

# NUKE INFO TOKYO



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## Belarus-Japan Symposium on Chernobyl Many New Findings Revealed and Discussed



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A Belarus-Japan Symposium on "Acute and Late Consequences of Nuclear Catastrophes: Hiroshima-Nagasaki and Chernobyl" was held on October 3-5 at the Academy of Sciences of Belarus in Minsk, Belarus. About 200 scientists from Belarus and other CIS countries as well as 14 participants from Japan attended the symposium. It was organized jointly by Byelorussian and Japanese scientists in

Byelorussian and Japanese scientists in order to assess the ongoing consequences of the Chernobyl accident independently from the notoriously controversial 1991 IAEA study on Chernobyl, with the aid of the latest information on the health effects of radiation, particularly on the survivors of the Hiroshima and Nagasaki atomic bombings.

As there were more than 100 presentations in all, given both orally and in a poster session, it is not easy to overview the whole symposium in this brief report, and I would like to focus on just a few of what I thought were the most interesting findings with regard to the aftereffects of Chernobyl.

#### **Thyroid Anomaly**

L.N. Astaxova of the Institute of Radiation Medicine in Minsk spoke on the "Clinical and Functional Thyroid State of Children and Adolescents Exposed to Radioiodine," based on her study, carried out from 1992 to 1993, of 93 seven to 15 year-old children who lived inside the 30 km zone of the Chernobyl plant at the time of the accident and were evacuated to "uncontaminated" regions about 10 days after the accident.

The dose to the thyroid ranged from 25 to 1,876 cGy, with an average thyroid absorbed dose of 506.6 cGy. While thyroid volume was mostly normal among the control group, an increased occurrence of enlarged thyroid hypoplasia was observed in 9 children who were 0 to 3 years old at the time of the accident and in 3 who were 4 to 7 years old (13.9% of the exposed children), while there were no similar cases among the control group. Astaxova also pointed out that those who were exposed to over 500 cGy have a higher risk of developing hypothyroidism.

#### **Forest Contamination and Changes in Fauna**

Another interesting presentation was made by V. Ipatyev of the Institute of

Forestry, Gomel, on changes in the ecosystem due to radioactive contamination from the Chernobyl accident. The behavior of radionuclides in the forest is much different from that on cultivated and uncultivated agricultural land. During the initial post-accident years, the main source of forest contamination was surface contamination due to direct fallout, with 80% of Cs-137 retained in the above-ground parts of trees (leaves and tree surfaces). But then the contamination due to accumulation of Cs-137 in the woody plant tissues absorbed through the roots began to play a dominant role. There was a striking tendency for younger trees to accumulate more radionuclides than older ones because of the faster growth (hence nuclide intake) rate.

Ipatyev also pointed out that workers engaged in forestry work have been exposed to radiation levels 3 to 13 times higher than those in urban areas. The numbers of some species of forest insects have decreased, while others like beetles have increased since the accident. All in all there has been a serious disturbance of the forest ecosystem, and this should be regarded as one of the most significant adverse effects of the accident.

Closely related to the changes in the forest ecosystem, changes in the fauna were also observed. M. M. Pikulik of the Institute of Zoology, Minsk, presented his study of the fauna changes induced by radioactive contamination. Immediately after the accident, the level of contamination of animals in the evacuation zone was very high and the populations of certain mammals decreased. But after a certain period, contamination levels stabilized and, quite interestingly some kinds of mammals like wild boars, which had been commercially hunted, began to increase. Pikulik emphasized the need for a long-term fauna observation program to build up a comprehensive picture of the effect of the accident on wild animals.

### Health State of Workers in Contaminated Region

N. K. Denisevich et al. from the Byelorussian Scientific Research Institute of Working Capacity of the Disabled contributed an interesting paper to the poster session, dealing with the state of health and capacity to work of people living in highly contaminated areas. According to the study, the Chernobyl accident adversely affected the ability of people living in the highly contaminated areas to work and also seriously affected the workers who took part in the so-called "liquidation" of the destroyed plant.

