechanism of embrittlement caused by irradiation of the steel in nuclear pressure vessels. It focused on prediction of microscopic embrittlement mechanisms. This article reports on a paper presented at the nuclear materials workshop by Hiromitsu Ino, Chihiro Kamisawa and Yoshinori Ito, all members of CNIC's Citizens' Research Group on Nuclear Power Plant Aging Issues. Their paper was entitled "Abnormal irradiation embrittlement of pressure vessel steels of domestic BWR plants".

What is irradiation embrittlement?

Inside the reactor core neutrons are continually inducing uranium atoms to undergo nuclear fission. Each time an atom fissions, it releases more neutrons, thus sustaining the chain reaction. Inevitably, irradiation by these neutrons is greatest in the part of the pressure vessel closest to the core. This irradiation displaces atoms in the pressure vessel from their original position. These atoms lodge between other atoms in the atomic lattice structure, while "vacancies" are created where these atoms originally were. If clusters of such vacancies and surplus atoms are formed, these areas become less flexible when force is applied. The material is said to have hardened (see figure 1).

Figure 1



Mechanism of Material Hardening due to Neutron Irradiation

To say that the material has hardened means that it has become brittle. As long as the force applied is small the material is very strong, but above a certain force cracks appear. These cracks grow rapidly until the material suddenly breaks. This is embrittlement fracture. It is easy to imagine what happens by comparing it with glass and stones.

Generally materials are harder at low temperatures. However, when materials are continually irradiated with neutrons, the temperature at which embrittlement fracture occurs rises more or less proportionally to the hardening of the material. Consequently, if the pressure vessel is cooled suddenly, there is a danger that it will suddenly break up due to the heat stress which arises.

To prevent this from occurring, test pieces of

material are placed in the pressure vessel for monitoring purposes. These are then removed and checked at predetermined intervals. Tests are carried out to determine whether irradiation embrittlement is proceeding at the predicted rate.

Research of Professor Ino's team

The paper presented by Professor Ino et al. had two research objectives.
1. Analyze and evaluate the data from the test pieces monitored in BWR pressure vessels and assess the appropriateness of the irradiation embrittlement prediction formula used in Japan;
2. Focus on abnormal embrittlement in BWRs and propose that this is dependent on the rate of irradiation.

Six years ago, during the Tokai-2 court case, Ino contended that the irradiation embrittlement was related to the rate of irradiation of the pressure vessel, but his evidence was not accepted. Later, in June 2003, test pieces from Japan's oldest reactor, Tsuruga-1 (commenced operation 1970), were removed and checked for the sixth time. It was discovered that the embrittlement transition temperature of these test pieces was much higher than predicted by the formula. The difference was not such that it could be said to be a random phenomenon, or within a reasonable margin of error. As shown in figure 2, the data from the third and forth monitoring tests were for test pieces irradiated at an accelerated rate. These were exposed to more neutrons than those from the sixth round of tests, which were exposed at a slower rate. The data from the third and forth monitoring tests match either the prediction formula, or the prediction formula with a margin added. From the diagram it can be seen that at the time of the fifth round of tests (test pieces removed in 1980) it was too early to judge whether the data matched the formula.

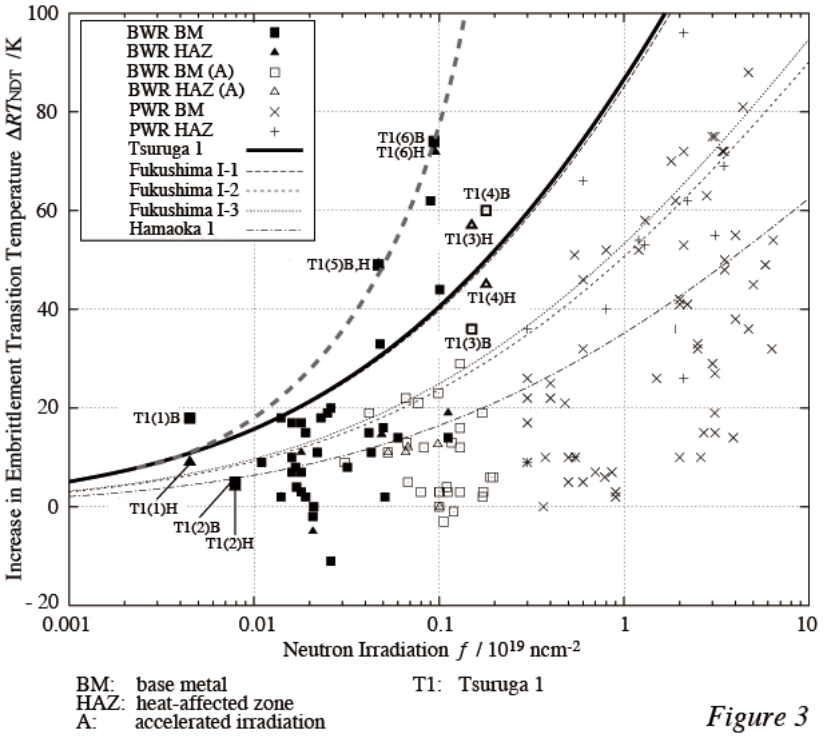


Figure 3

Ino believed that there was a problem with the official irradiation embrittlement prediction formula.

