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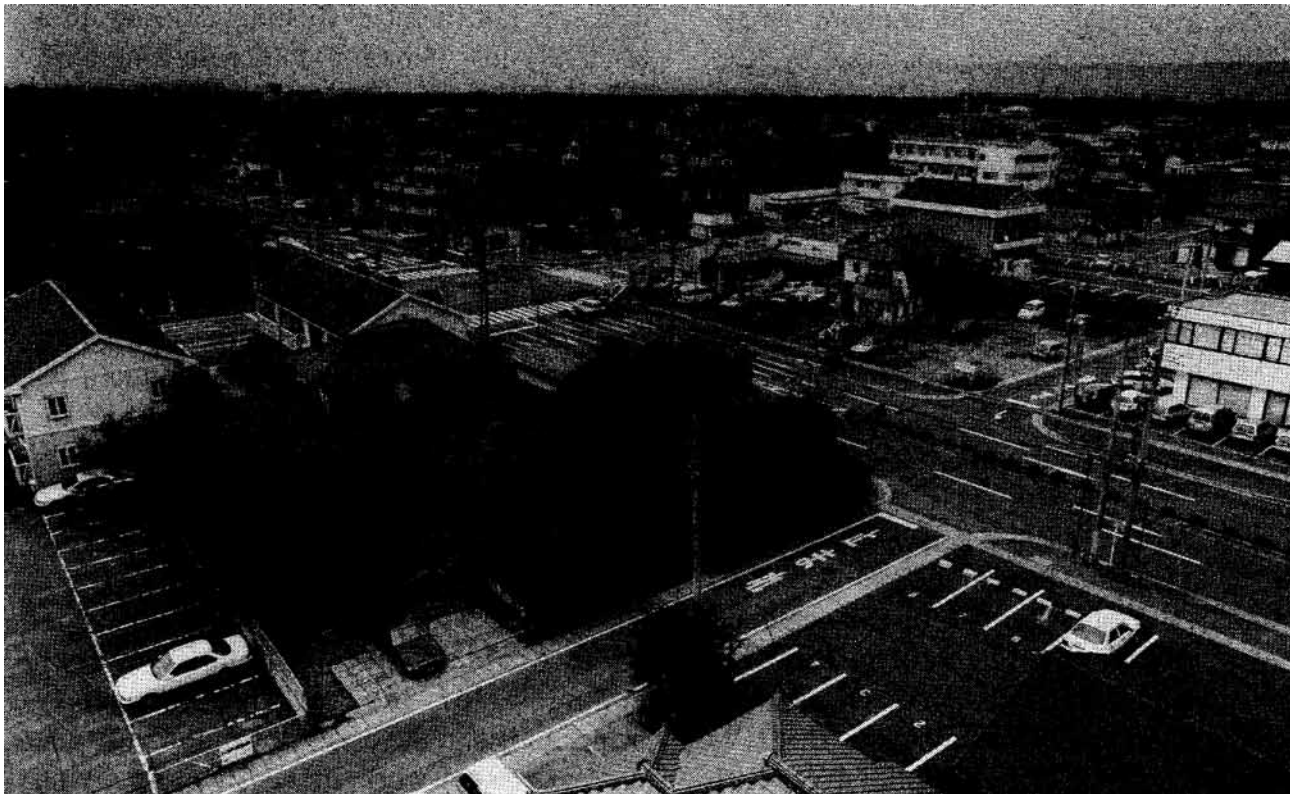
JCO Criticality Accident: How Many Lessons Will It Take?



The village center of Tokai-mura; a ghost town at 2:00 p.m. on OCTOBER 1st. (PHOTO BY KENJI HIGUCHI)

Rushed Interim Report Plays Down the Accident

The Interim Report

On November 4th, the Science and Technology Agency (STA) released data on the estimated scale of the September 30th accident at the JCO Tokai plant. The STA also announced the estimated radiation dose

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received by the local residents, based on this data. The following day an interim report with urgent suggestions reflecting those results was presented at the fifth meeting of the Uranium Conversion Facility Plant Criticality Accident Investigation Committee of the Nuclear Safety Commission (NSC).

The STA has asserted that about 1mg of uranium fissioned in the criticality accident. This amount is extremely close to the amount provisionally calculated by CNIC on the basis of data gathered before November 3rd by the Japan Atomic Energy Research Institute from analysis of the uranium sample collected from the precipitation basin by JCO employees on October 20th. However, when the sample was collected, the equipment set up to stir the contents of the precipitation tank failed to operate, and the sample was taken without the contents of the solution being stirred uniformly. Thus the sample represents only the top layer of the solution. CNIC is critical of the way this sample was collected, and there is a possibility that a higher amount of uranium underwent fission.

The STA also released results of tentative "theoretical" estimation on the exposure level of the area around the site of the accident. These results revealed that by the time criticality stopped at 6:15 a.m on October 1st, at a point 80 meters away from the JCO plant, where the closest public street lies, radiation would have been 160 times higher than the annual exposure dose limit of 1mSv for the general public. The radiation would have been 13 times higher than the annual exposure limit 200 meters away from the site, and over two times higher 350 meters away where evacuation was advised. It must be pointed out that this comparison is based on the annual dose limit, and residents and employees were exposed to amounts between two and 160 times the annual limit in a matter of hours. We assume that a considerable number of residents were exposed to radiation levels close to these figures by remaining too long around the site, or failing to evacuate at an earlier stage.

STA's Claims on Possibility of Cancer

The STA asserts that exposure under 200mSv will not result in cancer; however, nothing can be further from the truth. This assertion was based on exposure data from Hiroshima and Nagasaki A-bomb victims, yet in 1999 the International Commission on Radiological Protection made it clear that this data was not fit for evaluating exposure to a relatively low radiation dose with long-term effects. When exposed to radiation, varying health effects are seen according to the exposure dose. The possibility of contracting cancer increases in accordance with the exposure dose. However, even with a relatively low dose, an exposure to radiation will increase the possibility of contracting cancer no matter how small the amount is. There is a possibility that there will be adverse health effects for the local residents in the future, and these people must have a guarantee of sufficient aftercare over an extensive period.