Indices of primary invalidism among workmen and employees in eleven districts of Gomel region increased from 40.3 per 10,000 in 1985 to 48.3 in 1989. The index also increased for farmers (57.1 in 1989 as compared to 40.8 in 1985). This was in marked contrast to the situation in less contaminated regions where the index of primary invalidism barely changed from 44.0 in 1985 to 46.7 in 1989.

### Embryonic Disorders

G. I. Lazjuk of the Byelorussian Institute for Hereditary Diseases addressed the issue of the possible teratogenic and mutagenic effects of radiation exposure due to the Chernobyl accident. He specifically investigated the incidence of embryonic disorders after the accident as a marker for

hereditary diseases and found they had significantly increased.

The number of abortions increased sharply beginning a few months after the accident, and Lazjuk's group investigated as many as 30,000 aborted embryos. A marked increase of thyroid anomalies was observed in the aborted 6 to 10-week-old embryos of mothers whose thyroids had been intensively exposed to iodine. No significant increase was observed in embryos more than 10 weeks old.

Whereas the frequency of congenital malformation in medically aborted fetuses has not increased significantly in the two largest cities of Belarus (Minsk and Gomel), the frequency of mandatory registered congenital malformations (MRM) has increased statistically significantly since 1986 in all regions of Belarus.

The trend has been particularly noticeable in embryos, fetuses, and neonates from areas with Cs-137 contamination levels of 15 Ci/km<sup>2</sup> and higher. The observed increase in the frequency of congenital malformation in neonates considerably exceeds the incidence level predicted by the International Commission on Radiological Protection's risk estimates. It was also observed that the frequency of congenital malformation was to a small extent dependent on mothers' exposure dose levels.

Mikiko WATANABE

Table 1. Dependence of Frequency of Congenital Malformations on Mothers' Exposure Dose

Exposure Dose of Mothers in 1986-1988 (cSv)	Congenital Malformations per 1,000 Neonates (1987-1989)
0.8 - 1.3	7.02
1.4 - 2.3	8.67
2.4 - 5.2	8.14

## HLW TRANSPORT -- Series No. 6

### Expert Report Points Out Serious Flaws in Transport and Storage of Vitrified HLW

As we noted in the previous issue, a full environmental assessment of the vitrified high level waste (VHLW) sea transport must be carried out by the Japanese and French Governments before the actual transport takes place, as is required by the UN Convention on the Law of the Sea which has been in force since November 16 of this year. The Citizens' Nuclear Information Center together with WISE Paris, the Nuclear Control Institute and Greenpeace International sent an open letter on September 14 to the Japanese, French and US Governments and to the European Union asking them to perform such an assessment. Though we have received a short answer from Ms. O'leary stating that they will respond to our request in full at a later date, no response has come from the governments most responsible for the transport, Japan and France.

In view of the situation, we (CNIC, NCI and GPI) have now commissioned an independent safety study from Dr. Edwin Lyman of the Center for Energy and Environmental Studies, School of Engineering and Applied Science, Princeton University. Dr. Lyman is a physicist specializing in vitrified high level waste science.

The report, a valuable scientific contribution to this field is entitled: SAFETY ISSUES IN THE SEA TRANSPORT OF VITRIFIED HIGH-LEVEL RADIOACTIVE WASTES TO JAPAN. It was finalized and released at the beginning of December simultaneously by CNIC, NCI and GPI in Tokyo, Paris and Japan. Lyman clearly demonstrates, based on good scientific evidence and his new findings obtained in the study, that there are a number of crucial questions regarding the safety of the transport and storage of VHLW still to be resolved before the first shipment is carried out.

The following is an excerpt from his executive summary.

#### EXCERPT FROM LYMAN'S REPORT

##### Background

The first shipment of VHLW (vitrified high level waste contained in stainless steel canisters) is scheduled to depart from France in February of 1995, and will take approximately two months. The inaugural shipment is apparently intended to be a demonstration, since it will consist of only one TN28VT transport cask. But the cask will be loaded to its full capacity of 28 VHLW canisters, which contain in total 13 million curies (Ci) including 3.5 million Ci of Cs-137, a long-lived (30-year half-life), dispersable and highly hazardous radioisotope. This is equal or more than the quantity of Cs-137 released from Chernobyl.