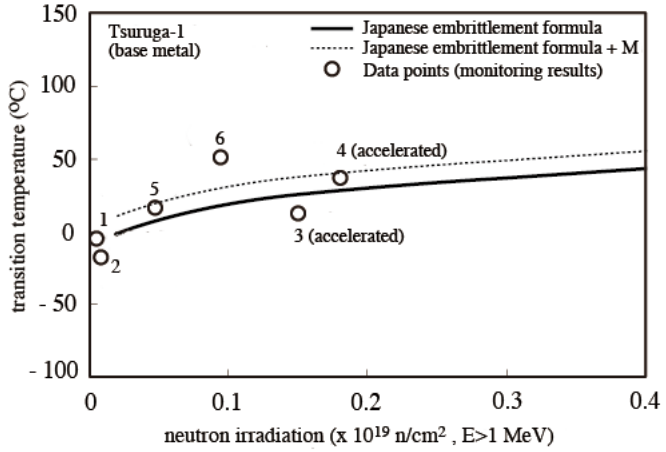
Official formula: ΔT = (material factor) x (function of number of irradiating neutrons)

ΔT is the rise in embrittlement temperature. The material factor depends on the quantities of various elements (copper, nickel, phosphorous, silicon, etc.) in the material, and the function of the number of irradiating neutrons is determined experimentally. This formula does not include the rate of irradiation. However, if one considers the physical processes involved, one would expect the growth of clusters of vacancies and interstitial atoms and the accumulation of impurities to take time. Furthermore, the accumulation of clusters of impurities (copper impurities) should be a function of time. Ino et al. proposed that since atoms and vacancies move around, a time factor should be taken into account, not just the total irradiation.

Ino et al. carried out comprehensive studies of data from Ministry for Economy Trade and Industry reports for 2005. Figure 3 is one

Figure 2

Nuclear Pressure Vessel Embrittlement Transition Temperature Test Piece Data for Tsuruga-1 (base metal)



Graph by CNIC, based on document 5-1 of the Committee into Ageing Management for Nuclear Power Plants (Ministry of Economy Trade and Industry, Advisory Committee for Natural Resources and Energy, Nuclear Industrial and Safety Subcommittee)

example. The horizontal axis shows the total neutron irradiation and the vertical axis shows ΔT.

The diagram might be difficult to understand because of the numerous data points, but it seems clear that it can be divided into several lines and groups. Data for Pressurized Water Reactors (PWR) is also included. In the diagram, BM is an abbreviation for base metal and HAZ for heat-affected zone. In the case of Tsuruga-1, it appears that data points are located on the steeply rising curve. However, this curve does not correspond to the official prediction formula. I drew it myself from the ideas of Ino et al.. I thought it would be great if a formula producing this curve could be derived from the physical observations.

The results from the seventh round of tests will be very important. It is highly likely that the data points will be much higher than predicted by the official formula. Aging will continue under the government's policy of extending the life of reactors to 60 years. We must seriously reconsider the safety of the pressure vessels.

Response of the Institutes

After Professor Ino's aural presentation, there was a comment from a researcher at the Central Research Institute of Electric Power Industry (CRIEPI). He suggested that enough time has elapsed at Tsuruga-1 so that copper impurities will have no further impact and embrittlement will not progress. Professor Ino responded that this may be so, but that there have also been reports that, contrary to expectations, these impacts have not yet been fully played out. He went on to point out that the best way to answer this question would be to look at actual monitoring pieces, but the problem is that CRIEPI doesn't publish this data. He added that it is very strange that Japanese researchers have to use test pieces from Belgium and Argentina. This last comment referred to a paper presented by researchers from the Tohoku University's Institute for Materials Research.

At the beginning of the opening day, Naoto Sekimura of Tokyo University Engineering Department gave the keynote speech about recent developments in research in Japan and overseas on steel used in reactor pressure vessels. I listened very carefully to his speech, because he is the head of the technical assessment working group of Nuclear and Industrial Safety Agency's (NISA) committee investigating management of aging nuclear power plants. Clearly he was aware of the research of Ino et al.. He expressed confidence in the progress of research into the tendency for copper-containing steel to be affected by the rate of neutron irradiation and in CRIEPI's development of a mechanistic prediction method. He also referred to the International Group on Radiation Damage Mechanisms (13 countries, 70 people), which meets once every 18 months or so, and provides an international forum for discussion of leading edge research. I was very surprised to hear that it is not a public forum. Evidently the closed "nuclear club" is still alive and kicking.

