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Citizens' Nuclear Information Center

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The Future of Kashiwazaki-Kariwa Unit 7

Citizens challenge official results by carrying out their own boring around the KK-NPP site.

On December 11, the Nuclear Safety Commission (NSC) announced its conclusion that, with a few provisos, the Kashiwazaki-Kariwa-7 Nuclear Power Plant (KK-7) is safe. NSC's conclusion was based on consideration of the results of the Nuclear and Industrial Safety Agency's (NISA) inspection and assessment of the plant. However, moves towards restarting the plant have not proceeded as NSC planned. The reasons are as follows:

1) The debate in two subcommittees established by Niigata Prefecture remains polarized on fundamental issues;
2) NSC and pro-nuclear academics were unable to answer questions posed by citizens during a debate sponsored by the above two subcommittees (Kariwa, December 23) and a hearing for local residents sponsored by NSC (Kashiwazaki, December 25);
3) In the course of work aimed at restarting the plants, there have been several fires and injuries, with the result that mistrust towards Tokyo Electric Power Company (TEPCO) has if anything increased.

The Niigata Prefecture subcommittee which is looking into the earthquake and the ground condition held its first meeting in March 2008. As of mid-January 2009 it had met seventeen times. Strange as it may seem, and contrary to a statement by the International Atomic Energy Agency (IAEA) in a press release dated December 5, scientific opinion remains divided about the cause of the July 2007 Chuetsu-Oki Earthquake.

Pro-nuclear academics say it was caused by the so-called F-B Fault (refer NIT 125). They base their assessment of potential future earthquakes and the design-basis earthquake ground motion ("Ss") on this fault. Back-checks (refer NIT 124) were carried out for all Japanese nuclear power plants to assess seismic safety in the light of new seismic guidelines adopted in September 2006. In the case of Kashiwazaki-Kariwa, Ss was assessed on the basis that the F-B Fault was 36-kilometers long.

On the other hand, more critical scientists believe that the F-B Fault branches off from a shallow part of the Eastern Boundary Fault of the Sado Basin (see NIT 124), which they say is 50-70 kilometers long. They claim that this fault is more important for understanding the Chuetsu-Oki Earthquake and the type of earthquakes that could arise in future. If that is so, the magnitude predicted for future earthquakes would be larger than the officially accepted estimate. Clearly, the design-

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basis earthquake ground motion should also be set higher, contradicting the conclusion handed down by NISA and NSC.

The pro-nuclear academics justify their position on the grounds that an ultra-sound survey conducted in August 2008 by NISA off the coast of Kashiwazaki failed to detect the Eastern Boundary Fault of the Sado Basin. However, despite the fact that the survey was carried out directly above the fault plain that gave rise to the Chuetsu-Oki Earthquake, it was unable to locate that fault plain. Hence, it is not possible to conclude that faults do not exist on the basis of off shore ultra-sound surveys. The critical scientists make this point and state that it is necessary to carry out a proper geomorphological assessment of the region.

The other sub-committee is looking into equipment integrity and earthquake resistance and safety. It held its twelfth meeting on January 13 this year. However, the committee members still do not agree about whether or not KK-7 is safe.

TEPCO's assessment of the plant's integrity is based on visual inspections of equipment and computer calculations. Cross-checks by the Japan Nuclear Energy Safety Organization (JNES) found locations where the stress incurred was near the permitted limit. JNES confirmed the integrity of these locations after repeating the checks. In regard to locations which cannot be accessed due to high levels of radiation and locations where the confined space makes it impossible to insert testing equipment, judgments were made on the basis of calculations, or checks on similar parts elsewhere in the plant.

However, as a result of the far greater than predicted ground motion, it is possible that plastic deformation (refer NIT 125) could have occurred, even though there is no visible deformation. Unless pieces are cut out and metallurgical tests are carried out, there is no way of checking this with certainty. The only method that the pro-nuclear side has come up with is "hardness testing", but this method is not accurate enough to detect strain in the key 0.2% ~ 2.0% range. Consequently, a grey zone remains where any judgment is mere guess work.

The sub-committee members do not necessarily agree about this grey zone. At the January 13 meeting TEPCO claimed that there is no grey zone. It says that the computer calculations are sufficiently conservative and that it knows from vast accumulated experience whether equipment is damaged or not. Some sub-committee members maintain that while there is a grey zone, it is not relevant from the point of view of safety. This issue relates to the question of whether to consider KK-7 separately from the other units (see NIT 127). It will be very interesting to see how this debate develops.

An issue relevant to the work of both sub-committees is how to interpret the fact that the reactor and turbine buildings have continued to move since the earthquake. TEPCO has measured the elevation of the buildings on three occasions since the earthquake - immediately after the earthquake, in February 2008 and again in August 2008. There are suspicions that the continued movement could be because the bedrock has broken up, or for some other similar cause. Alternatively, it could be related to the Madogasaka Fault, which NSC claims is not active.

During the December 23 meeting in Kariwa Village hosted by the Niigata Prefecture sub-committees, the chair of the subcommittee into equipment integrity and earthquake resistance and safety, Haruo Yamazaki, responded to a question with an example of a nuclear power plant floating on a cup of starch. When construction of the Kashiwazaki-Kariwa Nuclear Power Plant was first planned, people said it was like building a nuclear power plant on tofu. Now we find that the ground on which the plant is built is no more solid than a cup of starch.

On January 7, the mayor of Kashiwazaki stated in his New Year press conference that local approval is required on two occasions, before and after start-up tests of KK-7. His statement suggests that the bureaucratic processes are in motion. The Japanese fiscal year ends on March 31. We expect there will be lots of maneuvering until then.

Yukio Yamaguchi (CNIC Co-Director)

Haiku for the season

a camellia
dropped quietly
no one noticed but me

by Sachiko Kondoh

Comment

Japanese are spooked by the falling of camellia flowers. The flowers do not drop petal by petal. Rather, the whole flower falls at once. Japanese say it reminds them of the falling of a human head when a person has been beheaded.

Replacement of Hamaoka Reactors 1 and 2

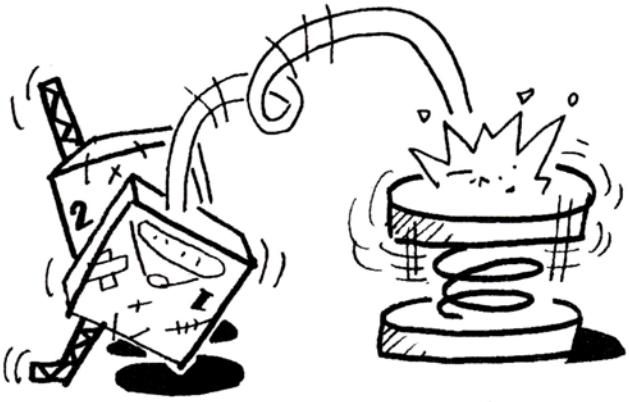
On December 22, the Board of Directors of Chubu Electric Power Company decided that it would terminate operations at Hamaoka Reactors No. 1 (540 MW, BWR) and No. 2 (840 MW, BWR) and replace them with a new Reactor No. 6 (1,400 MW, ABWR). (Hamaoka Nuclear Power Plant is located in Omaezaki City in Shizuoka Prefecture.) This is the first ever replacement plan in Japan. The Board also decided that the spent fuel from the spent fuel pools of Units 1 and 2 should be removed and placed in a common dry storage facility to be built onsite for all the plants.