The basic IAEA philosophy for assuring the safety of sea transport of radioactive material is to set certain standards (provided as Safety Series No.6 = SS No.6) in regard to the transport cask regardless of the contents and mode or manner of transport. This study shows that the IAEA philosophy as well as their standards are far from sufficient to guarantee the safety of sea transport of VHLWs.

##### Findings

1. The level of safety provided by the current international standards governing the sea transport of VHLW is highly uncertain.

The IAEA standards for the Type B packages like the TN28VT cask used for transport of VHLW require that the cask can withstand both "normal" and "hypothetical accident" (HA) test conditions of transport without experiencing a significant loss of containment. However, the severity of the IAEA thermal test which requires a fire duration of 30 minutes at 800°C has come in for particular criticism, because past records show that an average shipboard fire exceeds 1,100°C with a duration of nearly one day.

The issue of thermal test severity is of particular concern to the shipment of VHLW. The ability of glass to contain radionuclides rapidly deteriorates as its temperature increases from 800-1200°C. Yet there is no data the TN28VT would perform in thermal environments more extreme than the HA, and therefore no way of reliably assessing the consequences of such accidents.

## **2. The procedure for determining the maximum allowable TN28VT leak rate is obscure.**

As to the ability of the cask to contain the radionuclides, the IAEA standards specify the maximum rates at which it can emit radionuclides, after being subjected to normal or hypothetical accident conditions. However, these values were determined by using highly approximate risk assessment techniques which is hardly justified by available evidence and also based on the now-obsolete 1977 ICRP (International Commission on Radiological Protection) recommendations regarding the radiological bases which should now be replaced by the new much stricter 1990 ICRP recommendations. Therefore, the maximum emission rate defined by IAEA is itself open to question.

Furthermore, the actual permissible leak rate of the cask, which the Science and Technology Agency of Japan (STA) used for certification of the TN28VT cask, presumably derived from IAEA emission rates by using some unevidenced optimistic assumptions, is highly questionable. The STA permissible leak rate of 0.013 std cm<sup>3</sup>/s is 100,000 times larger than the engineering "leaktightness" definition adopted by the American National Standards Institute and would, according to our estimation on the assumption that only one canister developed a fracture, actually exceed the current IAEA limits of emission by a factor of 3. While this calculation is approximate, it illustrates that it is not obvious that the STA maximum leak rate provides an adequate degree of safety.

## **3. The maximum allowable storage and transport temperature are too high and appear to compromise safety.**

There are three barriers to the release of radionuclides during the transport of VHLW casks, namely, the glass matrix itself, the stainless canister and the TN28VT cask. The high temperatures allowed by the system design pose serious doubts as to the effectiveness of each of these barriers.

**Glass:** Because HLW generates large amounts of heat due to radioactive decay and glass has a low heat conductivity, internal temperatures in VHLW tend to be very high. According to the specifications of French reprocessor COGEMA, the temperature of VHLW under normal conditions is allowed to be as high as 510°C. But this provides little margin of safety against 600°C around which the glass starts to undergo undesirable changes.

At temperatures as low as 500°C, some of the radionuclides contained in the glass, most notably Cs-137 can evaporate from the surface in significant quantities. Cesium volatilized from the glass will condensate upon cooling into fine particles that could be widely dispersed. The rate of volatilization is enhanced greatly as the temperature increases and this process provides a major pathway for the release of radioactivity from the glass during accident conditions.

**Canister (stainless steel container):** The temperature of the canister would be around 440°C for a maximum glass temperature of 510°C, but this is not an adequate temperature for storage and transport, because the stainless steel material Type 309 which is used by

COGEMA to contain the glass log is susceptible within the range 425-800°C to a process known as sensitization. Sensitization causes the resistance of the material to rapidly deteriorate and in corrosive environments sensitized metals experience severe loss of strength, leading ultimately to falling apart. It can also reduce the resistance of stainless steel to fracture upon impact. A reduction in container strength would have serious consequences in the event of an accident.

Another safety issue raised by canister sensitization concerns its durability in the event that a shipping cask were lost at sea. Type 309 stainless steel is very vulnerable to a phenomenon called stress-corrosion cracking when brought into contact with chloride solutions. This process can cause rapid failure of the container at sites of high tensile stress, such as the lid weld of the canister.