The presentation by CRIEPI which followed left many questions unanswered. It related to an embrittlement prediction formula which took into account the rate of irradiation, but it didn't address the key issues.

Besides the usual measurement method using an electron microscope, several other methods using the latest measurement techniques were presented at this symposium: for example positron annihilation, coincidence Doppler broadening, 3-dimensional atom probe, and local electrode atom probe. Thus the issue of embrittlement was extended to the nano-scale. However, it was clear that there were no arguments refuting the issues raised by Ino et al..

Furthermore, the question I have been asking for many years remained unanswered. Can monitoring small pieces provide a full understanding of the embrittlement of a huge pressure vessel? Also, listening to several presentations in which it was stated that manganese (which is not an impurity but one of the main components of the steel used in pressure vessels) is definitely connected to embrittlement, my concerns about reactor pressure vessels deepened. One can only conclude that the current situation is very dangerous.

Professor Ino included this information in evidence he presented on September 8th this year during the court case calling for termination of operation of the Hamaoka nuclear power plant. Let us hope that the judge in this case takes into account the latest research developments and hands down a better verdict than in the Tokai-2 case.

Yukio Yamaguchi (CNIC Co-Director)

Haiku for the season

winter cherry blossoms
what makes you look so tranquil
in misty rain

by Sachiko Kondoh

First MOX Powder Produced at Rokkasho

As reported in previous issues of NIT, active tests at the Rokkasho reprocessing plant began on 31 March 2006. The plan is to reprocess 430 tons of spent fuel over 17 months in 5 steps of gradually increasing quantities: 30 tons, 60 tons, 70 tons, 110 tons and 160 tons respectively.

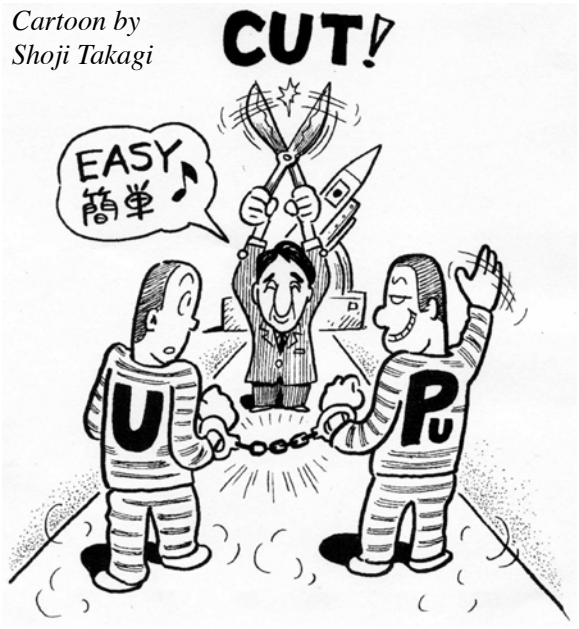
The first step, the main aim of which was to shear and dissolve 30 tons of spent fuel, was completed on June 26th. However, commencement of the second step was delayed so that measures could be taken to prevent a repetition of the worker exposure incidents that occurred in the latter half of the first step. Two cases of worker exposure occurred in the analysis laboratory due to problems such as insufficient understanding regarding handling of equipment and the failure of workers to wear masks (NIT 113).

The commencement of the active tests marked the beginning of the release of krypton-85 into the environment. During shearing of spent fuel, the concentration of beta radionuclides downwind of the plant reached 2 kilo-becquerels per cm^3 for the first time ever and the concentration of krypton in the atmosphere also increased accordingly. Official data on liquid emissions has not yet been released.

Delay during step 2

Shearing of spent fuel for step 2 commenced on August 18th, but the following day problems arose with the shearing machine and shearing was suspended for the next month. According to a problem report released by Japan Nuclear Fuel Ltd. (JNFL) at the end of September, something had lodged in the shearing machine. Whatever it was could not be removed by the usual method, so a new method had to be used. JNFL recommenced shearing on October 2nd without providing any detailed account of the problem which had caused the suspension.

As a result of the problems with the shearing machine, by the end of September only 6 PWR fuel assemblies (about 3 tons) had been sheared during step 2. This delay could potentially cause the schedule for commencement of "commercial" operations to be set back. To avoid this, JNFL proceeded at a rapid pace after it recommenced shearing, at times reaching the maximum pace envisaged under full-scale operating conditions of 4.8 tons a day. Clearly JNFL is trying to make up



Cartoon by Shoji Takagi

for lost time. However, if there have been delays during the active tests, naturally these delays should be reflected in the schedule for commencement of "commercial" operations. JNFL should take the utmost care during these tests. By prioritizing schedules, JNFL is putting extra pressure on workers. This will cause them to become stressed and exhausted. We fear this will only cause more problems and accidents.