On the same day, Chubu Electric informed the Minister of Economy, Trade and Industry of its plan to close down Units 1 and 2, requested Omaezaki City and the six local fishing cooperatives to allow construction of a sixth reactor, and sought the cooperation of the neighboring two cities and Shizuoka Prefecture.

In its press release Chubu Electric emphasized that rationalization on economic grounds was the reason. It denies strongly that it is closing down the reactors because of aging. Chubu Electric emphasizes this point because it has been telling local governments and others that, given a life span for nuclear reactors of 60 years, these reactors are in the prime of life. Unit 1 commenced operation in March 1976, making it nearly 33 years old, while Unit 2 commenced operation in November 1978, making it just 30. In regard to seismic safety, Chubu Electric concludes, on the basis of its own seismic motion estimate of 1,000 Gal, that reconstruction of major equipment is not necessary.

Nevertheless, Chubu Electric decided in January 2005 to carry out work to increase the seismic resistance leeway of all five reactors. Work on Units 3, 4 and 5 was completed by March 2008. Chubu Electric estimates that the work on Units 1 and 2 would cost over 300 billion yen and take over ten years to complete and that the investment would not be recovered until 2028.

Rather than spend all that money to upgrade Units 1 and 2, which would have less than 20 years left to operate when the work is completed, it makes more economic sense to build a new reactor, which would become operational at about the same time anyway. Besides which, the extra 1,400 MW will not be needed for the next 10 years or so.



Cartoon by Shoji Takagi

However, Chubu Electric's emphasis on economic rationality and its refusal to admit that safety is an issue only increased the distrust of the local people. The fact that it went ahead with work to increase the seismic resistance of Units 3 to 5, while postponing work on Units 1 and 2 suggests that at the time it was already thinking of closing Units 1 and 2.

At the time when it made its decision on the seismic resistance work, Unit 1 had already been shut down for four years since an explosion in November 2001 ruptured piping in the Emergency Core Cooling System. Unit 2 had been closed down for a year since February 2004, because of the discovery of cracks in the shroud during a periodic inspection. In December 2004 leaks from cracks in a shared exhaust stack were discovered. It was judged that the stack would have to be replaced. As repair costs kept rising, it should have been clear that the plants would not last 60 years.

Was the estimated 300 billion yen plus assigned for upgrading seismic resistance an indication of the extent of the seismic safety problems, or was Chubu Electric looking for an excuse to close down the plants? Was it trying to inflate the cost by opting to go so far as to replace the base mats of the two units? (The base mats of the other three units were not replaced.) In either case, the real issue was safety.

That is why the mayors and the heads of the municipal authorities of Omaezaki and the surrounding cities welcomed the decision to close

down Units 1 and 2, even though they complained about the lack of consultation. On the other hand, it seems that they will not readily agree to the construction of Unit 6 or the spent fuel dry storage facility. In anyone's eyes, in the absence of growth in electricity demand, building a new plant right over the center of the anticipated Tokai Earthquake will be seen as a risky venture. The local population is also unhappy that another plant might be built at Hamaoka to make up for the failure of Chubu Electric's plans to build nuclear power plants at Ashihama and Suzu.

Another concern raised by the local people, Mayor Kakegawa, and also in an editorial in the Shizuoka Shimbun is the way decommissioning and rebuild, which are both major projects in their own right, are being sold as a package deal. They are saying that Chubu Electric should wait until the local people have accepted that the decommissioning proposal is safe. Chubu Electric's plan is that Unit 6 will begin operating by 2018, or a couple of years thereafter, but at that stage Units 1 and 2 would either still be standing, or in the process of being dismantled.

It has been pointed out that the cost of decommissioning will exceed the approximately 48 billion yen set aside for the purpose. Chubu Electric announced that it will take a loss disposition of 155 billion yen for the accounting period ending March 2009 owing to the shutdown of Reactors 1 and 2. Besides decommissioning costs, this includes around 50 billion yen for disposal of unused fuel and around 57 billion yen for lost depreciation of fixed assets. Kazuhiro Matsubara, head of Chubu Electric's accounts division, is quoted in the December 24 edition of the Nikkei Shimbun as saying that this figure could change, depending on how the decommissioning plan actually turns out in practice. The author of the article, Taro Matsushita, makes the following point: "The fact is that it is impossible to be sure of the time required for decommissioning. If the scale of the decommissioning work exceeds predictions, it could put pressure on [the company's] performance." Aptly said, considering that these will be the first reactors to be decommissioned in Japan.

The reason why decommissioning and new build are being sold as a package is that without the prospect of a new reactor, decommissioning alone would punch a hole in the rationale for the government's nuclear energy policy. One feels some sympathy for Chubu Electric on this point. Along with Tokyo Electric and Kansai Electric, Chubu Electric is referred to as one of the big three power companies (Chuo Sansha). As such, Chubu Electric's President could potentially become the Chairman of the Federation of Electric Power Companies. It would, therefore, be an embarrassment if the percentage of nuclear in Chubu Electric's generation capacity were to fall. Seen in this light, even if it doesn't really want to build a sixth reactor, perhaps Chubu Electric had little choice but to offer the decommissioning of Units 1 and 2 and the construction of Unit 6 as a package.

This also suggests that other utilities wishing to close down reactors due to aging might offer decommissioning as a package deal with new construction. There are currently 17 reactors in Japan that have been operating for more than 30 years. The oldest, Tsuruga-1 (BWR, 357 MW), will be 40 years old in 2010, when it is due to be decommissioned. However, the next oldest, Mihama-1 (PWR, 340), which began commercial operations 8 months after Tsuruga-1, had its life extended to 60 years and is not scheduled to close down until 2030. Hamaoka-1 is the tenth oldest reactor, while Hamaoka-2 is the seventeenth oldest, so there are quite a few reactors that are older.

Another perspective on the package deal approach is that it was intended to reduce the impact of the proposal for a dry storage facility. This facility will have a capacity of 700 tons of uranium and it is proposed that it begin receiving spent fuel in 2016. It is supposed to take spent fuel from the spent fuel pools of Reactors 1 and 2, but in that case 2016 will be too late. It appears that Chubu Electric wants to take advantage of this opportunity to build a storage facility for the longer-term future.

Whatever way you look at it, the Hamaoka reactor replacement plan is anything but transparent.