**TN28VT cask:** The weakest part of the transport cask is the seal between the cask body and lid. The elastomer O rings used for the seal to prevent the escape of radioactive gases or fine glass particles can only withstand temperatures in the range -40 to 230°C. The temperature of the seals during normal transport operations could lie in the range of 150-200°C because of the high heat loading, providing a very small safety margin below the temperature at which seals fail. Therefore, exposure to "hypothetical accident" conditions could easily cause the seals to fail, leading to a significant loss of the cask's radiation containment ability.

**Consequences of an extremely severe fire:** From the above discussion, a credible scenario that could lead to the breach of all three containment barriers can be developed. Consider the exposure of the cask to a prolonged hot fire of 1,100°C flame temperature lasting for a day. The cask seal would fail within a couple of hours; a VHLW canister might rupture as the outer rim of a glass cylinder was heated through 450 to 500°C range, releasing the particulated glass into the cavity of the cask; the glass would begin to emit significant quantities of cesium vapor a few hours later, when its temperature exceeded about 800°C; after about a day, the glass temperature throughout the cask would exceed the flame temperature. We estimate, assuming a large rupture in a single VHLW canister, that for final glass temperatures of 1,000, 1,100 and 1,200°C, **the rate of emissions of radioactivity due to cesium alone would exceed the IAEA limits for accident conditions by factors of about 50, 125 and 250, respectively.**

In addition, because of the substantial internal heat generation and low thermal conductivity of the VHLW, even a fire burning at 800°C (lower than the IAEA HA condition) could heat the glass to the 1,150°C melting point in about one day.

#### **Conclusions and Recommendations**

We believe that there are enough questions regarding the safety of the sea transport of VHLW to justify a postponement of the first shipment, pending the results of further investigation. Optimally, an independent review of the VHLW storage and transport system should be undertaken, perhaps by the competent authority of one of the nations which may be affected by the shipments, a category which includes the United States. In order to facilitate this process, the industry must provide considerably more information than is already available.

- In light of the findings of this report, the review should include the following elements:
- \* The VHLW manufacturers should immediately undertake a program to determine if deterioration has occurred in canisters during storage. This should include analysis of a stainless steel container for signs of sensitization or corrosion.
  - \* High-temperature radionuclide volatilization rates from the glass should be made available so the consequences of extremely severe accidents can be more accurately characterized.
  - \* The TN28VT cask designers should make public information supporting their use of

elastomer seals and documenting their safety under HA conditions. Furthermore, even if they can show with certainty that the seal temperature would remain in the acceptable operation range after the 30-minute "hypothetical fire," they should determine the fire duration that would be likely to result in seal failure.

\* The Science and Technology Agency of Japan should make available the procedure used in setting the permissible maximum TN28VT cask leak rate, including all assumptions made and any supporting experimental data.

If the results of these studies confirm that there are problems associated with the permissible storage and transport temperatures, measures should be taken to reduce them. If there is evidence of container sensitization, the first step should be reconfiguration of the cooling arrangement in the storage facility to reduce the canister wall temperatures.

Subsequent palliative measures include aging the VHLW for longer periods before transport, reducing the concentration of HLW added to the glass, or not loading the cask to full capacity. Since only the first of these alternatives would not require increasing the number of eventual shipments, it is the most preferable one.

Changes in some of the materials used should be considered as well. For instance, a different grade of stainless steel could be employed in the VHLW container, and elastomer seals could be replaced with metal ones.

## Final Disposal Issue Highlighted in AOMORI

At the time of this writing, the Prefecture of Aomori, Rokkasho Village and JNFL (Japan Nuclear Fuel Ltd.) are about to conclude a safety agreement which is necessary for the prefectural government and village before they say "yes" to the acceptance of HLW, amid intensive concern and growing opposition among residents of Aomori. At the heart of the issue is the overwhelming concern of the residents that, if the Rokkasho Waste Management Facility (WMF) once accepts HLW from France, the site or some other place in Aomori will become the final repository for HLW, because no other prefecture is likely to accept the waste after the intermediate storage period which JNFL has promised will be "30 to 50 years."