The Accident Investigation Committee appealed for the revision of safety inspections and the establishment of safety at nuclear-related work sites. Upon receiving this request, the NSC began on November 11th the revision of the Safety Review Standards regarding nuclear fuel facilities. There is a need for an independent critical analysis of this accident. Thus CNIC is preparing to set up a Committee for Comprehensive Social Impact Assessment of the JCO Criticality Accident. Various aspects of the accident will be evaluated and a final report will be put out.

(By Chihiro Kamisawa)

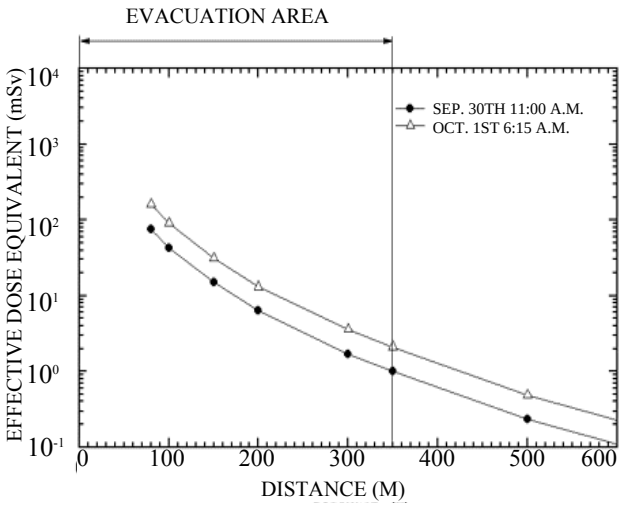
The Effects of Released Neutrons and Radioactive Materials

Effects Due to Neutron Release

On October 20th, the Japan Atomic Energy Research Institute (JAERI) staff collected a sample from the uranium solution left in the precipitation tank after the accident (see previous article). According to the results from the analysis of the sample, the total number of fissions was estimated as 2.5x10E+18, which corresponds to the fission of about 1mg of uranium 235. The number of fissions from 1g of uranium was estimated as 1.44~1.55x10E+14, and the amount of uranium solution put into the precipitation tank was estimated as 16.6kg.

The Science and Technology Agency (STA) mapped a graph based on the above analytical data and the measurement data of neutrons and gamma rays from the area monitoring posts (Figure 1). This is a total effective dose equivalent for the exposure of a person at a certain time and area who remained there without shielding. The results show that residents living within a 350m radius of the JCO plant were exposed to neutron dose of over 1mSv immediately after the accident. The radiation dose limit for the general public is 1mSv per year. Thus in just a matter of hours following the accident, the residents were exposed to an amount exceeding the dose limit for a year. This result has also confirmed our assertion that the evacuation area of 350m radius was set too small. In addition, this result is only an estimation based on uncertain assumprions, and the actual rate of exposure could well be higher.

[Figure 1]



There is no reliable data available of the radiation dose at the site of the accident. On the basis of past incidents, however, it is thought that the radiation level rises rapidly when one approaches the spot. The employees who extracted the coolant water 16 hours after the accident were thus forced to work under radiation level as high as about 2Sv per hour.

Fission reaction consists of an intial burst and a prolonged plateau due to delayed criticality. Based on the estimation of the National Institute of Radiological Sciences (NIRS) that the three employees at the site of the accident were each exposed to a radiation dose of about 17, 10, and 3Sv, it can be assumed that an extreme amount of neutrons were released at the time of the initial burst. On the other hand, a neutron dose rate of 6.3 μSv/h was measured immediately after the

accident at a monitoring post of JAERI located about 1.7km from the JCO plant. In addition, sodium 24 was found at an elementary school 3km away from the plant. It has been calculated from the analysis of the uranium solution sample that the total effective dose equivalent received by a person 1.5km away from the site was 0.22μSv on September 30th at 11:00, and 0.45μSv on October 1st at 6:15. A significant level of gamma ray was released as well. Around 11:00 on the day of the initial burst, 0.84mSv of gamma ray was measured at a monitoring post 110m away from the site of the accident. The measured gamma ray most likely resulted directly from the criticality and was released into the environment. Furthermore, even an hour after the accident, the dose of gamma ray rose for about 20 minutes at a facility 7km west of the JCO plant. Such rises of gamma radiation were measured at a total of 38 monitoring posts. It can be assumed that gamma rays measured further away from the JCO plant were released from fission products released into the environment during criticality.

The release of radioactive materials

Many radioactive materials were produced from the neutrons released into the environment. Sodium 24, which was often talked about during this accident, is produced when a neutron hits sodium 23, itself a stable material naturally existing in the environment. Sodium 24 has a half-life of 15 hours and releases beta-ray and two gamma rays as it disintegrates. As a result it becomes stable again fairly quickly. Sodium 24 was also found in the vomit of one or two of the three employees directly connected to the accident. Furthermore, it was detected in nearby soil samples and in salt left in a nearby house. Activated gold, copper, and manganese were found as well. In addition, massive amounts of rare gases such as krypton and xenon were produced due to fission. It was learned later that nuclides such as strontium 91 and cesium 138 were detected, respectively, as decay products of krypton 91 with a half-life of 9.5 hours, and xenon 138 with a half-life of 32 minutes. It can be assumed that a massive cloud of highly concentrated radioactive rare gas was released at the time of the accident since cesium 138 was measured even a couple hours after the accident despite its short halflife, and an amount close to the concentration limit within the atmosphere was measured. In addition, radioactive iodine (iodine 131 and 133, with half-lives of 8 days and 20.8 hours respectively) were found from soil samples from various places several days after the accident. Iodine 131 will accumulate in the thyroid gland and cause internal exposure when inhaled or when consumed by eating contaminated vegetables. It was belatedly found out on October 11th that such iodine was being released into the atmosphere through a ventilating system that had been left on after the accident until that day. Radioactive nuclides were found from 108 of the mere 138 cases of soil sampling conducted by the government. In addition, nuclides were found on vegetables and wild vegetation as well. Only 17 samples of drinking water and 31 of well water were examined, yet the Nuclear Safety Commission (NSC) put out a "safety declaration" at a very early stage of the accident.