Baku Nishio (CNIC Co-Director)

Problems with the Production of Glass Canisters at the Rokkasho Reprocessing Plant

The Rokkasho Reprocessing Plant, owned and operated by Japan Nuclear Fuel Ltd. (JNFL), is in the final stage of active testing, but problems with vitrification of high-level radioactive waste to form glass canisters have become an obstacle to completing the tests. The problems are fundamental. They will take a long time to solve and I predict that it will be necessary for equipment to be replaced.

As a by-product of reprocessing spent nuclear fuel to extract uranium and plutonium, large quantities of radioactive waste containing many types of radioactive materials is produced. The most dangerous waste is referred to as "high active waste", or "high level waste" (HLW).

It is hard to imagine any way of disposing of this waste other than vitrifying it to form glass canisters and storing it deep underground ("geological storage").

There are two methods of producing glass canisters. One method is to evaporate off the nitric acid by heating the HLW nitric acid solution, mixing HLW oxide powder produced at high temperature with glass, melting this mixture and sealing it in stainless steel canisters. This is the method used in France. The other method, used in Japan, is to mix HLW in liquid form with glass and then heat the mixture to melt the glass.

Borosilicate glass (Na2O-B2O3-SiO2) is used. Some people might think that there should not be any problems, because glass has been manufactured in Japan from ancient times. However, it is by no means a simple process when all sorts of heat producing radioactive isotopes are incorporated into the glass.

The majority of the radioactive substances in the glass canisters are elements produced as a result of nuclear fission reactions ("fissile products"). Besides these, there are also radioactive elements produced by neutron irradiation ("neutron-induced radionuclides"). Table 1 shows the elements contained in 1 ton of spent light water reactor (LWR) fuel (equivalent to the quantity in one glass canister). Elements which are not sent to the vitrification facility are not included in the list.

Table 1: Weight and radioactivity of elements contained in 1 ton of spent LWR fuel
(Burn-up 33,000 MWd/t, cooled for 10 years after removal from LWR)

Element	Weight (kg)	Radioactivity (Bq x 10^{12})
Strontium ($_{38}$Sr)	0.77	2180
Yttrium ($_{39}$Y)	0.46	2130
Zirconium ($_{40}$Zr)	3.62	0.068
Molybdenum ($_{42}$Mo)	3.35	2×10^{-5}
Technetium ($_{43}$Tc)	0.77	0.49
Ruthenium ($_{44}$Ru)	2.18	22.2
Rhodium ($_{45}$Rh)	0.47	22.1
Palladium ($_{46}$Pd)	1.37	0.004
Tellurium ($_{52}$Te)	0.48	11.2
Cesium ($_{55}$Cs)	2.38	3230
Barium ($_{56}$Ba)	1.73	2900
Lanthanum* ($_{57}$La)	1.22	0
Cerium ($_{58}$Ce)	2.37	6.30
Praseodymium ($_{59}$Pr)	1.12	6.38
Neodymium* ($_{60}$Nd)	4.03	0
Promethium ($_{61}$Pm)	0.011	363
Samarium ($_{62}$Sm)	0.86	12.0
Europium ($_{63}$Eu)	0.13	228
Neptunium ($_{93}$Np)	0.45	0.64
Americium ($_{95}$Am)	0.58	63.4

(* These elements are not radioactive after one year cooling.)

Chemists will find something rather troubling in this table. That is that not all these elements can be incorporated into glass. One would not expect that platinum group elements with high melting points (ruthenium, rhodium, palladium) could be incorporated into glass. Also, molybdenum readily forms the molybdate ion, which behaves as an anion and is therefore difficult to incorporate into glass. This has become a real problem.

Some of the glass produced in the vitrification facility of the Rokkasho Reprocessing Plant did not flow into the stainless steel canisters. It is believed that this was due to the fact that platinum group elements had blocked the outlet. JNFL tried but failed to make a homogeneous molten glass mixture by stirring it with a metal stirring rod.[1] This is an extremely serious problem. The facility cannot be restarted until this problem is solved.

Also a substance referred to as "yellow

phase", which does not dissolve in glass, has been discovered. This might not turn out to be a major problem, but it is certainly not a good thing. It destroys the fundamental assumption that the glass is homogeneous.

Why then were these problems overlooked until now? First, the knowhow that has been accumulated in Japan was not put to good use. The former Power Reactor and Nuclear Fuel Development Corporation (PNC) (now Japan Atomic Energy Agency (JAEA)) constructed and operated the Tokai Reprocessing Facility in Tokai Village, Ibaraki Prefecture. The vitrification technology used at Rokkasho is based on technology developed for the Tokai facility. Many problems arose during the course of the operation of the Tokai facility and it appears that the details of these problems were not adequately communicated. Second, the organizations that designed and constructed the equipment, JNFL and IHI Corporation, bear much of the responsibility. It is said that these organizations did not pay sufficient heed to the advice of PNC. Finally, insufficient tests were carried out. Had tests been repeatedly carried out using model spent fuel during the uranium test stage (real spent fuel was not used at this stage), which preceded the active tests (which use real spent fuel), the current problems might have been avoided.

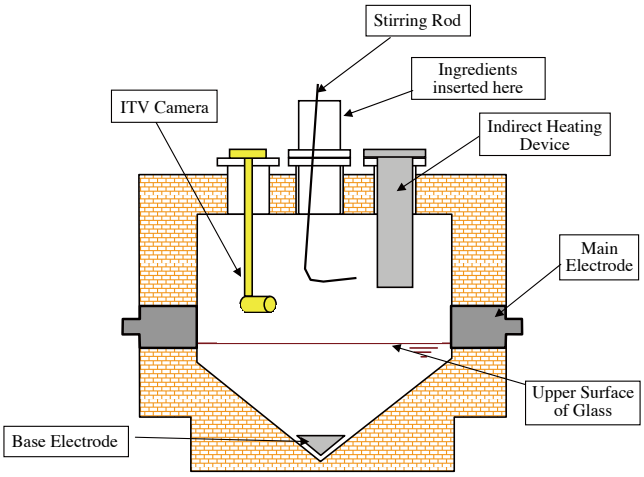
The current situation is very serious. Due to the paucity of information, there are aspects about which it is impossible to judge. However, replacing equipment that has already been contaminated with radioactive material will be no easy matter. Therefore, it can be expected that fixing the problems will take a long time.

By Emeritus Professor Michiaki Furukawa (nuclear chemist and member of CNIC Board of Directors)

1. Post Script re Stirring Rod

Vitrification tests have been attempted on three occasions: November to December 2007, for 12 hours on July 2, 2008, and October 10~18. Each time they ended in failure. The earlier tests only involved fission-product-containing high-level liquid waste and alkaline liquid waste. In October, for the first time waste liquid containing undissolved scrap was poured into the vitrification kiln. The vitrification process had not worked without the undissolved scrap, so not surprisingly, it did not work when this material was added. A rod was inserted to stir the platinum group elements that had accumulated at the bottom of the kiln, but then the rod could not be removed. A camera was inserted to see what was wrong and it was discovered that the rod was bent 90^{o} (see diagram). Of course, there is no chance that active tests will be completed in February 2009 as scheduled.