FEPCO (Federation of Electric Power Companies), which is virtually the owner of the waste and responsible for its disposal, has repeatedly stated that vitrified HLW from Europe would be stored at Rokkasho WMF for no longer than 50 years and STA (Science and Technology Agency) officials have many times given verbal assurances that this would really be the case since it is basic government policy. But the local people are not satisfied with this response and the Governor of Aomori, Masaya Kitamura was forced to promise before the Prefectural Assembly that he would get a written assurance from STA head Makiko Tanaka that the HLW would be carried out of the WMF after the intermediate storage term of 30-50 years and no place in Aomori would ever be used as the final disposal site.

Kitamura officially sent a letter of inquiry to STA asking for such an assurance on Nov. 16 and received a reply from Minister Tanaka on Nov. 19. As expected, the answer was written in the "deliberately ambiguous" style typical of Japanese bureaucrats. It can be summarized as follows.

1. STA confirms that the Rokkasho WMF is an intermediate storage facility for the vitrified high level waste (VHLW) and will not serve as the final repository. STA will guide the company to carry the VHLW out of the facility after the end of the storage period which is expected to be 30 to 50 years.

2. STA will take the necessary steps in cooperation with the related bodies to promote an adequate and sure final disposal of HLW along the lines described in the Long Term Nuclear Energy Program.

3. The final disposal site should be decided with the approval of the local (prefectural and regional) communities. In view of the present situation that Aomori prefecture is against the prefecture being selected as the final storage site, STA confirms that Aomori will not be the site for the final disposal.

This actually says nothing beyond what is stated in current government policy and does not respond directly to what the local people really want to know, that is, whether the government will be able to find any other site for the HLW after the termination of intermediate storage at Rokkasho. Under the present situation, the HLW would remain stored at the Rokkasho WMF indefinitely under the name of "temporary storage." The majority of Aomori residents were apparently disappointed at Tanaka's statement and are now angry with governor Kitamura because he appears satisfied with Tanaka's answer and is willing to conclude the safety agreement.

On Nov. 21 local antinuclear activists handed a petition with the signatures of 532 Rokkasho villagers to the village council, demanding a local referendum on whether to accept the VHLW. The number of signatures is far greater than the 2% of the total number of voters (some 170) needed to validate the petition. The village council now has to decide whether the referendum will be carried out or not. While it is highly unlikely that the village council will vote in favor of the referendum being carried out, judging from the opinions of the present members of the council, the very fact that antinuclear activists were able to collect as many as 532 signatures in a nuclear industry-ruled small village in just two weeks shows the high degree of concern among the village people.

In parallel with the movement inside the village, activists all over the prefecture including people from citizens' movements, trade unions and farmers' organizations have decided to start a joint signature collecting campaign. They intend to collect as many as 500,000 signatures from the prefecture in about a month and hand the petition to the prefectural assembly demanding that it enact an ordinance stating that, unless necessary steps are taken to confirm the safety of the VHLW and to finally dispose of it safely outside of Aomori prefecture, the Governor of Aomori should refuse to accept any HLW. JNFL should make available all information requested by the residents of Aomori concerning the Rokkasho Nuclear Fuel Cycle Facilities.

So far the signature collecting campaign has got off to a good start, showing that the residents of Aomori are far from being satisfied with Tanaka's ambiguous assurances. Despite this rapid growth in the opposition, however, the governor of Aomori, the mayor of Rokkasho and JNFL will likely sign the safety agreement before this NIT issue goes to press, in order to enable the first shipment to take place as scheduled.

But this kind of high-handed enforcement - a trick often used by Kitamura in the past - is going to land him in serious difficulties this time, because his term of office expires in February 1995 and an election is to be held on Feb. 5, just before the VHLW carrier leaves France. Although he will stand as candidate again, another pro-nuclear conservative is also expected to run for governor, and if the anti-nuke camp can put up a good united candidate, there is a significant possibility they will be able to win the election and scrap at least the Rokkasho HLW and reprocessing projects. Citizens, trade unionists and farmers are now coordinating their efforts to decide on a united candidate in time for the election.



# NEWS WATCH

## A-Bomb Redress Bill Drafted

A draft bill to redress Japan's atomic bomb victims was sent to the Diet by the ruling coalition government, after 20 years of discussion, on November 22. The bill is expected to be debated and passed during the current session.