Widespread contamination by nuclear materials was prevented since the velocity of the wind had been low and it had rained shortly after the accident, conversely exposing local residents to higher levels of radiation. However, the spread of radioactive materials cannot be predicted only on the basis of limited information derived from meteorological conditions. For instance,

gamma-ray thought to be emitted from released fission products was measured even at a point 7km west of the JCO plant.

The total number of fissions estimated from the uranium solution sample was 2.5x10E+18, as mentioned earlier. This number nearly corresponds with the calculation done shortly after the accident by CNIC. Taking all these facts into consideration, above all when we think of the seriousness of the neutron exposure level outside the plant boundary, CNIC firmly believes that the accident belongs to level 5 of the International Nuclear Event Scale.

Because the JCO plant did not have any counter-measures in the event of criticality, this accident brought about radiation exposure from a continuous release of neutrons into the atmospher, and from a large amount of fission products which escaped out of the conversion plant even after the evacuation order was called off. The government's poor safety control and accident management brought about serious damage, and the cost was paid by the local residents. (By Tadahiro Katsuta)

Absorbed Dose: Energy absorbed by materials from ionizing radiation. Expressed in SI units Gy or JkgE-1.

Bequarel (Bq): SI unit of radiation equal to one disintegration of a radionuclide atom per second.

gray (Gy): The SI unit for rads. 1 Gy equals 100 rads.

Neutron: An uncharged elementary particle found in the nucleus of every atom except hydrogen. Solitary mobile neutrons travelling at various speeds originate from fission reactions. Slow neutrons can in turn readily cause fission in the atoms of some isotopes, e.g., U-235, and fast neutrons can readily cause fission in atoms of others, e.g., Pu-239. Sometimes atomic nuclei simply capture neutrons.

rads: A unit to measure the absorption of radiation by the body. A rad is equivalent to 100 ergs (unit of work or energy in the C.G.C. system) of energy from ionising radiation absorbed per gram of soft tissue.

Sievert (Sv): SI unit indicating the biological damage caused by radiation. One Joule (J) of beta or gamma radiation absorbed per kilogram of tissue has 1 Sv of biological effect; 1 J/kg of alpha radiation has 20 Sv effect and 1 J/ky of neutrons has 10 Sv effect. 1 Sv equals 100 rem (another unit of dose equivalent).

SI units: A component of the International System of Units. It consists of seven standard units (Bq etc.), two sub-units, and combined units created by various combinations of these units.

Release All Data on Exposure Doses As Soon As Possible

The Science and Technology Agency (STA) originally stated that 49 people had been exposed in the accident at Tokaimura, but it was announced at the second Uranium Conversion Plant Accident Investigation Committee of the Nuclear Safety Commission that the number was now 69--i.e. 59 JCO workers who were at the plant at the time of the accident, (including the three seriously exposed), three ambulance workers who attended at the scene of the accident, and seven people who happened to be nearby. The Committee said that it based these figures on inspections of the film badges worn by workers at the site. However, the actual number of people exposed is unlikely to be as low as the figures suggest.

The publicised figures do not include 18 workers who carried out the extraction of coolant water from around the precipitation tank to stop the criticality condition, or the workers who were engaged in mounting

aluminum-filled bags around the conversion test plant to shield radiation. Since these workers knew that they would be exposed, they are considered as 'planned exposure workers', and are therefore not included in the count--an odd form of calculation, to say the least. Surely all information relating to exposure in this accident should be made public as soon as possible.

The three workers who were seriously exposed are estimated to have been subjected to between 3 and 17 Sv of radiation, and two of them were actually exposed to a lethal dose. Quite a few exposed workers, including those three, were not even wearing the required film badges (integrating dosimeters for gamma ray measurement) for workers dealing with radiation. This is just one instance of the kind of irresponsibility revealed in this case.

Only a limited number of people were examined for exposure to gamma radiation or internal contamination through inhaling radioactive substances. Thus the exposure doses were measured by the following methods; calculate exposure dose from changes in the number of lymphocytes, calculate the amount of sodium 24 in the blood, check for change in chromosome, speculate on the exposure dose from the sodium 24 count measured by the whole body count (WBC), and so on. If you are exposed to neutron radiation, sodium 23 in the body was irradiated and becomes radioactive sodium 24. Then gamma radiation counts from sodium 24 can be counted by a WBC. However, the half-life of sodium 24 is only 15 hours, so the measurement has to be done right away before sodium 24 ceases to exist.

At the time of the accident there were 124 workers within the JCO property. Even the workers without film badges could have been checked for sodium 24 if they had been given a WBC sooner. The same may be said for residents living in the area of the plant. The only way to estimate the amount of radiation to which these people were exposed is to check the dosimeters worn by the "planned exposure" workers. The ratio of neutron and gamma radiation contributions to dose equivalent was regarded as about 10 to 1. The National Institute of Radiological Science, which examined the three seriously exposed workers, estimates that 85% of the exposure was due to neutron and 15% due to gamma radiation.

According to the measurements (absorbed dose) of 44 people, including JCO workers on site by WBC, out of 18 workers who carried out the extraction of coolant water, the highest doses were found in two workers who took pictures of the coolant valve. During this three-minute task, one of them was exposed to about 120mSv (neutron and gamma) and the other to 98mSv. This means that the first person had more than 100mSv, the maximum permissible dose at the time of emergency. Another five workers had 74 to 56mSv and four others had more than 40mSv.

The estimated exposure dose of the people other than those "planned exposure" workers is only given in the absorbed dose (Gy), a measurement unit that shows the amount of energy absorbed in exposure to neutron and gamma radiation. Proper calculations should be made so that the effects on the human body are clear. Neutron and gamma radiation counts should be made separately and be given by the unit of Sv. Exposure dose becomes more and more ambiguous as time goes by, and thus accurate data on exposure doses should be released as soon as possible.

(by Mikiko Watanabe)

The History of JCO Ltd.

