

JCO Criticality Accident and Local Residents: Damages, Symptoms and Changing Attitudes

Data and Analysis of the Results of
a Field Survey of
Tokai-mura and Naka-machi Residents

By Koichi Hasegawa and Yuko Takubo

The JCO Criticality Accident
Comprehensive Assessment Committee

Translated and edited
by Gaia Hoerner

Citizens' Nuclear Information Center

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Citizens' Nuclear Information Center
3F Kotobuki Bldg. 1-58-15 Higashi-nakano, Nakano-ku, Tokyo 164-0003 JAPAN
(tel) 81-3-5330-9520
(fax) 81-3-5330-9530
e-mail: cnic-jp@po.ijnet.or.jp
URL: <http://www.cnic.or.jp>

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Contents

Foreword	i
JCO Criticality Accident and Local Residents: Damages, Symptoms and Changing Attitudes	1
Afterword	18
Survey on Impacts of JCO Criticality Accident on Nearby Citizens (Simple Totals of Form A and B)	21
Appendix	
A: Map of JCO Co. and the Survey Area	
B: Distance from JCO and Radiation Dose	
C: Exposure Dose Estimate by the Science and Technology Agency	
D: Photos from the Field Survey	
E: Media Coverage of the Field Survey	
F: Related Article by Koichi Hasegawa	

Foreword

A criticality accident was triggered at 10:35 a.m. on 30 September 1999 at the conversion building of JCO Co. in Tokai Village, Ibaraki Prefecture - a village which has been the center of nuclear energy development in Japan. This criticality accident was the first of its kind in Japan, and it was the first example where people died of acute radiation injury in the course of carrying out tasks as part of Japan's "peaceful use of nuclear energy." It was also rare even in the international realm in that citizens were exposed to neutrons due to a nuclear accident, and thus the accident was widely reported in magazines and newspapers overseas.

The accident occurred during the final process of preparing a solution needed for manufacturing fuel for the Joyo Experimental Fast Breeder Reactor. The solution instantaneously reached criticality because a large amount of this dangerous highly enriched uranium solution, containing 18.8% of uranium 235, was poured into a "precipitation tank" where criticality can easily be reached. Criticality, a nuclear chain reaction, continued for about 20 hours. Criticality was contained early in the morning of the next day, when the cooling water surrounding the precipitation tank was removed and borate solution was poured into the tank. Until that time, neutrons and gamma-rays were continuously emitted and radioactivity kept being produced. Local residents were either evacuated or advised to stay indoors. Transportation was greatly affected as trains went out of service and roads were sealed off.

Among the three JCO employees who were exposed to lethal or nearly-lethal doses of radiation, Mr. Ouchi who was exposed to the highest dose died on 21 December 1999, and Mr. Shinohara, who was exposed to a lesser dose, also died on 27 April 2000. Mr. Yokokawa, who was exposed to the least dose among the three, was able to leave the hospital in mid-December 1999, but has not yet fully recovered.¹⁾

The government recognized the seriousness of the accident and has been reforming laws and nuclear regulatory bodies to improve the administration of nuclear matters. However, the effectiveness of such reforms can only be evaluated after observing changes over a long period of time. While such reforms can not have worsened the conditions at nuclear facility sites, citizens must keep a watchful eye on whether the countermeasures implemented by the central government are adequate or not.

The Uranium Processing Plant Criticality Accident Investigation Committee set up by the government's Nuclear Safety Commission held its last meeting on 24 December 1999 and released its final report.²⁾ It is widely assumed and was confirmed by some officials that there was strong pressure on the Committee to finish its report by the end of the year. Reasons like that led to the early dissolution of the Committee without adequate investigation and deliberations.

Thus it was necessary to initiate an independent investigation of the accident by citizens. Citizens' Nuclear Information Center and the Japan Congress Against A- and H-Bombs together formed the "JCO Criticality Accident Comprehensive Assessment Committee" and gathered qualified and diversified members, held extensive discussions on the causes and background factors leading to the accident, and released a final report in September 2000. Though we met with great difficulty in acquiring the necessary documents, we credit ourselves with carrying out an investigation from a different angle to that of the government's investigation committee.