By Masako Sawai (CNIC)



Vitrification Kiln
State of Stirring Rod

Continued from page 12

TEPCO Considers Building Reactors Overseas

On December 17, in an interview with Kyodo News, Tokyo Electric Power Company President, Masataka Shimizu, expressed interest in building nuclear plants in Asia. The Kyodo report cited Vietnam and India as likely candidates. The report said that TEPCO might set up joint ventures with local utilities and that TEPCO will study the possibility of launching overseas power generation jointly with a Japanese equipment maker.

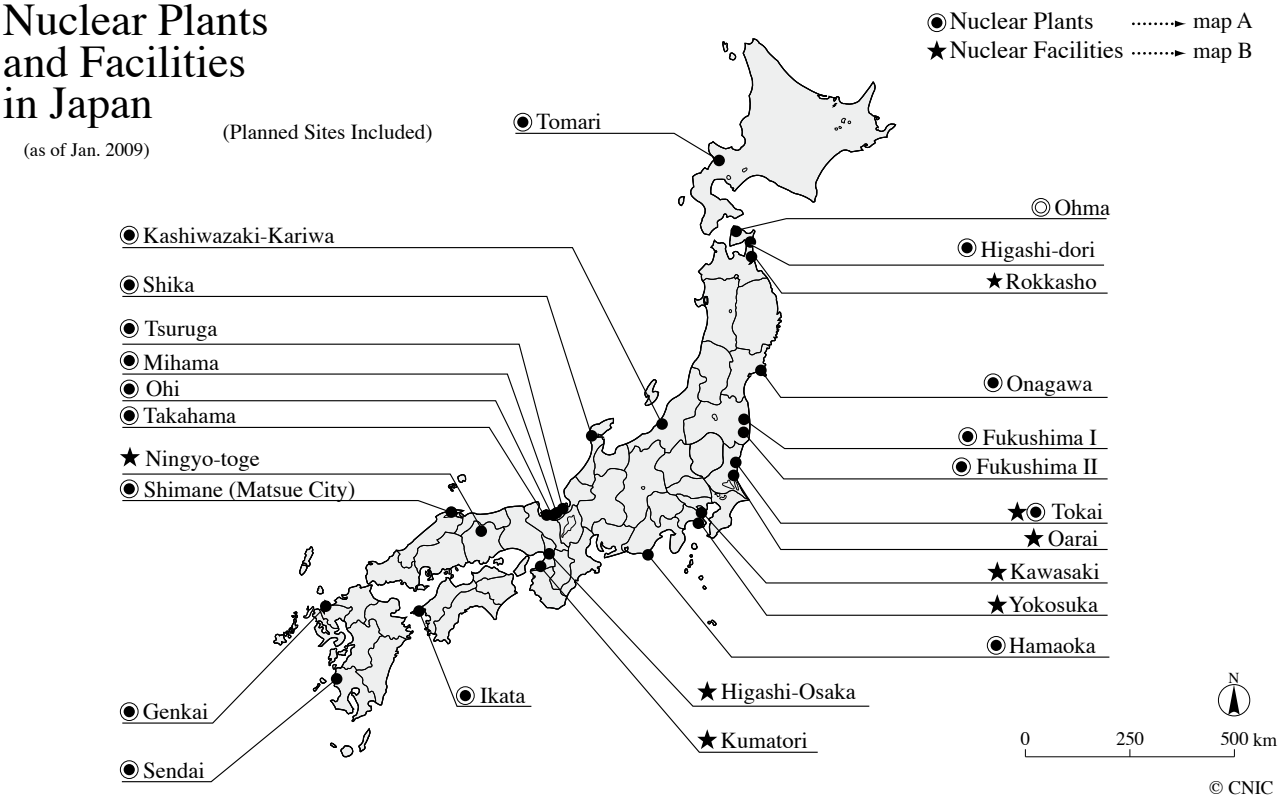
Under conditions of stagnant demand for electricity in Japan, TEPCO is looking for new sources of income. Kyodo quoted Shimizu as saying, "Tokyo Electric has accumulated considerable knowhow on the construction, maintenance and operation of nuclear power stations...Based on the assumption that it (overseas nuclear power generation) is profitable, I think we should give it a try."

Japanese power companies have participated in hydroelectric and thermal power plant projects in the past, so it is not surprising that they should contemplate nuclear projects as well, but this is the first specific mention. In the past they even had reservations about exports by Japanese plant makers, saying, they didn't want to suffer knock-on effects from accidents overseas.

Nuclear Plants and Facilities in Japan

(as of Jan. 2009)

(Planned Sites Included)



Commercial and Research Nuclear Facilities in Japan

(as of Jan. 2009)

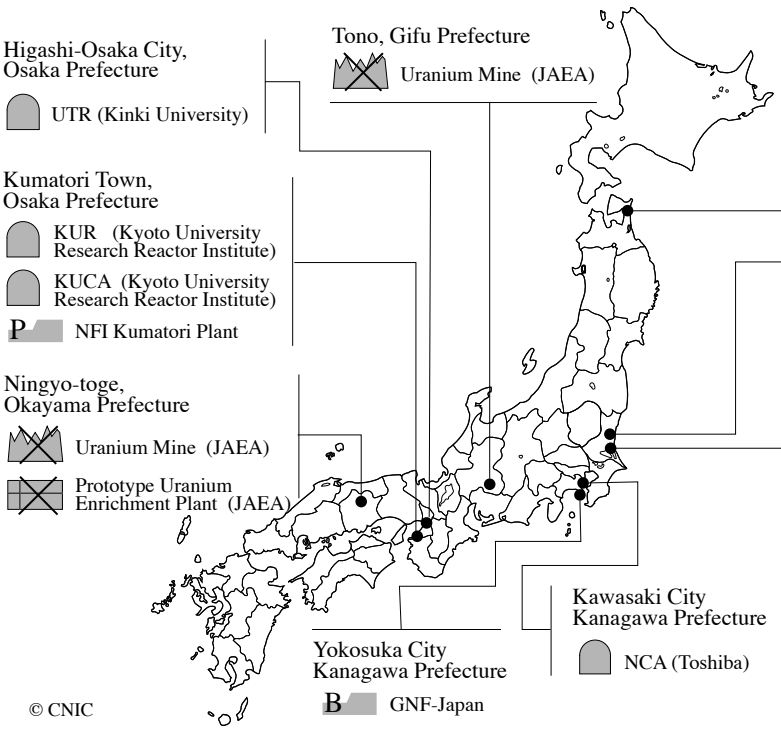
Type of Facility

- ·····Research reactor (CA = Critical Assembly)
- B ·····Uranium fuel manufacturing plant for BWR
- P ·····Uranium fuel manufacturing plant for PWR
- Mox ·····MOX fuel manufacturing plant
- ·····Uranium reconversion
- ·····Uranium enrichment plant
- ·····Reprocessing plant
- ·····Mine
- ·····Others