First MOX powder produced

All 50 tons of PWR spent fuel scheduled to be sheared and dissolved during step 2 were completed late October and shearing and dissolving of BWR spent fuel commenced mid-November. Testing of the processes of blending uranium and plutonium solutions and denitration of uranium and mixed plutonium-uranium solutions began for the first time at the beginning of November, and on November 16th JNFL announced that Rokkasho's first MOX powder (the finished product) had been produced.

The mixed oxide denitration process is a major difference between the Rokkasho reprocessing plant and the reprocessing plants in France and the UK. This process was a requirement of a 1977 Japan-US joint decision regarding reprocessing at the Tokai reprocessing facility. Uranium nitrate and plutonium nitrate solutions are mixed in a 1:1 ratio. The nitrate component is then removed from this mixture to create a mixed oxide (MOX) powder. The Carter administration firmly demanded this process as a non-proliferation measure and the

original design of the Tokai facility was altered to accommodate the US position. The process employed at Rokkasho is essentially the same as that used at Tokai.

A portion of the MOX powder produced at Rokkasho will be shipped to Tokai Village to be used at the mock-up JMOX test facility that has been set up there. JMOX is the name of the MOX fuel fabrication plant that will be built next to the Rokkasho reprocessing plant. It is not scheduled to commence operations until 2012. In the meantime a test facility has been set up in Japan Atomic Energy Agency's Plutonium Fuel Production Facility at Tokai.

One man's fuel is another man's bomb material

It is a great irony that production of plutonium-uranium mixed oxide powder began at Japan's first industrial-scale reprocessing plant a month after North Korea conducted a nuclear weapons test. It is believed that the weapon tested by North Korea was a plutonium bomb. While North Korea might have extracted enough plutonium for a few nuclear weapons, when fully operational Rokkasho will produce enough plutonium each year to produced 1,000 such weapons.

The Japanese government and nuclear industry persist with their claim that the mixed oxide denitration process described above is proliferation- resistant. The International Atomic Energy Agency takes a different view. The IAEA's Safeguards Glossary lists MOX as follows: "MOX is considered a special fissionable material…and a direct use material". "Direct use material" is further defined as "nuclear material that can be used for the manufacture of nuclear explosive devices without transmutation or further enrichment." Japanese officials and industry representatives may be able to repeat the old fiction without blinking, but other than the Japanese public no one is deceived. While we do not believe that Japan has a nuclear weapons program or that the government intends to produce nuclear weapons in the foreseeable future, Japan's plutonium program is an obstacle to non-proliferation and disarmament. The best service Japan could do for these causes would be to close down the Rokkasho reprocessing plant and abandon the illusion of plutonium as an inexhaustible fuel source (see also page 7).

Masako Sawai and Philip White (CNIC)

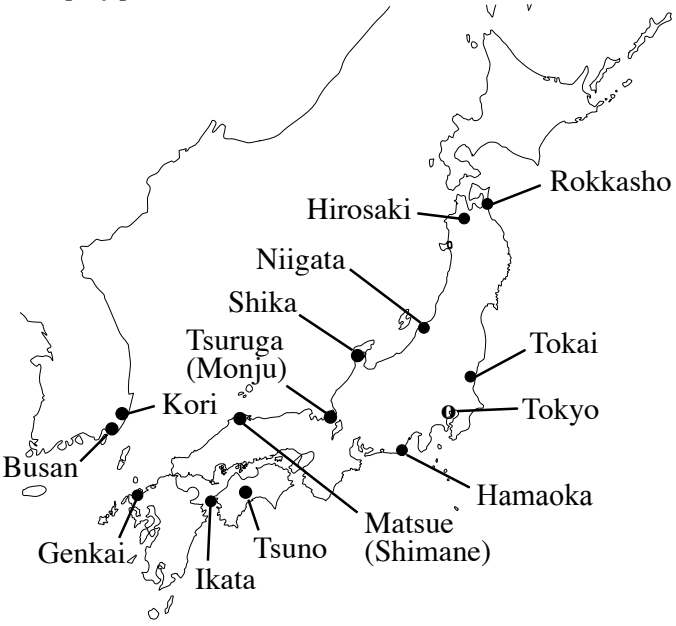
continued from page 1 September 2003 to require companies to adopt measures in response to the issue of aging NPPs and to set maintenance standards. Before plants turn 30, a technical assessment of major components must be performed and a long-term maintenance plan must be established. If these measures are approved, a license extension of 10 years can be granted. Up to three extensions may be granted, giving a maximum operating life of 60 years. Tanaka pointed out that this is an extremely optimistic system.

Most of South Korea's reactors are pressurized water reactors (PWR). Tanaka stressed the importance of paying careful attention to developments related to aging PWRs in Japan and the US, for example problems with reactor vessels such as cracked nozzles and embrittlement caused by neutron irradiation (see article on page 2). He said that Japanese citizens' groups are keen to cooperate on technical issues.