One of the important issues concerning this accident was the exposure of citizens who were living or transiting outside the nuclear facility to neutrons. Many residents were thrown into extreme anxiety because of the controlling agencies' inadequate responses and sensationalized reports by some of the media in the initial stage of the accident. Thus, with such a background, we believe the sociological field survey and analysis carried out by two of our committee's members - Prof. Koichi Hasegawa and Assistant Prof. Yuko Takubo - with help from others deserves special mention and dissemination. The survey results, derived despite adversities such as lack of survey funds, are extremely valuable upon examining the long-term effects of this accident. The results of the survey attracted significant interest from the media, ordinary citizens and the academic realm. We believe it is highly desirable that the survey has been translated into English and that it will be read widely by the international community.

Michiaki Furukawa,
Chairman of the Criticality Accident Comprehensive Assessment Committee
Nuclear Chemist, Professor Emeritus, Nagoya University
Board member, Citizens' Nuclear Information Center (CNIC)

1) For further details of the accident, please refer to the English-language book, *Criticality Accident at Tokai-mura, 1mg of uranium that shattered Japan's nuclear myth* (J.Takagi and the Citizens' Nuclear Information Center. May 2000. Tokyo: Citizens' Nuclear Information Center)

2) An English translation of this report, "The Report of the Uranium Processing Plant Criticality Accident Investigation Committee," is available for free down-loading at http://nsc.jst.go.jp/english/report/nscnews_report_f.htm

JCO Criticality Accident and Local Residents: Damages, Symptoms and Changing Attitudes¹⁾

SUMMARY:

This paper reports the results of a survey concerning the effects of the 1999 JCO Criticality Accident on the lives of local residents in Tokai Village and Naka Town. The main results were: (1) residents experienced physical abnormalities and mental symptoms; (2) residents had strong anxiety over the future effects from radiation on themselves and their family members; (3) lack of information was a factor of anxiety and dissatisfaction during and after the accident. Only 14% had accurate knowledge of the JCO plant. (4) on one hand, over 90% of the residents held the Science and Technology Agency highly responsible for the accident and its effects; (5) but on the other hand, the emergency responses taken by Tokai Village and the Mayor were highly rated; (6) on one hand, about 2/3 of the residents became critical of nuclear power; (7) but on the other hand, about half saw Tokai Village's future as "co-existing with the nuclear industry".

On the basis of the results of the survey, we submitted policy suggestions to the government to disclose all data concerning the accident, to conduct adequate health care for local residents, and to review the current nuclear energy program.

KEYWORDS:

nuclear accident, dissatisfaction, anxiety, physical symptoms, disclosure of official information

1. Lack of consideration on the lives of local residents — government's final report

What kind of effects did Japan's worst nuclear power accident of 30 September 1999, the JCO criticality accident, have on the lives, health, and thoughts of local residents? The criticality (a nuclear chain reaction) accident at JCO plant, located in Tokai Village (Tokai-mura), Ibaraki Prefecture, was the first in Japan to expose residents of a large area to radiation. Large amounts of neutrons were emitted and radioactivity contaminated the vicinity of the JCO plant. The central government failed to initiate the evacuation of the residents. Tokai Village ordered residents within a 350 meter radius of the JCO plant to evacuate four and a half hours after criticality began, and Naka Town (Naka-machi) did the same eight hours after the beginning of criticality. Twelve hours after criticality was triggered, Ibaraki Prefecture ordered residents within a 10 km radius of the facility to stay indoors. This request was lifted by the Ibaraki Governor at 16:30 on 1 October. The evacuation orders were lifted by the Mayors of Tokai Village and Naka Town on the evening of 2 October. The deci-

sions to lift these orders were not based on adequate deliberation of the situation and there was no guarantee that the fission products and neutron activated products had ceased to affect the residents.

The accident cannot be fully understood without finding out its physical, mental, economic, and sociological effects on local residents.²⁾ However, the final report published on 24 December 1999 by the Nuclear Safety Commission's Uranium Processing Plant Criticality Accident Investigation Committee does not include anything on the effects of the accident on the lives of local residents and community life in general. To amend this lack, the JCO Criticality Accident Comprehensive Assessment Committee - consisting of researchers, lawyers, and citizen activists mobilized by the Citizens' Nuclear Information Center and Japan Congress Against A- and H-Bombs - planned and carried out a survey of local residents. The survey concerned the extent of mental and physical damage to local residents and the effects on their lives. The survey was carried out on the weekends of February 12-13 and 19-20, 2000, by means of questionnaires completed by the respondents themselves and follow-up interviews upon collection. This survey's objective was to clearly illustrate findings on the following items: 1) Physical symptoms following the accident; 2) Resident's emotions regarding the accident; 3) As factors assumed to be the basis of such emotions, residents' rating of a.) nuclear energy development, b.) controlling agencies of nuclear energy and nuclear accidents³⁾; and 4) Residents' thoughts on Tokai-mura's "co-existence" with nuclear energy, and conditions for accepting such "co-existence."