The JCO plant where the criticality accident occurred began operation in 1973 as a Tokai factory in the nuclear fuel division of Sumitomo Metal Mining Co. In 1979 it became Sumitomo's affiliate, Nuclear Fuel Conversion Co., retaining its facilities, workers, and technology. As the demand for nuclear fuel increased, operation expanded, especially at the second fabrication building. The plant changed its name to JCO last year.

JCO had been reconverting uranium hexafluoride to uranium oxide to be used to fabricate nuclear fuel in boiling water reactors (BWRs) and pressurized water reactors (PWRs). Japan Nuclear Fuel (JNF) have been fabricating fuel and manufacturing fuel assemblies for BWRs and Nuclear Fuel Industry (NFI) have been fabricating fuel and manufacturing fuel assemblies for BWRs and PWRs. Mitsubishi Nuclear Fuel Co. (MNF) reconverts and fabricates fuel and manufactures fuel assemblies for PWRs. The annual demand for uranium conversion is about 1,000 tons. JOC and MNF share this market, JCO producing 718 tons annually and MNF 475 tons. However, the demand for the JCO material has decreased sharply in the last several years. JNF, together with GE of the United States, operates a reconversion factory in the States, and NFI also imports uranium dioxide powder directly from an American company. Both Japanese companies now depend more on the cheaper uranium powder from abroad and have reduced their orders to JCO by half.

These developments occurred at a time of severe pressure from the utility companies to lower the cost of nuclear fuel due to the changes brought about by the Electric Utility Industry Law of 1995, accompanied by severe competition from foreign manufacturers armed with cheap nuclear fuel. More recently, Japanese nuclear fuel manufacturers have set up business partnerships with American manufacturers and have been seeking cooperative production not only on reconversion but on all other fuel manufacturing processes. Now the fuel assembly itself has begun to be imported from the States.

According to the paper submitted to the "Investigation Committee," JCO has reduced its uranium production to between 350 and 360 tons, compared with 500 tons at the peak time in 1993. Sales are also down from 3.3 billion yen to 1.7 billion yen. As a result, in 1996 JCO started to make drastic cuts in the numbers of its workers. The number of production division workers has been cut from 38 to 68, a reduction of 56%. What is more, JCO was planning to abandon the current wet conversion technique (ADU), which produces large amounts of liquid waste, and made a contract with British Nuclear Fuel plc that would lead to the introduction of the dry reconversion method (IDR). JCO had planned to invest several billion yen in a new plant installed with equipment for IDR, and the company submitted a request in May this year to make changes to its installation.

This drastic cost-saving effort in the low-enriched uranium processing also affected the conversion test plant. The conversion test plant is hardly used except for the production of fuel for the Joyo Experimental Test Breeder Reactor once every five years or so. As a matter of fact, it was not in operation at all between June 1998 and early September this year. Five workers, including three who were working at the time of the accident, are called the "special crew," and when the conversion test plant is not in operation they are usually in the second fabrication plant, doing reconversion work, handling solid waste disposal, and so on. Consequently, these employees (apart from the deputy-head worker) were conducting the operation which led to the accident for the first time, and without any training on criticality control. They considered this task as extra work, something to be dealt with quickly. This is how the "safe, low-cost" nuclear power industry is being operated in Japan.

(By Masako Sawai)

Anti-Nuke Groups Take KEPCO to Court Over MOX Data Falsification

Pluthermal Program

The pluthermal program, designed to use plutonium uranium mixed oxide (MOX) fuel in Japanese commercial nuclear power plants, is the Japanese government's trump card for reducing surplus plutonium now that the fast breeder program has come to a de facto standstill due to the December 1995 sodium leak and fire accident at Japan's prototype fast breeder reactor, Monju. The goal of the current pluthermal program is to have 16 - 18 reactors burning MOX fuel by the year 2010. Recently, however, the initiation of the pluthermal program has been set back several months due to a series of data falsification scandals. Falsification of MOX and spent fuel transport cask neutron shielding data delayed the first shipment of MOX from Europe to Japan for several months, and then another scandal broke out during the first shipment of MOX cargo due to British Nuclear Fuels plc (BNFL)'s fabrication of pellet diameter quality control data on MOX fuel being prepared for the Takahama Unit 3 nuclear reactor.

MOX at Takahama

The first commercial reactor scheduled to use MOX fuel is the Takahama Unit 4 reactor in Fukui Prefecture. Although the prefectural and local governments have already officially approved the pluthermal plan, citizens in the town of Takahama are gathering signatures to try to force a referendum on the issue. If they get signatures from more than 1/50th of the town's registered voters, they can present the signatures to the Mayor, who will then have to write an opinion on the pluthermal program and submit it, along with the signatures to the town council. Based on the number of signatures, and the opinion given by the Mayor, the council members will then vote on whether or not to hold a referendum on the issue. The citizens have until the 29th of November to gather signatures, and the vote by council members is expected to take place in early December.

On the 19th of November, the introduction of MOX fuel into the Takahama Unit 4 reactor met yet another hurdle; this time in the form of a lawsuit by 212 citizens from the Kansai region who are claiming that pellet measurement data for the Unit 4 MOX fuel has also been falsified, and that the loading of the fuel should be prohibited.

Fabrication of MOX Fuel Quality Control Data

On 14th of September, two weeks before the MOX fuel for Takahama Unit 4 was set to arrive in Japan, the British newspaper *The Independent* ran an article disclosing that pellet measurement data for Takahama Unit 3 MOX fuel, which was still under production at the BNFL's plant in Sellafield, England, had been falsified. The scandal was a big political blow for Kansai Electric Power Company (KEPCO), and the company immediately sent officials to BNFL to investigate BNFL's quality control data for Takahama Unit 4 and Unit 3 fuel and the extent of data falsification.

In spite of the fact that BNFL knew about the

falsification for more than two weeks before they contacted Mitsubishi Heavy Industries, the contractor for KEPCO, BNFL had found only 11 lots of fuel falsified, whereas the actual number of lots found to have falsified data was increased to 22 within days of KEPCO sending officials to BNFL to investigate.