A-bomb victims (called Hibakushas) have long been demanding an admission by the state that it was responsible for starting the war, which was the direct cause of the bombings, and also to demonstrate Japan's commitment to peace in the future and its determination not to become a nuclear power.

However, due to the confrontational stances of the Social Democratic Party of Japan and the Liberal Democratic Party, which together form the ruling coalition government, "government responsibility" has been interpreted merely as the duty of the government to provide the A-bomb victims with welfare handouts, as with the victims of past tragedy.

The Hibakushas are not basically asking for money, or any other form of government assistance. What they are demanding is an 'apology' to the victims, an acknowledgement by the state that it was responsible for starting the war and incurring the atomic bombings, and a pledge by the government that such a tragedy will never occur again. This is the basic principle behind the victims' demands and unless responsibility is defined in this way the bill will lose all its meaning.

Furthermore, in order to avoid compensating other war victims, such as those who died in the conventional bombings of

Tokyo, Okinawa, etc., the SDPJ has yielded to the LDP's condition that compensation should be limited to individuals who are themselves A-bomb victims. This would mean that where an A-bomb victim was married to a non-victim and subsequently died, none of the family could receive compensation. In many cases, small children who had been evacuated from the cities were lucky enough to escape the bombing but their parents became A-bomb victims and died later. These people would not be eligible for compensation either.

There has been an immediate and sharp reaction from the bomb survivors. "We are demanding an admission of responsibility by the government because we want Japan to resolve that there will never again be 'hibakusha'." "The bill does not make sufficient reference to Japan's responsibility in World War II." "Since the draft does not fully reflect our desire for all the victims to rest in peace, I cannot say this is what Hiroshima had hoped for," were some of the comments on the bill.

The Hiroshima chapter of the SDPJ demanded that the government hold an inquiry to listen to the Hibakushas' point of view. The Hiroshima branch of the Japan Congress Against H and A-bombs (Gen-suikin) submitted a criticism of the government's draft on November 21, and held an impeachment rally together with various labour unions the following day.

## Fukui Governor Fails to Say OK 16th Reactor

The governor of Fukui Prefecture, Mr. Kurita, announced on October 21 that the Prefecture would not give permission for the environmental study for Tsuruga 3 and

4 reactors, which the Japan Atomic Power Co. is planning to build in Tsuruga City, Fukui Prefecture. If JAPCO still wished to carry out the study then they could do so on their own. Even if they completed the study, however, the Prefecture wouldn't agree to the construction plan, so it might not be of any use. This kind of announcement is quite unusual in Japan.

What usually happens at a proposed site is that the Prefectural government gives permission for the study and then accepts the construction plan. There has not been a single case where construction has been disallowed after a study has been done.

The Prefectural Assembly passed a resolution last December promoting the construction of these reactors. The governor's announcement contradicts this resolution and yet he says, "I am considering various opinions not only from the Prefectural Assembly, but also the local and neighboring assemblies, and petitions against the reactors, and I will make a comprehensive decision."

There are already 15 reactors in operation in Fukui and the opposition against further construction is getting stronger. The mayors of neighboring local communities are all against the new reactors and 150,000 signatures have recently been submitted to the governor. The governor himself has said "nuclear power

hasn't contributed anything to local prosperity."

## Monju Testing Shows Fuel Deterioration

It was recently revealed that the in-core fuel of Monju, the fast-breeder reactor (power output 280MW) now under trial operation at zero power, has seriously deteriorated.

According to the Power-Reactor and Nuclear Fuel Development Corporation (PNC), one of the fissile components of plutonium, Pu-241, whose half-life is only 14 years, decayed more than initially designed, due to the delay in the start of operation caused by a series of troubles in the fuel fabrication process.

PNC says that the reactor was designed to operate for 123 days at full output, but will only be able to run for about 75 days. However, since 70 days are scheduled for power-raising testing next year, there is no need to change the fuel until the tests are over, said PNC.

PNC's explanation is, however, open to question, since the discrepancy is far greater than can be attributed simply to the decay of Pu-241. It may be that the confusion in the fuel fabrication process might have caused some unexpected defects in the burning characteristics of the fuel.

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