2. Tokai Village (Tokai-mura. *Mura* is Japanese for Village.)

Tokai Village is located in northern Ibaraki Prefecture near the center of Japan. The village has been the center of nuclear energy development in the country. Nuclear power development began there in the 1950s, and Japan's first ever commercial nuclear power plant began operation in the Village in 1966. This small village with a population of about 34,000 and an area of 37 km² is dotted with nuclear facilities built alongside residential areas. Approximately a third of the villagers work for nuclear facilities. The village has enjoyed tax incomes from nuclear facilities, as well as many fine civic facilities and well-maintained roads. The villagers have long been very supportive of nuclear development. However, a fire and explosion at the Tokai Reprocessing Plant in 1997 and the 1999 criticality accident have greatly distressed the town. This became apparent at the village assembly election held soon after the criticality accident when, for the first time in the village's history of nuclear development, an anti-nuclear candidate was elected as the assembly member. This was the first time that an anti-nuclear citizen could even enter the election as a candidate. As this study shows, though the village is still reliant on the nuclear industry, nuclear energy has definitely lost its privileged status as the sole option for sustaining the village.

3. Area sampling of two km radius. Procedure of subject selection.

The subjects comprised 946 households in Tokai Village and Naka Town of Ibaraki Prefecture, which lie within a 2 km radius of the JCO plant. The selection of the subjects was carried out by area sampling using a residential map. According to that map, households within the entire 0~2,000 m radius, which is the target population, total 2,683 (Tokai Village: 2,264 households, Naka Town: 419 households). Up to a 500 m radius, every household (excluding non-residential businesses) was surveyed. Thereafter, an area consisting of about 24~30 neighboring households was counted as a selection unit for random sampling. This type of sampling was done to highlight the differences in impressions of the accident and damages to residents according to the distances from the scene of the accident. Specifically, the subjects were: all 41 households of Tokai Village within a 350 m radius of the outside wall of the JCO plant's conversion test building (the scene of the accident); all 138 households (Tokai Village: 129 households; Naka Town: 9 households) within a 350~500 m radius; 192 randomly chosen households (Tokai Village: 131 households; Naka Town: all 61 households) within a 500~1,000 m radius; 255 households (Tokai Village: 159 households; Naka Town: 96 households) within a 1,000~1,500 m radius; 320 households (Tokai Village: 231 households; Naka Town: 89 households) within a 1,500~2,000 m. The total was 946 households (Tokai Village: 691 households; Naka Town: 255 households).

We composed two survey forms A and B. Form A was prepared for those most interested in filling out the survey as representatives of households (thus A form respondents were not necessarily the heads of households). Form B (most question items were identical to Form A) was prepared for other members of households. Such method was taken under the assumption that it is preferable to survey as many household members as possible - including those young and old, and both genders - in order to better understand damages and effects particular to nuclear accidents. The collection number of Form A was 662 forms and of Form B, 520 forms. The response rate for Form A was 70.2%. The response rate was much higher than our expectation. Questionnaires can be limiting in that you can only get superficial answers because the respondents are restricted to multiple choice answers. To supplement such limitation, significant room for open questions was provided and

Table 1 Distance from JCO and respondents' residences (%)

Distance (Radius)	Tokai Village	Naka Town	All Respondents
350 m	40 (3.4)	0 (0.0)	40 (3.4)
350-500 m	176 (14.9)	11 (0.9)	187 (15.8)
500-1,000 m	174 (14.7)	75 (6.3)	249 (21.0)
1,000-1,500 m	199 (16.8)	120 (10.2)	319 (27.0)
1,500-2,000 m	286 (24.2)	101 (8.5)	387 (32.7)
Total	875 (74.0)	307 (26.0)	1182 (100.0)

interviewers were encouraged to ask supplementary questions when they visited houses for collection. Contrary to typical responses to this type of survey, many people wrote substantially in these open question sections. It can be said that the interest of the subjects was extremely high. The interviewers were graduate and undergraduate students, and members of citizens' groups in Tokai Village and its vicinity, as well as Mito City and Tokyo. Altogether there were 79 interviewers, with about 35 of them visiting residents door to door each day of the four-day survey period.