Prior to the arrival of Takahama Unit 4 fuel at the Takahama Nuclear Power Plant site, KEPCO rushed to prepare an interim report on the extent of the falsification for Takahama Unit 3 fuel. As part of the interim report KEPCO came to the conclusion that there was no problem with the safety of Takahama Unit 4 fuel.

Quality Control of MOX Fuel

Because MOX fuel pellets are more difficult to fabricate than uranium pellets, an automatic diameter size check is carried out on every single pellet immediately after the pellets are ground to size. Then in order to verify that the pellets meet the strict diameter specifications, a second manual inspection is carried out on 200 pellets for every lot produced. This inspection is known as the quality control inspection and the data for this test is sent to KEPCO in the form of a quality control release certificate. This certificate certifies that the diameter of the pellets in the fuel assemblies is according to specification. It was on this second test that data falsification took place.

KEPCO's Interim Report

In their interim report, KEPCO reported that when quality control inspectors at BNFL were questioned about the reason why they falsified data, inspectors responded that they thought that the quality control inspection was redundant (considering all the pellets were already checked during the automatic inspection), so they decided to copy the pellet diameter values from earlier lots and paste them into subsequent lots in order to reduce their workload and save time.

In their interim report, KEPCO insists that there is no problem with Takahama Unit 4 fuel. However, KEPCO limited their investigation to this “cut and paste” form of data fabrication and failed to consider that other forms of data fabrication, such as altering data to fit specification measurements, could also have taken place.

Citizens' Analysis of BNFL's Data

After KEPCO made the pellet measurement data available to the public in early October, two Japanese citizens groups, Green Action and Osaka Citizens against the Mihama, Oi, and Takahama Nuclear Power Plants (Mihama no Kai), entered the data for six suspicious lots from Takahama Unit 4 fuel into the computer and produced distribution graphs comparing the total pellet inspection data with the quality control inspection data. What they found was that in some instances the data distribution graphs for the quality control inspection did not match the data distribution graphs for the automatic inspection. Statistical analysis ran on one set of graphs (lot P824) indicated a less than 0.1% chance that that these two graphs depicted the same lot. This analysis strongly suggests that some sort of data falsification must have also taken place on the quality control data for Takahama Unit 4 fuel.

On the 20th and 21st of October, the two groups sent their findings to KEPCO, the Governor of Fukui, the Mayor of Takahama, the Nuclear Safety Commission, and Ministry of International Trade and Industry (MITI)’s Agency of Natural Resources and Energy (ANRE) which is responsible for carrying out the imported fuel rod inspection that must be passed before the fuel can be loaded into the reactor. All five addressees were asked to prohibit the loading of Takahama Unit 4 fuel until after it can be proved that no data falsification took place.

However, rather than investigate for other

forms of data fabrication, KEPCO released a final report on the data falsification scandal on November 1st, which concluded that no data falsification took place for Takahama Unit 4 fuel. (This included their conclusion that there were no problems with the suspicious lot P824.) KEPCO simultaneously released to journalists and the regulatory officials a written response to questions raised by Green Action and Mihama no Kai. The response reiterated KEPCO's position that there was no falsification of Takahama Unit 4 quality control data. However, when KEPCO was questioned about the basis for their conclusions during a meeting with the two citizens groups on the 8th of November, the company was unable to provide any proof to substantiate their conclusions.

In their response to Green Action and Mihama no Kai, KEPCO seek to prove that no falsification took place on lot P824 by insisting that the pellet inspection distribution for this lot has two peaks which were caused by a change in the grinder blade during the fabrication of this lot. This is in spite of the fact that the graph they use to illustrate their point is a rather narrow bell curve and in no way can one locate "two peaks" on the graph as they claim. (figure 1)