The other panelists besides Mitsuhiko Tanaka were Seok Kwanghoon of Green Korea United and Kim Yongguk, legislative assistant to Democratic Labor Party MP Chun Young Se and activist opposed to the Yonggwang NPP. Seok Kwanghoon presented analysis showing the risk of excess load on the grid and future surplus capacity. Speaking from past experience, Kim Yongguk stressed the importance of not letting the government and KHNP deceive them.

Chihiro Kamisawa (CNIC)

Map of places mentioned in NIT 115



CNIC Response to North Korea's Nuclear Weapons Test

Despite North Korea's prior warning, its nuclear test came as a great shock in Japan. Once again, the question of whether Japan should acquire nuclear weapons raised its ugly head. At this stage it remains a debate about whether to have a debate. Prime Minister Abe quickly rejected proposals to discuss the issue, but his refusal to sack senior government politicians who continued to push for a debate has the effect of weakening the taboo.

Nevertheless, it would be premature to write off Japan as a lost cause. It is inconceivable that Japan will acquire nuclear weapons in the near future. However, the long term effect of North Korea's nuclear test on the public psyche and on the political climate is a matter of great concern.

This page presents a couple of responses from CNIC.

Philip White (NIT editor)

North Korea Nuclear Test: Statement of Protest

For over half a century, human beings have been yearning for the elimination of nuclear weapons. All over the world people from all walks of life have been striving for this cause.

The nuclear weapon test conducted by North Korea on 9 October 2006 was a crushing blow to humanity's fervent hope, held ever since Hiroshima and Nagasaki, for the elimination of nuclear weapons.

We realize that there are already many countries which possess nuclear weapons. We also realize that there are people who recite the mantra of "peaceful use" to promote nuclear energy for the generation of electric power. Furthermore, we know very well that some people are in a great rush to extract plutonium from spent nuclear fuel at the huge Rokkasho Reprocessing Plant in Aomori Prefecture. However, depending on the circumstances, plutonium may at any time be turned into nuclear weapons.

We believe that nuclear weapons are the flip side of the "peaceful use" of nuclear energy. Unless the path to nuclear weapons (including the precursors to nuclear weapons) is absolutely prohibited, the world will be unable to achieve permanent peace.

We strongly protest North Korea's nuclear weapon test. It is necessary to remind ourselves that human beings and nuclear energy, "peaceful" or otherwise, cannot coexist.

Yukio Yamaguchi (CNIC Co-Director)
10 October 2006

Letter to the Japanese Government

Prime Minister Shinzo Abe
Foreign Minister Taro Aso

On 6 September 2006, 48 citizens' groups sent an appeal to the former Prime Minister, Jun'ichiro Koizumi, demanding that Japan oppose lifting Nuclear Suppliers Group (NSG) restrictions on nuclear trade with India[1]. The contents of this appeal have become even more important since North Korea announced on October 9th that it had conducted a nuclear test. North Korea must not be given the impression that the criticism of India's nuclear tests was just a passing phenomenon. Japan must firmly maintain the position that possessing nuclear weapons and conducting nuclear tests is unacceptable for all countries.

America wanted to make an exception for India, but as soon as the US-India deal surfaced, Pakistan, which also conducted a nuclear test in 1998, demanded that it too be exempted from NSG nuclear trade restrictions, and discussions between China and Pakistan about further nuclear cooperation have been gradually progressing in recent months. Moves to relax restrictions on nuclear trade with India and Pakistan may not be the direct cause of North Korea's nuclear test, but they certainly would have given encouragement to North Korea. International rules should be followed on the assumption that exceptions cannot be limited to a single country - that exceptions will inevitably spread. If this principle is not adhered to, irreversible nuclear proliferation problems could arise.

We demand that the Japanese government uphold the non-proliferation system and that it not allow exceptions. At the same time as condemning North Korea's nuclear test, Japan should also pursuade America and China not to make exceptions for India and Pakistan. We therefore repeat our demand for the Japanese government to oppose lifting NSG restrictions on nuclear trade with India.

Hideyuki Ban (CNIC Co-Director)
11 October 2006

1. See letter to former Prime Minister Koizumi on the following page of CNIC's web site: http://cnic.jp/english/news/newsflash/2006/indiaus6Sep06.html

Japanese Holdings of Separated Plutonium at 2005 Year End

Separated Plutonium Held in Japan (kgPu)		
Facility	**Form**	**Amount at end 2005 (end 2004)**
JAEA Tokai Reprocessing Facility	Plutonium nitrate etc.: processes from dissolving until (but not including) placement in storage containers for storage as plutonium	660 (562)
	Plutonium oxide: stored in storage containers as plutonium oxide	164 (275)
	Total	824 (837)
	Total fissile	565 (569)
JAEA MOX Fuel Fabrication Facility	Plutonium oxide stored in storage containers as plutonium oxide	2,526 (2,442)
	Testing and fabrication stage	863 (686)
	Newly fabricated fuel: held as completed fuel assemblies etc.	338 (433)
	Total	3,727 (3,562)
	Total fissile	2,603 (2,499)
Nuclear Reactor Facilities (held as new fuel etc.)	Joyo	145 (85)
	Monju	367 (367)
	Fugen	0 (0)
	Power reactors in use	415 (415)
	Research and development facilities	445 (445)
	Total plutonium	1,372 (1,311)
	Total fissile plutonium	1,021 (976)
Total plutonium held in Japan		**5,923 (5,710)**
Total fissile plutonium held in Japan		**4,188 (4,045)**