Status

Operable | Under construction | Permanently shut down

GNF-Japan - Global Nuclear Fuel - Japan
JAERI - Japan Atomic Energy Research Institute
JNC - Japan Nuclear Cycle Development Institute
JNFL - Japan Nuclear Fuel Ltd.
NFI - Nuclear Fuel Industry



Higashi-Osaka City, Osaka Prefecture
- UTR (Kinki University)

Tono, Gifu Prefecture
- Uranium Mine (JAEA)

Kumatori Town, Osaka Prefecture
- KUR (Kyoto University Research Reactor Institute)
- KUCA (Kyoto University Research Reactor Institute)
- P NFI Kumatori Plant

Ningyo-toge, Okayama Prefecture
- Uranium Mine (JAEA)
- Prototype Uranium Enrichment Plant (JAEA)

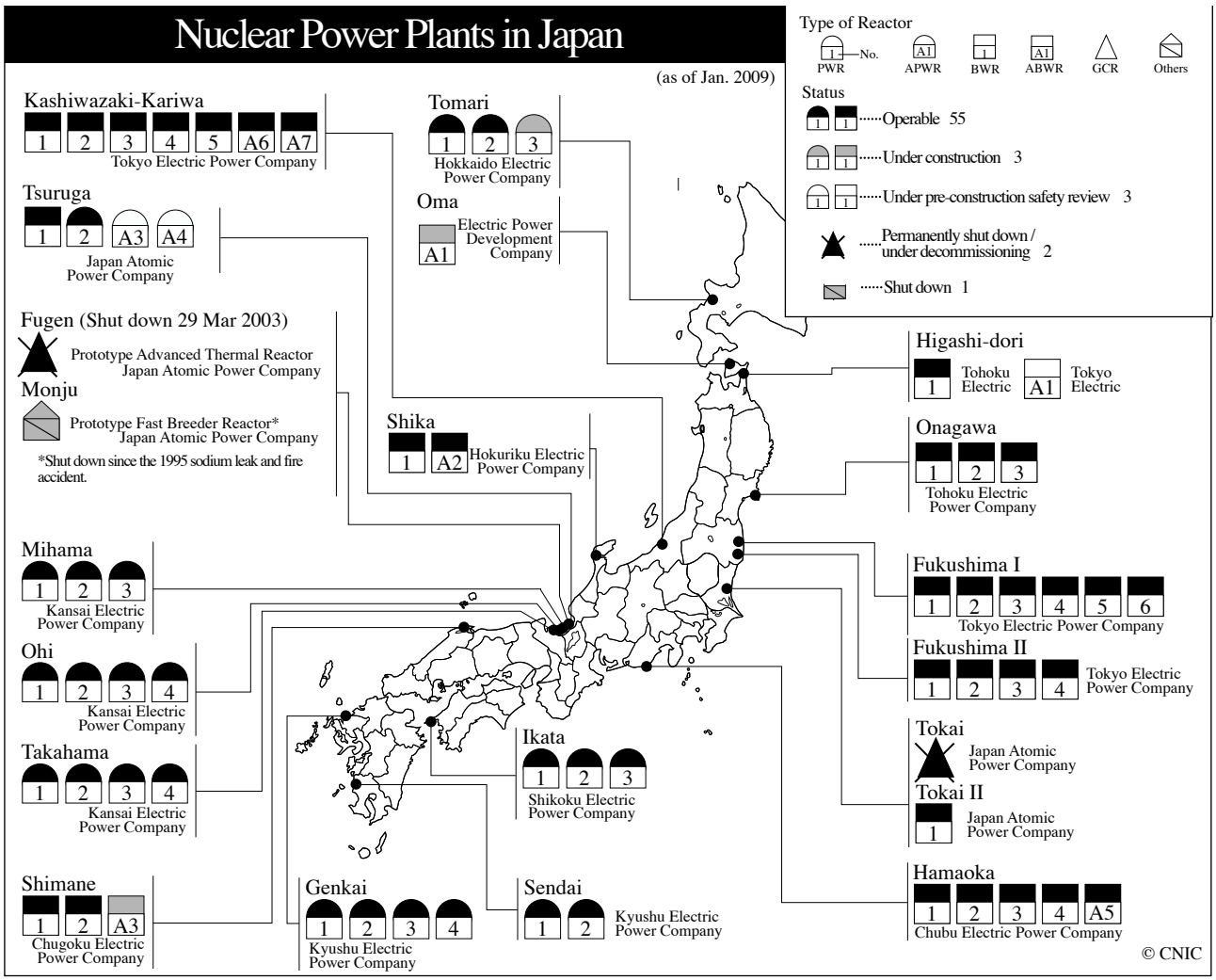
Yokosuka City Kanagawa Prefecture
- B GNF-Japan

Kawasaki City Kanagawa Prefecture
- NCA (Toshiba)

Rokkasho Village, Aomori Prefecture
- Reprocessing Plant (JNFL)
- Uranium Enrichment Plant (JNFL)
- Low-level Radioactive Waste Disposal Center (JNFL)
- High-level Radioactive Waste Storage Center (JNFL)

Tokai Village, Ibaraki Prefecture
- Mitsubishi Nuclear Fuel
- P Mitsubishi Nuclear Fuel
- JCO Tokai Plant
- B NFI Tokai Plant
- Mox Plutonium Fuel Production Facility (JAEA)
- Reprocessing Plant (JAEA)
- Vitrification Facility (JAEA)
- JRR-3 (JAEA)
- TCA (JAEA)
- JRR-4 (JAEA)
- FCA (JAEA)
- NSRR (JAEA)
- TRACY (JAEA)
- Yayoi (Tokyo University)
- STACY (JAEA)

Oarai Town, Ibaraki Prefecture
- HTTR (JAEA)
- JMTR (JAEA)
- Joyo Experimental Fast Reactor (JAEA)