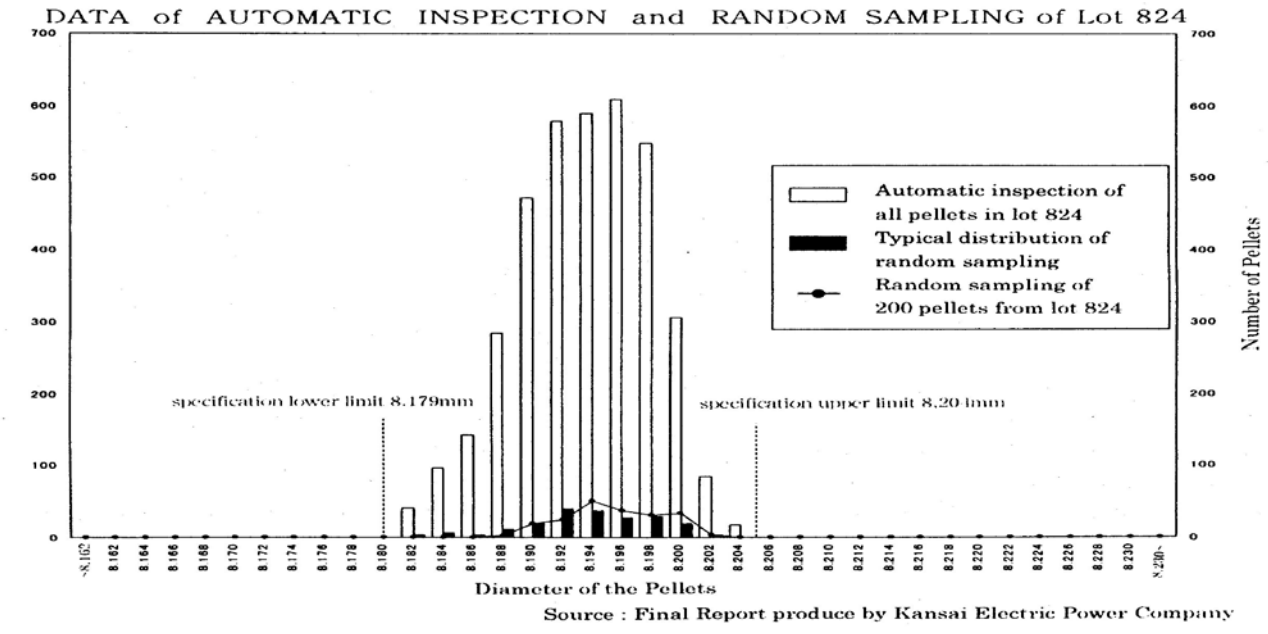
Citizens Bring Their Questions to Tokyo

Two days later, on the 10th of November, Green Action and Mihama no Kai held a meeting in Tokyo with officials from MITI's Agency of Natural Resources and Energy (ANRE) and the Nuclear Safety Commission, with a member of the Japanese Upper House in attendance. The citizens' groups asked how these government agencies could support Kansai Electric's position when KEPCO themselves could not explain how they arrived at their conclusions. The ANRE official was unable to back up KEPCO's position with statistical data, and only repeatedly stated, "[w]e don't think that data fabrication other than cutting and pasting took place." These irresponsible comments by the ANRE official show the extent to which the Japanese regulatory process is dysfunctional.

Citizens Take KEPCO to Court

Convinced that the regulatory agencies are not prepared to carry out their own investigation

[Figure 1]



into the Takahama Unit 4 data falsification, and since KEPCO intends to go forward with the loading of the fuel in December as planned, 212 people from all over the Kansai region have joined together to take KEPCO to court. Legal documents were submitted to the Osaka District Court on November 19th asking the court to issue an order of provisional disposition to prohibit the use of MOX fuel in the Takahama Unit 4 reactor.

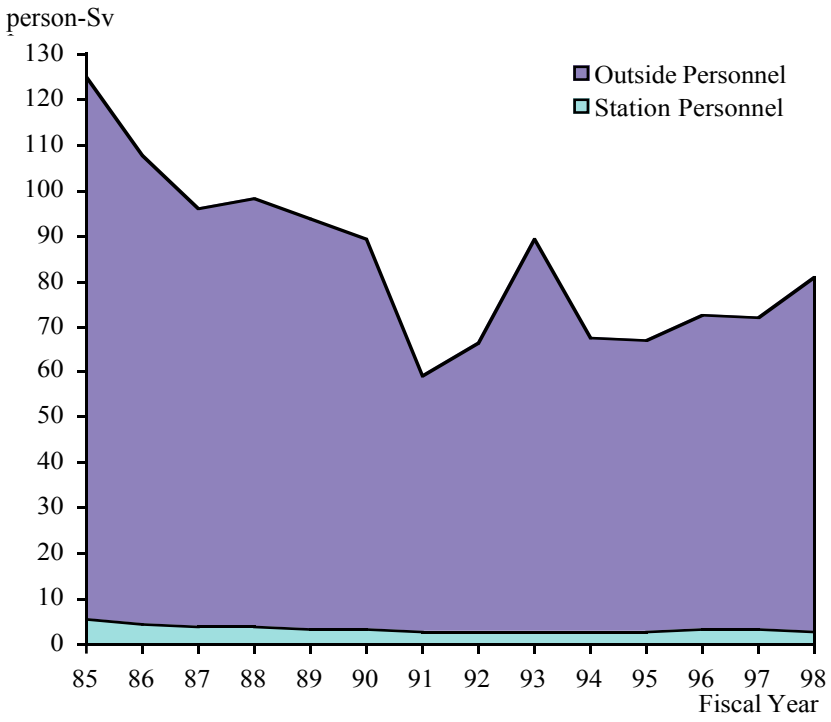
Although KEPCO can still legally proceed with the loading of the fuel in spite of the suit being filed, politically speaking it will be much harder for the company to ignore court proceedings and go ahead as originally planned. During the court proceedings, KEPCO will be required to make information available to the court and it is expected that analysis of this data will reveal more about the data falsification which took place at BNFL, and the subsequent cover-up by the British company.

Stephen Ready, Green Action Staff

Workers' Exposure at Nuclear Plants (1985-1998)
Annual Collective Dose of N-plant Workers (person-Sv)

Fiscal Year	Station Personnel	Outside Personnel	Total
85	5.72	119.33	125.05
86	4.66	102.78	107.44
87	4.17	91.94	96.11
88	4.14	94.25	98.39
89	3.46	90.34	93.80
90	3.29	86.03	89.32
91	2.86	56.06	58.92
92	2.92	63.53	66.45
93	2.98	86.40	89.38
94	2.66	64.63	67.25
95	2.97	63.87	66.80
96	3.15	69.33	72.47
97	*3.07	*68.78	*71.85
98	*2.98	*77.77	*80.77

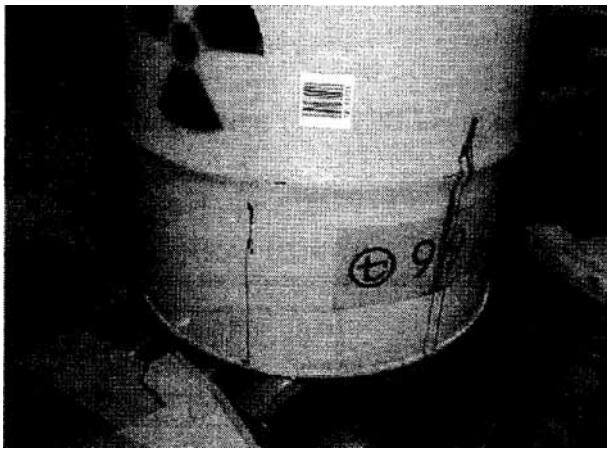
*Fugen excluded



Developments at the Rokkasho Nuclear Fuel Cycle Facility

"Uranium enrichment facilities" have been shipping enriched uranium to JCO, the reconversion facility in Tokaimura where the recent criticality accident occurred. Because all JCO operations were halted, the Rokkasho plant lost its primary shipment receiver. Nevertheless, Japan Nuclear Fuel Ltd. (JNFL) has not changed its operation plan at all, and indicates its intent to proceed according to plan. Thus it will build new on-site product storage capacity, and is asking the electric utilities to obtain about 300 more storage cylinders. Should this plan be implemented, another large amount of uranium hexafluoride will be stored for several years at Rokkasho. In view of the danger, this should not be allowed, and the operation plan should be cut back.