Separated Plutonium Held Overseas* (kgPu)	
UK	16,582 (15,703)
France	21,270 (21,385)
Total plutonium held overseas	**37,852 (37,088)**
Total fissile plutonium held overseas	**25,417 (24,992)**

*Plan to fabricate this plutonium into MOX fuel overseas and use it in LWRs in Japan

Corrected Overseas Plutonium Holdings* (kg plutonium)								
Year	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**
Corrected	6,160	8,664	11,291	14,972	18,916	24,152	27,309	31,889
Uncorrected	6,197	8,720	11,378	15,100	19,096	24,398	27,596	32,070
Year	**2001**	**2002**	**2003**	**2004**				
Corrected	32,189	33,010	34,894	37,088				
Uncorrected	32,379	33,231	35,149	37,381				

*Nuclear loss (radioactive decay of Pu-241) for plutonium held at overseas reprocessing plants was treated inconsistently by the various power companies in previous years. From now on the figures take into account nuclear loss. While fixing these inconsistencies, errors were also discovered in BNFL's (BNGS) previous reports of plutonium held in the UK. These have been corrected.

2005 Increase/Decrease in Inventory of Separated Plutonium Held in Japan

	Total (kgPu)
Separated at reprocessing facility	271
Loaded into reactors	- 35
Increase/decrease during processes within facilities	- 23
Total increase/decrease	213

JAEA Reprocessing Facility (separation & purification to storage of raw material for mixing and conversion)		
Item		**Increase/Decrease**
Holdings at 1 January 2005 (end 2004)		837
Separated during 2005		271
Outgoings during 2005 (removed from facility)		- 272
Increase/decrease during processes within reprocessing		- 12
Detailed breakdown	Transfer to retained waste	- 8.7
	Retransfer (recovered) from retained waste	7.0
	Nuclear loss (radioactive decay)	- 1.6
	Measured discard	- 9.0
	Material unaccounted for	0.6
Holdings at 31December 2005		824

JAEA MOX Fabrication Facility (from mixed oxide powder (MOX) to completed fuel assemblies)		
Item		**Increase/Decrease**
Holdings at 1January 2005 (end 2004)		3,562
Received during 2005		272
Outgoings during 2005 (removed from facility)		- 95
Increase/decrease during processes within reprocessing		- 11
Detailed breakdown	Shipper/receiver difference	- 0.4
	Transfer to retained waste	- 0.2
	Retransfer (recovered) from retained waste	0.0
	Nuclear loss (radioactive decay)	- 10.8
	Material unaccounted for	- 0.1
Holdings at 31December 2005		3,727

Nuclear Reactor Facilities Etc. (Joyo, Fugen, Monju, power reactors in use, research and development facilties)	
Item	**Increase/Decrease**
Holdings at 1January 2005 (end 2004)	1,311
Received during 2005	95
Loaded during 2005	- 35
Holdings at 31December 2005	1,372

(For explanations of terminology see the IAEA Safeguards Glossary)

Comment: NIT readers will note that the data released this year is more detailed than in the past. Of particular interest is the material unaccounted for (MUF). The figures shown here are very low. Indeed, the positive figure for JAEA's Tokai reprocessing facility means that the balance books show 0.6 kg more plutonium than there should be. MUF is an indication of the limits of the plutonium accounting system, and given that the measurements for the other categories are not 100% accurate, positive MUF figures such as this are quite possible. The plutonium in the retained waste (stored within the material balance area) and the measured discard (disposed of in such a way that it is not suitable for further nuclear use) could conceivably be plus or minus several percent compared to the figures shown here. (No response was ever received to CNIC's inquiry about the accuracy of these measurements.) However, the most significant thing about the data released this year is that we can expect similar detailed information next year. We look forward to seeing a detailed breakdown of the plutonium accounting for the active tests at the Rokkasho reprocessing plant. (Ed.)

Anti-Nuke Who's Who

Yoshiko Kuratsubo: committed to her hometown of Hirosaki

by Midori Inaba*

On August 26, 2006 eight members of the "Association of Mothers to Protect Children from Radioactivity" conducted their 221st public demonstration. During the protest Yoshiko Kuratsubo, born and raised in the Tsugaru region of Aomori Prefecture, gripped the microphone and addressed passers-by in her kind voice. Yoshiko joined the movement to oppose the nuclear fuel cycle facilities located in the village of Rokkasho 20 years ago. She began marching in monthly demonstrations, with her young children in tow. The Association's slogans captured the essence of the issues at stake: "Children must be protected from radioactivity." "We can't leave the costs of nuclear power to our children." "Let's not pollute our hometown."