Nuclear Power Plants in Japan
(as of Jan. 2009)
Type of Reactor
No.
PWR
APWR
BWR
ABWR
GCR
Others
Status
Operable 55
Under construction 3
Under pre-construction safety review 3
Permanently shut down / under decommissioning 2
Shut down 1
Kashiwazaki-Kariwa
1 2 3 4 5 A6 A7
Tokyo Electric Power Company
Tsuruga
1 2 A3 A4
Japan Atomic Power Company
Fugen (Shut down 29 Mar 2003)
Prototype Advanced Thermal Reactor
Japan Atomic Power Company
Monju
Prototype Fast Breeder Reactor*
Japan Atomic Power Company
*Shut down since the 1995 sodium leak and fire accident.
Mihama
1 2 3
Kansai Electric Power Company
Ohi
1 2 3 4
Kansai Electric Power Company
Takahama
1 2 3 4
Kansai Electric Power Company
Shimane
1 2 A3
Chugoku Electric Power Company
Tomari
1 2 3
Hokkaido Electric Power Company
Oma
A1
Electric Power Development Company
Shika
1 A2
Hokuriku Electric Power Company
Genkai
1 2 3 4
Kyushu Electric Power Company
Sendai
1 2
Kyushu Electric Power Company
Ikata
1 2 3
Shikoku Electric Power Company
Higashi-dori
1
Tohoku Electric
A1
Tokyo Electric
Onagawa
1 2 3
Tohoku Electric Power Company
Fukushima I
1 2 3 4 5 6
Tokyo Electric Power Company
Fukushima II
1 2 3 4
Tokyo Electric Power Company
Tokai
Japan Atomic Power Company
Tokai II
1
Japan Atomic Power Company
Hamaoka
1 2 3 4 A5
Chubu Electric Power Company
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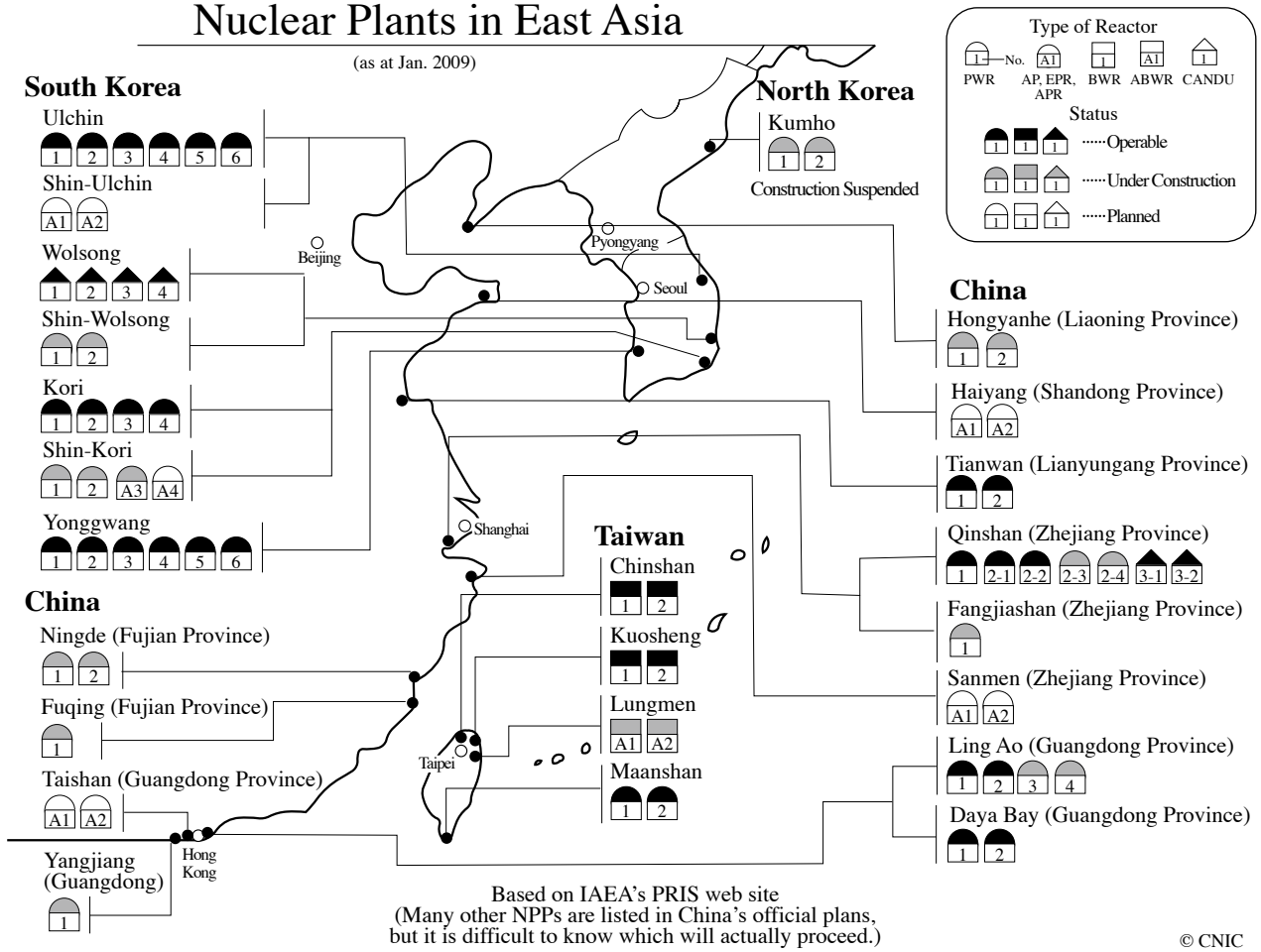

Nuclear Plants in East Asia
(as at Jan. 2009)
Type of Reactor
No.
PWR
AP, EPR, APR
BWR
ABWR
CANDU
Status
Operable
Under Construction
Planned
South Korea
Ulchin
1 2 3 4 5 6
Shin-Ulchin
A1 A2
Wolsong
1 2 3 4
Shin-Wolsong
1 2
Kori
1 2 3 4
Shin-Kori
1 2 A3 A4
Yonggwang
1 2 3 4 5 6
North Korea
Kumho
1 2
Construction Suspended
Beijing
Pyongyang
Seoul
Shanghai
Taipei
Taiwan
Chinshan
1 2
Kuosheng
1 2
Lungmen
A1 A2
Maanshan
1 2
China
Ningde (Fujian Province)
1 2
Fuqing (Fujian Province)
1
Taishan (Guangdong Province)
A1 A2
Yangjiang (Guangdong)
1
Hong Kong
China
Hongyanhe (Liaoning Province)
1 2
Haiyang (Shandong Province)
A1 A2
Tianwan (Lianyungang Province)
1 2
Qinshan (Zhejiang Province)
1 2-1 2-2 2-3 2-4 3-1 3-2
Fangjiashan (Zhejiang Province)
1
Sanmen (Zhejiang Province)
A1 A2
Ling Ao (Guangdong Province)
1 2 3 4
Daya Bay (Guangdong Province)
1 2
Based on IAEA's PRIS web site
(Many other NPPs are listed in China's official plans, but it is difficult to know which will actually proceed.)
© CNIC

The Man Whose Body was Destroyed from the Inside Out

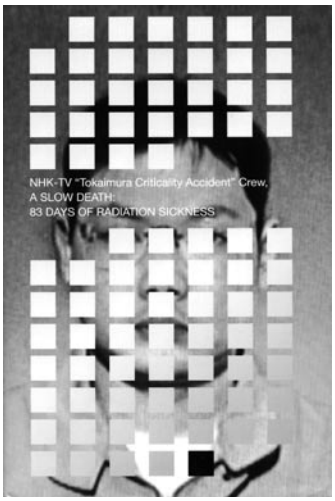
NHK (Japan Broadcasting Corporation) has produced an important contribution to the English literature on the criticality accident, which occurred at the JCO nuclear fuel processing facility in Tokaimura, about 110 km north-east of Tokyo. The September 30, 1999 accident killed two workers and destroyed the "nuclear safety myth" propagated by the Japanese government and the nuclear industry.