The low-level waste disposal site was opened in 1992, and as of March 1999, 127,040 200-liter drums of low-level wastes have been taken there for final disposal. But in September signs of liquid leaks were found on the surfaces of waste drums shipped from the Fukushima I and Hamaoka plants, and radioactivity was detected. Measurements confirmed the presence of cesium 137, with readings of 0.26 and 0.045 Bq. These low-level wastes had been stored on-site in drums which, due to corrosion occurring during storage, had sprung leaks to which emergency stainless steel patches had been applied. Many of the wastes were solidified by cementation inside the drums, but corrosion had occurred because the cement had not fully dried. The Science and Technology Agency forbade the repaired drums from being put in final storage until the cause is determined.



Three test shipments have arrived at the 3,000-ton spent fuel storage pool, bringing the amount of spent fuel stored there to 32 tons. But with the completion date of the Rokkasho reprocessing facility itself postponed to 2005, and with the problem of excess plutonium from reprocessing contracted to Britain and France, it is not clear when or if the plant will operate.

There has been an announcement about the fifth waste shipment to the high-level waste intermediate storage facility. According to the information released, the French company COGEMA is to ship 104 canisters of vitrified waste--46 for Kansai Electric, 28 for Tokyo Electric, and 10 each for Chubu Electric, Chugoku Electric, and Kyushu Electric. This shipment will include vitrified waste made at COGEMA's UP-2 plant, but as all spent fuel from Japan is processed at the UP-8 plant, this means that gas-cooled reactor and Super Phenix wastes reprocessed at UP-2 will come to Japan, which is a serious problem. For details see *Nuke Info* no. 65.

(By Masako Sawai)

Anti-Nuke Who's Who

GAN NEMOTO

"Gan-San" has National Currency

By Shinichiro Hida,
Council Member of Ryugasaki City, Ibaraki Prefecture

We concerned citizens and workers have been involved in the anti-nuclear movement here at Tokai-mura in Ibaraki prefecture, the site of the JCO plant criticality accident, as members of a network called 'Ibaraki Action Coalition against Nuclear Power.' We have been opposing the concentrated development of nuclear power such as Tokai-mura Reprocessing plant, Tokai nuclear power plant, and other nuclear related facilities at Tokai-mura

Mr. Gan Nemoto, whom I'm introducing today, has been a central and crucial figure and does indispensable work within our network. He also plays an important part in the national network of people from regions with nuclear sites. 'Gan-san' has nation-wide currency.

He has, for example, fought for nearly 20 years as one of the plaintiffs in the Tokai II Case (currently under a second review at the Tokyo High Court), and is an eye-witness to nearly 40 years of disputes between nuclear developers and citizens in Ibaraki prefecture. Yet despite being such a veteran, he still applies himself to the cause with all the energy of a very young man.

Many nuclear facilities exist in Ibaraki prefecture. In Tokai-mura there are research institutes such as the Japan Atomic Energy Research Institute (JAERI), the Japan Atomic Power Company, and the Japan Nuclear Cycle Development Institute, which deal solely with plutonium in Japan. In Oharai-machi there is the Joyo fast-breeding test reactor, and in Naka-machi the JAERI's Naka Institute, a nuclear fusion facility. The host of technically varied problems regarding each of these facilities strain our capacities, and require us to undertake a lot of studying.

As a leader more than merely being a specialist, Gan-san deals with each new problem that crops up. At the same time he continues with the tasks of recording and classifying information in order to maintain a constant watch on key developments andto bring to light nuclear related problems.

You may think that we always rely on Gan-san. In fact, many young people are emerging in this field, and a variety of people are lending strong support to their own regional anti-nuclear civil activities--encouraged, of course, by Gan-san. Activities in Ibaraki prefecture stand within a global network, and Gan-san is not fighting alone.

Nuke Info Tokyo relies on many wonderful translators and proof-readers who devote their time free of charge to put together every issue that arrives in your mailbox. The editor in great gratitude would like to take the opportunity here in the last issue of the 20th century to introduce these precious people. Each person is introduced by their name and occupation, followed by a short message to the readers.

Translators:

Rick Davis, Japanese-English translator:
Nuclear power is a black hole. It will quickly absorb all the money and resources we throw at it, growing ever later, and in the end it will suck us in as well. The technology of ruination, a deal with the devil.

Akiko Fukami, Freelance writer, translator:
Thank you for subscribing to NIT. We're working hard to get Japan on the course toward nuclear phase-out. Keep supporting us!

Taeko Miwa, translator:
It is always a challenge to translate nuclear-related articles, but I'm glad that I can be of some help.

Yu Tamura, Freelance:
Thank you for reading NIT!

Junko Yamaka, Translator at Lingua Guild, Inc.:
I feel very honored to be able to participate, even in a very small way, in producing NIT, a very important news source sent out from Japan to the world with the aim to stop nuclear development and create a nuclear-free world. The situation surrounding nuclear development in Japan has become ever graver, as shown in the recent incredible accident at JCO. So NIT continues to be an important media linking people who are working to denuclearize the world.

Proof-readers:

Tony Boys, Junior College Instructor:
I hope NIT is useful for you in terms of the information it provides about nuclear issues in Japan and Asia. All feedback concerning content and English (especially technical language) is very welcome!

Michael Donnelly, Professor, University of Toronto:

Dr Antony Moore, University lecturer and researcher in Renaissance English Literature:
We are still in the dark about the nuclear power industry. 'Nuke Info' is one of the few publications to throw light on what appears to be a worldwide, government-sponsored catastrophe --a catastrophe happening every day of the year.

Stephen Ready, Green Action (Kyoto, Japan) Staff:
I started working here at Green Action in May and have worked almost non-stop ever since! It's a pleasure to work together with CNIC to help rid Japan of nuclear pwoer. I hope you enjoy this edition, and thanks for your support.