The "Association of Mothers" began holding regular demonstrations in July 1986, following the nuclear disaster at Chernobyl. They march in snow or rain, sometimes as few as three people and sometimes as many as thirty, but more important than numbers, the people of Hirosaki see a visible and recognizable opposition to the nuclear fuel cycle facilities.

The group makes its way slowly along the busy shopping district of Hirosaki, holding a quilt stitched with the phrase "We don't need nuclear fuel cycle facilities." They call out to onlookers with a hand-speaker and distribute leaflets. It was very difficult for Yoshiko when she first embarked on this path of protest. She confessed that when she first began marching she looked down at the ground, afraid of meeting someone she might know. Now when she sees friends or acquaintances, she waves with a confident enthusiasm. For people of Hirosaki the demonstration is a familiar sight. They often shout encouragement to the demonstrators. Yoshiko feels that everyone is against the nuclear fuel cycle facilities, but most people find it extremely difficult to publicly express such feelings. She believes that people are grateful to the "Association of Mothers" and that the warm greetings they receive are an expression of gratitude for continuing demonstrations on their behalf.

Hirosaki is Japan's number one apple producing region. More than ten years ago, Yoshiko started seasonal work during the spring and fall at an apple farm operated by a family that she met through the movement. She helps out from the time when flower buds open until the apples are ready for harvest. She says that by playing her part, she has come to understand both how hard farmers work and their feelings about their apples.

Early spring in Hirosaki is a season of spectacular beauty, as the apple blossoms burst into full bloom. The village of Rokkasho is some 80 kilometers from Hirosaki, but if an accident occurred at the Rokkasho reprocessing plant, radioactive contamination would spread to Hirosaki polluting everything including this beautiful landscape. She feels more strongly than ever now the importance of protecting her hometown from radioactive pollution and preventing the ruin of an industry that is deeply rooted in this region of Japan.

When the region of Tsugaru is mentioned, what springs to mind in Japan along with apples is the Tsugaru shamisen. Yoshiko also plays the Tsugaru shamisen, an instrument she began studying 10 years ago. Today she gives concerts at various events and at nursing homes, but her first encounter with the Tsugaru shamisen was also through the movement. In this way, Yoshiko's loyalty and commitment to her hometown of Hirosaki, reflected in her continuing participation in protest activities, has become even stronger.

During the past twenty years Yoshiko and her friends have engaged in a variety of protests and demonstrations to protect children and their homeland from radioactive pollution. Although active testing has begun at the Rokkasho reprocessing plant, Yoshiko is determined never to give up, but to continue with perseverance and good spirits the movement to terminate the plant.

* Midori Inaba is a member of *Citizens Against the Interim Storage Facility* in Shimokita

NEWS WATCH

Turbine damage due to "high-cycle fatigue"

On October 27th, Chubu Electric and Hokuriku Electric power companies submitted final reports to the Nuclear and Industrial Safety Agency about the causes of and response measures for damage to low-pressure turbines in their Hamaoka-5 (ABWR, 1380 MW) and Shika-2 (ABWR, 1358 MW) reactors (see NIT 113). Chubu Electric's English press release states, "The combined stresses generated repeatedly by random and flashback vibration resulted in high-cycle fatigue and the occurrence of cracking." Random vibration occurs as a result of "turbulence in steam flows within the turbines during no load and low load operations" and flashback vibration arises due to "high-speed reverse flows of steam in the turbine from water supply heater during load cutoff testing".

Both companies blamed the turbine maker (Hitachi) for taking insufficient care in the design of the vanes for the scaled-up low-pressure turbine used in these ABWR reactors. In a press conference held on the same day, Hitachi responded that the problem could not have been foreseen on the basis of engineering knowledge at the time. These different perspectives reflect the companies' respective positions in relation to compensation for loss of income. No details regarding compensation have emerged so far.

Shifting international alliances in nuclear industry

On October 17th Toshiba announced that it had completed its purchase of Westinghouse. Originally Toshiba hoped to provide only 51-53% of the total price of $5.4 billion. However, one of the prospective partners, Marubeni, got cold feet and Toshiba was left to foot 77% of the bill. The other partners in the deal are the Shaw Group with 20% and Ishikawajima-Harima Heavy Industries with 3%.

Hitherto Westinghouse has cooperated closely with Mitsubishi Heavy Industries (MHI) and Westinghouse President Steve Tritch says that he hopes to continue the relationship. However, on October 19th MHI announced that it had entered into a strategic partnership with Areva.

Not to be outdone, on November 13th Hitachi and General Electric announced their intention to set up joint ventures in Japan and the US. The Japan-based company will be 80% Hitachi and 20% GE owned, while the US-based company will be 40% Hitachi and 60% GE owned. Final agreement on the alliance is planned for June 2007.