4. General summary of the survey results.

The main results were: (1) there were many people, a number exceeding our expectation, who experienced bodily weakness along with skin irritation on the day of the accident and shortly after. There were also many who expressed mental symptoms such as anxiety and terror of the scene of the accident itself; (2) strong anxiety over the future effects from radiation on the subjects and their family members; (3) on one hand, over 90 % of the respondents hold the then Science and Technology Agency (STA), now incorporated into the Ministry of Education, Culture, Sports, Science, and Technology (MEXT), highly responsible for the accident and its effects; (4) but on the other hand, the emergency responses taken by Tokai Village and the Mayor, Tatsuya Murakami, are highly rated; (5) on one hand, about 2/3 of the residents have become critical of nuclear power; (6) but on the other hand, 44.9% see Tokai Village's future as "co-existing with the nuclear industry," and only 18.2% see "village development centered on industries other than nuclear" as a future for Tokai Village.

(1) Generic characters of the respondents

The respondents' gender proportion was about the same: male 49.7%, female 46.2% (NA: 4.1%). Seventy-four percent were Tokai Village residents and 26% were Naka Town residents (see Table 1). Those who own their own homes amounted to 74.8% of the entire population - a high percentage of home ownership. Of the 156 people living in Naka Town who responded to this question, 155 own their own homes. In case of Form A respondents, there were 25.7% who had been living in the area since birth, and altogether there were 57.6% who had lived in the area for over 20 years (see Table 2). Those

Table 2 Years living at the present address (N=662) %

Residence	Tokai Village	Naka Town	All Respondents
Since birth	15.5	56.0	25.7
At least 20 years	33.9	25.9	31.9
10-20 years	15.5	9.0	13.9
5-10 years	16.9	4.2	13.7
Less than 5 years	16.1	3.6	13.0
NA	2.0	1.2	1.8
Total	100.0 (496)	100.0 (166)	100.0 (662)

who cited the reason for living in the area as “I was born and raised in this area” amounted to 28.1%. In Naka Town, there were 62% who cited the above item. In comparison, 33% of the respondents' households in Tokai Village had begun living there 10 years ago (5~10 years ago: 16.9%, less than 5 years ago: 16.1%). “Since birth” amounted to 15.5%, and 33.9% responded that they had lived in the area for more than 20 years. Those who cited “because I was born and raised in this area” amounted to 16.7%. Thus, the survey area has a high permanent residency and low mobility, which is a characteristic of a rural agrarian village. The selected area of Naka Town especially had this characteristic.

(2) Bewilderment, anxiety, and physical effects

The immediate reaction to the accident can be generally divided into two patterns: anxiety type and bewilderment type. Highest number of responses, 217 respondents (31.4% of the 691 respondents who wrote in the related open questions), belong to the anxiety type where uncertainty and anxiety were expressed in the written response section. It can be understood from comments like the following that anxiety was caused by the lack of accurate information: “Though vague, I was overcome by anxiety that something terrible had happened.” [Resident of Tokai Village within the 350~500 m radius. All free answers will be supplemented with parentheses hereinafter. Nothing in the original Japanese responses was changed except for obvious spelling mistakes.] Special attention should be given to the fact that many were not aware of the type of plant or the location of JCO until the accident. There were some who were “surprised that there was such a plant in the vicinity.” There were also many who did not even know the name of the company (or identified the plant by its former name “Nuclear Fuel Conversion” or its parent company “Sumitomo,”) so there were cases off and on where respondents did not realize that the accident had occurred in the vicinity. Strong dissatisfaction was expressed about the fact that respondents had not been informed of the existence of such a risky nuclear facility, a nuclear fuel material processing plant, in the vicinity of their residences.

There were also many who can be classified as the bewilderment type, such as represented in the following response: “I had no idea what was going on. I did not know what JCO was, where it was, nor what I had to do at that moment (Resident of Tokai Village, 350~500 m radius).” One hundred forty-nine people (21.6%) responded that “(the accident) had no reality” and “(I) had no idea (what to do)” because of the lack of information about the characteristics of the accident or what type of actions had to be taken in response to it. There were strong dissatisfaction and anxiety stemming from the lack of information.