A Slow Death: 83 Days of Radiation Sickness is a translation of a Japanese book based on an NHK television documentary. The documentary was aired in May 2001 and subsequently won the Gold Nymph Award at the 42nd Monte Carlo Television Festival in 2001. It gives only a rudimentary account of the accident itself, choosing instead to focus on the medical treatment and slow death of one of the workers involved. Hisashi Ouchi died almost 3 months after receiving a massive radiation dose of about 20 Sieverts. The mortality rate for patients exposed to levels exceeding 8 Sieverts is considered to be 100%.

Ouchi was exposed while pouring uranyl-nitrate solution from a bucket into a tank, as instructed by his superiors, but in complete breach of approved procedures. The solution suddenly went critical, releasing a burst of neutrons that penetrated the bodies of the workers and the walls of the JCO facility itself. *A Slow Death* exposes the unpreparedness of authorities to deal with such an accident and recounts the impromptu response of a hastily cobbled together medical team to the unprecedented challenges presented by Ouchi's case.

The book will be of interest to anyone who wishes to understand the impact of radiation on the human body. The language is highly accessible to lay people, but there is also plenty of detail to fascinate medical professionals and radiation researchers. For example, a discussion about whether chromosome damage discovered in cells transplanted from Ouchi's sister was caused by the so-called "bystander effect" (p. 63-64) will provide grist for the mill for proponents of this theory.

A Slow Death provides a moving and thought-provoking presentation of the responses of Ouchi (who was able to communicate verbally for the first ten days), his family and the medical professionals who looked after him. It raises difficult questions about the wisdom and ethics of continuing to treat Ouchi for so long. Like the nurses who attended him, no doubt each reader will form different conclusions. However, for this reader it was either an appalling failure of medical decision-making processes, or a grossly inhumane case of scientific inquisitiveness. Probably it was both.



After suffering patiently for a week, Ouchi suddenly cracked. "I can't take it any more. ... I am not guinea pig". (p.52) His words shocked the physicians and nurses in charge of his treatment. Was this the time to shift the focus from cure to palliative care? Even if a case could be made for persevering a bit longer, what purpose could possibly have been served by resuscitating him on the 59th day, after his heart stopped three times for a total of 49 minutes? (p.92-95) This was a man whose chromosomes had been destroyed. "[N]one of Ouchi's chromosomes could be identified or arranged in order."(p.38) Ouchi's body was destroyed from the inside out. (p.122) It was a slow, painful and presumably unpreventable death. Surely the doctors should have been able to recognize very early that he could not be saved.

The narrative of *A Slow Death* is compelling and the translation is very readable. There are some rather strange choices of phraseology, mainly arising from excessively literal translation of Japanese expressions, but it is fluent and the medical details appear to this non-expert reader to be accurate. It is a valuable addition to the record of radiation exposure resulting from nuclear-related accidents.

Philip White (NIT Editor)

Details

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Group Introduction

Committee to Consider Pluthermal and Saga Prefecture's Next 100 Years

by Hatsumi Ishimaru*

The Genkai nuclear power station is located in the north west of the island of Kyushu on the tip of Saga Prefecture. With a population of 8,000, Genkai Town is situated in a rich natural environment facing the Japan Sea.

When Kyushu Electric Power Company submitted a request to the Prefectural government in 2004 for prior approval of its pluthermal plan, a petition was submitted by over 300,000 people from all over Japan calling for the plan to be abandoned. After Governor Furukawa declared on February 7, 2006 that the plan was safe, we set up camp outside the prefectural offices and held a parade to express our opposition. Saga Prefecture citizens collected over 20,000 signatures in just two weeks, but on March 26, 2006 the governor gave his prior consent for the plan, declaring that the public's understanding had been obtained. We immediately began a campaign for a prefectural referendum ordinance and two months later submitted 53,000 signatures (three times the two percent of voters required to demand such an ordinance) to the Prefectural Assembly.

In January 2007 an extraordinary session of the Prefectual Assembly was convened to consider the issue, but the bill for a referendum ordinance was overwhelmingly defeated by the combined forces of the Liberal Democratic Party and the New Komei Party. They said that a referendum about pluthermal would "negate the existence of the prefectural assembly" and would be "a departure from indirect democracy". They also said, "The assembly will make a carefully considered judgment. Citizens are not capable of making a comprehensive assessment of the effects of pluthermal." The governor said, "It cannot be concluded that a referendum in which prefectural residents decide directly on this important issue is necessary...Referenda are appropriate where the citizens' representatives have debated an issue but cannot reach a decision, or for issues which relate to the very existence of the prefecture, such as a proposal to change the prefecture's name. However a referendum is not appropriate for pluthermal."

Nevertheless, the referendum campaign

Collecting Signatures

achieved some things. It generated widespread public interest in the pluthermal plan. People who had carried the campaign against nuclear power for many years were joined by people who became involved for the first time due to their concerns about pluthermal. Together they formed the *Committee to Consider Pluthermal and Saga Prefecture's Next 100 Years*. Since then, the Committee has been working to inform the residents of Saga Prefecture about pluthermal, raising it as an issue for the whole prefecture.

Although Genkai-3 is scheduled to become the first nuclear power plant in Japan to implement pluthermal, many people are continuing to raise concerns about issues of safety, economics, and whether pluthermal is necessary in the first place. Another reason why people are concerned is that no decision has been made about what to do with the spent MOX fuel. Also they are concerned because Japan is a very earthquake-prone country.

We refuse to accept the implementation of pluthermal. People in Saga Prefecture and throughout Japan, generations born and unborn, will be forced without their knowledge to live in a land which is radioactively contaminated. It is the responsibility of today's adults to take action now.

They say that Genkai's pluthermal plan will be implemented in 2010, that MOX fuel has already been fabricated and that the project is going forward step by step. However, we have not given up hope and will continue to do what we can to block the plan.

**Hatsumi Ishimaru is a member of the Committee to Consider Pluthermal and Saga Prefecture's Next 100 Years.*

NEWS WATCH

Pluthermal Developments

NIT 127 reported on Japan's pluthermal plans, but there were several new developments in November and December.