SUBSCRIPTION

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 (subscription rates: Regular subscriber - $30 or ￥3,000/year; supporting subscriber $50 or ¥5,000/year). The subscription fee should be remitted from a post office to our post office account No:00160-0-185799, HANGENPATU-NEWS. We would also appreciate receiving information and newsletters from groups abroad in exchange for this newsletter. (When sending the subscription fee from overseas, please send it by international postal money order.)

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NEWS WATCH

Nuclear Power Plant Shut Down due to Power Failure

On October 27th the electrical power supply was shut off in a wide area of Kyoto Prefecture. The shutdown was caused by trouble at a power substation. About 420,000 households were affected. Trains and subways in the area were also delayed. Owing to the power stoppage, Takahama 1, 3 and 4 (PWRs with a total output of 2,566 MW) in Fukui Prefecture automatically shut down. Takahama 2 (PWR, 826 MW) had previously been shutdown for regularly scheduled inspection. Electrical power was restored in most of the area within 25 minutes. However, it was three to four days before the three reactors resumed operations, one after the other, on the 30th and 31st.

This incident clearly reveals the inadequacies of nuclear power plants as a source of electrical power. Since the use of reactors is accompanied by enormous danger, they are very carefully protected so that they automatically stop operations whenever an even slight anomaly occurs in the transmission system. In other words, they shut down automatically very easily. Once the reactors are shut down, it takes time before operations can be resumed. At the time of the recent automatic shutdown, steam was mixed in the lubricating oil of the bearings of the turbines and feed pumps at all three reactors. It took a few days to change the lubricating oil. Even without this requirement, it takes a day before any reactor can resume operations. When power was initially restored on the 27th, the supply of electricity to the affected area was provided by hydraulic and thermal power stations.

It is important to note that the same three nuclear reactors were shut down together once before, in 1991, due to a similar power failure. On this occasion the failure was caused by a one-second delay in the supply of electricity after lightning hit a power line. It took a couple of days before all the reactors were able to resume operations.

Compensation Payments for Nuclear Plant Workers Approved

The Labor Standards Inspection Office approved compensation payments to a 54-year-old man employed on a subcontracting arrangement in nuclear plants. It was accepted that the worker had developed lymphatic leukemia due to work-related radiation. He had been engaged in the inspection of equipment at nuclear plants located in various parts of Japan for more than 12 years, from December 1984 to January 1997. During this period he was exposed to more than 0.6 Sv of radiation. The victim became ill in September 1998 and applied for worker compensation payments in January 1999.

In Japan there have been only four cases in which plant workers' application for compensation have been approved. Even after becoming ill, it is difficult for applicants to prove a causal relationship between the illness and the levels of radiation to which they were exposed while working at nuclear-related facilities. There are many illnesses caused by radiation (see the following article), but only leukemia is recognized as a work-related illness for the purposes of compensation. The compensation program is also restricted to people whose radiation dosage is very high.

Meanwhile, on October 26th applications for worker compensation payments were approved for the three workers exposed to radiation during the criticality accident at JCO. As these workers are suffering from acute radiation poisoning the causal relationship is very clear. Their applications were

approved in six days. This is the first time that worker compensation payments have been approved for acute radiation sickness.

Effects of Radiation Other Than Cancers

The causal relationship between radiation exposure and cancer has been demonstrated, and recently data showing the links between radiation exposure and other illnesses has been compiled. The evidence was published in the recent issue of *Radiation Research*, a U.S. journal, by Yukiko Shimizu, Deputy Director of Epidemiology and others at the Radiation Effects Research Foundation (RERF).

The researchers studied about 2,700 people who were among atomic bomb victims in Hiroshima and Nagasaki and who had died between 1950 and 1990. The victims had died of illnesses other than cancer. The researchers discovered that the higher the radiation dosage, the higher was the rate of deaths from heart diseases, cerebral apoplexy and liver troubles.

RERF directors are taking a cautious stance, claiming that the casual relationship between radiation exposure and heart diseases has not been established from the study of animals, and thus further studies are required. The Director of epidemiology, however, recognized that the increase in the death rate cannot simply be explained by reasons other than radiation exposure.

JCO Accident Further Delays Japan's Nuclear Power Plans

Plans to construct additional nuclear power plants were being delayed even before the JCO accident. The accident seems to have delayed plans even further. The fundamental reason for these postponements, however, is that the electric companies do not expect a significant increase in the demand for electric power. In addition, local governments are not enthusiastic about the construction of additional nuclear plants, since the atomic facilities have not brought about the kind of regional economic development originally expected.

On October 27th the Japan Atomic Power Co. submitted a report to Fukui Prefecture on the accident at its Tsuruga 2 nuclear reactor, located in Fukui Prefecture. The accident involved an enormous amount of cooling water that leaked from a cracked pipe in the primary coolant system (see NIT Nos. 72 and 73). In the report the Company presented findings of its investigation of the causes and outlined measures to be adopted to prevent such an accident from happening again. JAPCO also submitted a plan to resume operations in late January 2000. The Prefectural Government's response to this was only that it would proceed with caution.

JAPCO cannot propose plans to build two additional reactors at the same site until Tsuruga 2 resumes operation. In addition, they have been unable to obtain agreements with local municipalities, which are necessary before safety reviews of improvement plans for the FBR Monju can advance.

Elsewhere, on October 1st, the Japan Nuclear Cycle Development Institute was scheduled to propose its plan to the Ibaraki Prefectural Government and the village of Tokai to resume operations of the Tokai Reprocessing Plant. The plan was naturally shelved. Unless operations at the reprocessing plant resume, there will be no place to deliver spent fuel produced by ATR Fugen and so it is likely that the Fugen facility will have to suspend operations.

A delay in the use of MOX fuel at Takama 4, which was scheduled to begin in October, is inevitable. It was decided to remanufacture the fuel for Reactor 3 (see pp.8-10). With regard to the use of MOX fuel at Kashiwazaki 3, the mayor of Kashiwazaki City proposed that it be postponed, and the director of the power plant officially announced a one-year postponement of the plan. Kyushu Electric Power Co. was planning to propose to Saga Prefecture and Genkai-machi the use of MOX fuel at Genkai 3 but the company has decided to go back to the drawing boards.

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