Only 14.1% of those surveyed knew that the JCO plant was a nuclear fuel processing plant (see Q17, p.28). The ratio was 23.1% even within the 350 m radius and constantly decreased in response to an increase in distance: 21.2%

for 350~500 m radius; 12% for 1,500~2,000 m radius. There were 48.5% people within the 1,500~2,000 m radius who were not even aware of the existence of the plant. Even within the 350 m radius and 350~500 m radius, there were about 25% respectively who were not aware of the plant's existence. Not only the residents, but the STA and Tokai Village officials also did not think much of the fact that a nuclear fuel material processing plant was located in close vicinity to residential areas.

When asked about the time criticality continued from the evening of 30 September 1999 to the morning of 1 October, we received graphic responses such as the following: "I was very anxious because I could not obtain any detailed information of the Town. I wondered for how long the curfew would last, and if I was really protected from radioactivity just by staying indoors. I could not open the windows and could not breathe fresh air, and the day seemed very long (Resident of Naka Town, 1,000~1,500 m radius)." The "delay in responses" of Tokai Village, Naka Town, and Ibaraki Prefecture were pointed out by 102 people (16.4% of the 622 responses to the relevant free answer sections), and 120 people (19.3%) pointed out the deficiency in safety control and information relay systems.

"The accident occurred right in front of my eyes at a distance only within a couple of hundred meters but when I called the Village Office in the evening on whether to evacuate, they only gave a vague answer that I probably did not need to evacuate by that time (since it wouldn't really make a difference) (Resident of Tokai Village, 350~500 m radius)." In Naka Town, there was dissatisfaction with the delay in the Town's response and also strong dissatisfaction with the fact that the media focused exclusively on Tokai Village. "Information was only available from television. I wanted to know what the Town had done. Reports focused on Tokai Village while information about our side [Naka Town] was rare. I was strongly annoyed with the lack of information despite the fact that there was an accident so close (Resident of Naka Town 1,500~2,000 m radius)."

Many changes were seen in the daily lives of the respondents when asked about matters that had changed in life following the accident: "I threw out all vegetables from my garden (Resident of Tokai Village, 350 m radius)," "Ever since the accident I've been using mineral water even for cooking (Resident of Tokai Village, 350 m radius)," "I haven't opened the window on the JCO side ever since the accident (Resident of Tokai Village, 350 m radius)," "I don't feel like passing by the vicinity (of JCO) so I don't ever walk around there, even though it is close (Tokai Village, 350~500 m radius)."

We followed questionnaire items often used for post nuclear facility accident surveys, such as ones after the Chernobyl accident, for inquiring about physical abnormalities experienced on the day of the accident. Headache (33 people), bodily weakness (25), abnormal smell (20), nausea (13), and palpitations (10), were the main symptoms (see Q6-6, p.24). It is also significant that there were six who experienced metallic tastes in their mouths, a symptom

Table 3 Correlation between the distance from the JCO site and the number of people having physical abnormalities

Distance (radius)	Abnormalities on the day of the accident ¹⁾ (%)	Abnormalities experienced up to the time of survey ²⁾ (%)	Number of all respondents from the area (%)
350 m	6 (15.0)	15 (37.5)	40 (100.0)
350-500 m	41 (21.9)	78 (41.7)	187 (100.0)
500-1,500 m	39 (15.7)	106 (42.6)	249 (100.0)
1,000-1,500 m	38 (11.9)	93 (29.2)	319 (100.0)
1,500-2,000 m	35 (9.0)	122 (31.5)	387 (100.0)
Total	159 (13.5)	414 (35.0)	1182 (100.0)