On November 5, Tohoku Electric Power Company applied to Miyagi Prefecture and the local governments of Onagawa Town and neighboring Ishinomaki Town for permission to implement pluthermal at its Onagawa-2 reactor (BWR, 825 MW). The following day, without waiting for approval from the local authorities, Tohoku Electric went ahead with an application to the Minister of Economy, Trade and Industry.

On November 10, Kansai Electric Power Company (KEPCO) applied to the Minister of Economy, Trade and Industry for inspection of 16 MOX fuel assemblies to be imported for its Takahama-3&4 plants (PWR, 870 MW each). On the 21st it entered into a contract with Nuclear Fuel Industries (NFI) for an additional 32 assemblies. On the same day, NFI signed a contract for the additional assemblies to be fabricated at Areva's Melox plant in southern France. It is planned that fabrication of the previously ordered 16 assemblies, which will also be carried out at the Melox plant, will begin early this year. Initially 8 MOX assemblies each will be loaded into reactors 3 and 4. The second load will comprise 16 MOX assemblies each. The third load will also comprise 16 assemblies each, but these assemblies have not yet been ordered. When all these MOX assemblies have been loaded, about a quarter of the core will be MOX fuel.

On December 14, a committee of experts, established by Hokkaido Prefecture, Tomari Village and the three surrounding towns to look into the pluthermal plan for Tomari-3 (PWR, 912 MW), submitted its final report. The report concluded that the plan was safe and on December 19 the Tomari Village Council gave its approval.

On December 4, a consultative committee meeting was held by the four towns in Fukushima Prefecture which host nuclear power plants. The meeting agreed to consider in a positive fashion the question of whether or not to approve the implementation of pluthermal at Tokyo Electric Power Company's (TEPCO) Fukushima I-3 (BWR, 784 MW). Meanwhile, the prefectural government maintains its cautious stance. MOX fuel was delivered to Fukushima I-3 in September 1999, but the governor rescinded his approval of TEPCO's pluthermal plan in September 2002, after it was discovered that TEPCO had covered up problems at its nuclear power plants.

MOX Transports from Europe in First Half of 2009

On December 28, Kyodo News reported that it had been informed that MOX fuel fabricated at Areva's Melox plant would leave France some time during the first three months of 2009 and arrive in Japan between April and June. Fuel would be shipped for three companies as follows: 16 assemblies for Kyushu Electric's Genkai-3 (PWR, 1,180 MW), 21 assemblies for Shikoku Electric's Ikata-3 (PWR, 890 MW), and 28 assemblies for Chubu Electric's Hamaoka-4 (BWR, 1,137 MW). Fabrication of MOX assemblies for the first two companies has already been completed.

The most likely route is thought to be around South Africa. This route has been used on two previous occasions. However, it is also possible that the fuel could be shipped around South America, or through the Panama Canal. Secrecy concerning the time and route is even greater than in the past, on the grounds of protection of nuclear materials.

Sunameri Whales Appeal for Reversal of Permission to Reclaim Sea

As reported in NIT 127, on October 22, 2008 the governor of Yamaguchi Prefecture gave permission for the reclamation of an area of sea for Units 1 and 2 of Chugoku Electric's planned Kaminoseki Nuclear Power Plant (ABWR, 1,373 MW each). In response, on December 2 an appeal for reversal of the decision was submitted to the Yamaguchi District Court on behalf of six endangered species, including sunameri whales and crested murrelets (a small seabird). Wild species are said to be emblematic of the negative effects that the reclamation will have on the ecology of the region. There have been previous examples of suits taken out in support of the "rights of nature", but no case has ever been won in Japan.

Application to Build 3rd Reactor at Sendai

On January 8, Kyushu Electric Power Company officially applied for approval to build a third reactor (APWR, 1,590 MW) at its Sendai Nuclear Power Plant in Satsumasendai City, Kagoshima Prefecture. Kyushu Electric also submitted a draft environmental impact statement to the Minister of Economy, Trade and Industry. It plans to begin operations at the new plant during the 2019 fiscal year.

From the afternoon of January 7, about thirty members of civil society groups staged an all night demonstration in front of the Prefectural Offices. They pitched a tent in front of the entrance and displayed banners with slogans such as "Why Rush to Build?"

Uranium Enrichment Plant: Last Cascade Barely Functioning

On December 9, Japan Nuclear Fuel Ltd (JNFL) announced that more centrifuges in the final operating cascade of its Rokkasho Uranium Enrichment Plant would be removed from service. The plant, which commenced operation in 1992, was originally intended to have ten cascades, but only seven were installed. Each cascade has about 4,000 centrifuges and has a capacity of 150 tonSWU/year, meaning that the plant as a whole has a theoretical capacity of 1,050 tonSWU/year. However, as centrifuges aged and the speed at which they rotated fell, they were removed from service. When the number of out of service centrifuges in a cascade rose above a certain level, the whole cascade was stopped. Six of the seven cascades have already been stopped completely.

This was the second time centrifuges in the final cascade have been removed from service. Previously some centrifuges were removed from service in November 2007. The remaining capacity has not been disclosed. It is said to be "sensitive information" on non-proliferation grounds. However, based on the experience of the other cascades, it would not have been surprising if JNFL had closed down the final cascade completely.

The only reason why it is being kept operating seems to be that it would look bad if the capacity were to fall to zero before the new "advanced centrifuges" are introduced. On December 16, JNFL submitted an application to the Minister of Economy, Trade and Industry for permission to introduce the new centrifuges. The capacity of each centrifuge is claimed to be five times that of the existing centrifuges. Enrichment using these centrifuges is scheduled to begin during the 2010 fiscal year. The plan is to increase the capacity of the plant to the originally planned 1,500 tonSWU/year over the following ten years.

Areva and Mitsubishi Form New Nuclear Fuel Company

On December 22, Mitsubishi Heavy Industries Ltd. (MHI), Mitsubishi Materials Corp., Mitsubishi Corp. and Areva announced that they would establish a new nuclear fuel company. The company will integrate design, development, fabrication and sales of nuclear fuel. It will succeed Mitsubishi Nuclear Fuel Co. Ltd. (Tokai Village), which is jointly owned by MHI and Mitsubishi Materials. MHI will hold 35% of the shares in the new company, while Mitsubishi Materials Corp., Areva and Mitsubishi Corp. will hold 30%, 30% and 5% respectively. Mitsubishi Nuclear Fuel has hitherto fabricated PWR fuel for use in Japanese reactors. The new company intends to produce uranium fuel and MOX fuel for PWRs and BWRs, as well as fuel for high-temperature gas reactors for Japanese customers and to produce PWR fuel for reactors in countries other than Japan. The partners also announced their intention to invest in a new plant to produce PWR fuel for the US market.

The strengthening of links between MHI and Areva could be seen as accelerating the shift away from the situation where Japanese nuclear plant makers were located within the framework of "national policy".

Continued on page 6

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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