Mitsui feasibility study into development of Russian uranium

On October 6th, Mitsui & Co. Ltd. announced a joint feasibility study with Tenex into the development of a sector of the Yuzhnaya zone of the Elkon uranium ore field in Russia's far eastern Republic of Sakha. The Yuzhnaya zone is believed to contain reserves in excess of 250,000 tons making it one of the largest uranium deposits in the world.

Aomori governor unimpressed by application for receipt of radioactive waste from abroad

On October 17th the Federation of Electric Power Companies applied to Aomori Prefecture and Rokkasho Village for permission to receive medium and low-level radioactive waste produced as a result of reprocessing Japanese spent fuel in France and the UK. The UK portion of this waste would be substituted with high-level waste of equivalent radioactivity content. The Mayor of Rokkasho, Kenji Furukawa, said, "consideration of the request will take time", while Governor Shingo Mimura maintained that the first priority was to confirm the safety of the Rokkasho reprocessing plant. He took the view that the request was premature saying, "The circumstances are not right to consider this request now".

Tsuno Town won't apply for HLW dump

On October 30th the Tsuno Town Council (Kochi Prefecture, Shikoku Island) unanimously rejected petitions presented to it both for and against applying for consideration as a candidate

site for a high-level waste dump. The council decided "not to become involved in this issue, either now or in the future". In response to this decision Mayor Takeo Myojin said, "I have decided not to submit an application and consider the matter finished as of today."

Application for pluthermal at Shimane-2

On October 23rd Chugoku Electric Power Company applied to the Minister for Economy Trade and Industry for a license variation to allow it to implement pluthermal at its Shimane-2 reactor (BWR, 820 MW). Earlier on the same day Takashi Yamashita, President of Chugoku Electric, visited Shimane Governor, Yoshinobu Sumita, and Matsue City Mayor, Masataka Matsuura, and received their permission to apply for the license variation. The safety agreement requires that the governor and the mayor give their permission for license variations. The prefecture had originally indicated that it would grant final permission before the application for a license variation was submitted to the minister, but in the end it decided to align itself with the more cautious approach of Matsue City. The approach finally adopted by both Shimane Prefecture and Matsue City involves a two-step process of first granting permission to apply for a license variation and then granting final permission after the minister's approval is received.

Local approval for pluthermal at Ikata-3

On October 13th, Moriyuki Kato, Governor of Ehime Prefecture, and Kazuhiko Yamashita, Mayor of Ikata Town, handed letters of final approval for implementation of pluthermal at the Ikata-3 reactor (PWR, 890 MW) to Momoki Tokiwa, President of Shikoku Electric Power Company.

Call for Saga Prefecture citizens' referendum re pluthermal

A petition was launched on October 3rd demanding that the question of whether or not to implement pluthermal at Kyushu Electric Power Company's Genkai-3 reactor (PWR, 1180 MW) be decided by a Saga Prefecture citizens' referendum. The legal requirement for such a petition is that at least one in fifty eligible voters (about 14,000 people) sign, but to make it more difficult for the prefectural assembly to reject the petition, the organizers are aiming to obtain the signatures of ten percent of eligible voters (70,000 people).

Signatures can be collected until December 3rd. The validity of the signatures will then be checked and the petition for a referendum ordinance submitted to the governor. After receiving the petition, the governor will submit it, along with his own views on the matter, to the prefectural assembly.

A citizens' referendum on pluthermal was held on 18 April 2001 in Kariwa Town, Niigata Prefecture (site of Tokyo Electric's Kashiwazaki-Kariwa nuclear power plant). A majority of Kariwa residents opposed pluthermal in that referendum, but the proposed Saga referendum would be the first to address pluthermal at a prefectural level.

Request submitted for approval of new fuel plan for Monju

On October 13th, Japan Atomic Energy Agency applied to the Minister for Economy Trade and Industry for approval of its plan to replace some of the fuel at Monju (prototype FBR, 280 MW). Operation of Monju has been suspended since an accident relating to a sodium leak on 8 December 1995. Since then, the composition of the initial load has changed (as a result of the decay of plutonium-241 to americium-241) and the reactivity of the core has decreased. To overcome this problem, a portion of the fuel will be replaced by fuel with a one percent higher fissile component than that currently loaded.

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. Please write to us for a subscription (Regular subscriber - $30 or ¥3,000/year; supporting subscriber $50 or ¥5,000/year). When paying in Japan, the subscription fee should be remitted from a post office to our post office account No. 00140-3-63145, Genshiryoku Shiryou Jouhoushitsu. Due to costly processing fees on personal checks, when sending the subscription fee from overseas, please send it by international postal money order. Alternatively, you can ask us to send you details regarding bank transfers. We would also appreciate receiving information and newsletters from groups abroad in exchange for this newsletter.

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