Notes: 1) $X^2 = 19.768$ d.f. =4 $P < 0.001$ 2) $X^2 = 31.209$ d.f. =16 $P < 0.05$

commonly assumed to be an effect of radiation exposure. There were some 159 (13.5% of the entire 1,182 respondents) who experienced one or more symptoms from immediately after the accident and until the next day. There were 129 who experienced one symptom, 21 with two symptoms, and 9 with three or more symptoms. The breakdown of the locality of the 159 people who experienced one or more symptoms are: 6 people within the 350 m radius (15% of the respondents living within the 350 m radius, hereinafter same notification), 41 within the 350~500 m radius (21.9%), 39 within the 500~1,000 m radius (15.7%), 38 within the 1,000~1,500 m radius (11.9%), 35 within the 1,500~2,000 m radius (9.0%) (see Table 3). When the relation between the distance from the JCO plant in a straight line and the complaints of more than one physical abnormality were examined by chi-square test, significant differences were detected at 1% level. When the correlation coefficient is examined, the distance from the scene of the accident to the residences and the physical abnormalities experienced on the day of the accident have a statistically significant negative correlation ($r = -0.1221\%$, significant at 1% level). The shorter the distance, the greater the complaints of physical abnormalities. However, it must be brought to attention that 9% complained of physical abnormalities even within the 1,500~2,000 m radius.

Physical and mental symptoms following the accident were asked about based on the time of the survey (February 2000) with a question, "Do (or did) you have the following symptoms?", and question items often used in public hygienics (see Q10-1, p.25). Two hundred thirty-three people, 19.7% of the entire respondents, felt "extremely anxious." There were 214 people (18.1% of the entire respondents) who were "afraid to approach the accident site." There were responses such as: "I don't want to see any news about the criticality accident (113 people, 9.6%)," "I suddenly have vivid flashbacks of the accident (111 people, 9.4%)," (both items being threatening memories of the accident) "I feel uneasy and irritable (81 people, 6.9%)," "I can't sleep (75 people, 6.3%)," "I get tired more easily (70 people, 5.9%)," "I have headaches (68 people, 5.8%)," "My body feels weak (60 people, 5.1%)," and there were 207 people (17.5%) who

were examined by a doctor.

It must be highlighted that people experiencing headaches (68 people) and bodily weakness (60 people) each increased more than two times from respectively 33 people and 25 people who had such complaints immediately after the accident.

There were 414 people who selected more than one physical abnormality from the 20 items, amounting to 35.0% of all respondents. There were 145 people (12.3%) who cited one item, 97 people (8.2%) who cited two items, 99 people (8.4%) with 3~5 items, and 73 people (6.2%) with 6 or more items. As seen in Table 3, there were 15 people who complained of one item or more within 350 m radius (37.5% of all respondents within the 350 m radius, hereinafter same notification), 78 people within the 350~500 m radius (41.7%), 106 people within the 500~1,000 m radius (42.6%), 93 people within the 1,000~1,500 m radius (29.2%), and 122 people within the 1,500~2,000 m radius (31.5%). When the relation between the distance from the JCO plant in a straight line and the number of items selected regarding physical and mental abnormalities were examined by chi-square test, significant differences were detected at 1% level. The correlation coefficient of the two variables was $r = -0.118$; a significant figure at 1% level. The closer to JCO plant, the more complaints of physical abnormalities. However, it must be brought to attention that there were 31.5% who complained of physical abnormalities even within the 1,500~2,000 m radius.

The administrators and the mass media tended to draw an artificial border line surrounding the 350 m radius area which was designated for evacuation. However, it must be emphasized that it cannot be concluded from our study that the 350 m border has any particular meaning.

(3) Future anxieties

Anxiety over future radiation effects are strong. "Anxiety over delayed effects from radiation" was cited by 54.6% and there were about the same amount of concerns that "there might be another nuclear-related accident," cited by 53.9% (multiple responses. See Q12, p.26). Strongest concerns at the time of the survey were over the "effects of radiation to oneself or one's family members," cited by 606 people (multiple responses. When the total of all responses is calculated as 100%, the relative frequency comes to 30.1%. When percentage is calculated in relation to the 1,131 respondents, excluding blank answers, who responded to this particular question, it amounts to 53.6%). Also, 24.5% (43.7% of the respondents) cited their anxiety that "there might be another serious accident" (multiple responses). It can be said that about half the people are living in anxiety over the accident's effects and a possible recurrence.

Answers like "(I am concerned that the government's estimation of) neutron dose was corrected a couple of times (see Appendix B and C), each time decreasing, and it was four months later that the doses were (reported) to the residents so I am (concerned about) my health, very anxious whether I should

go to the doctor or not, and perplexed over which doctor to see (Resident of Tokai Village, 350 m radius).” “I’m just praying that there will be no delayed effects a few years later. I am (concerned) about my children’s health - whether they can have children even if they get married, and the possibility of having abnormal children (Resident of Tokai Village, 1,000~1,500 m radius).”

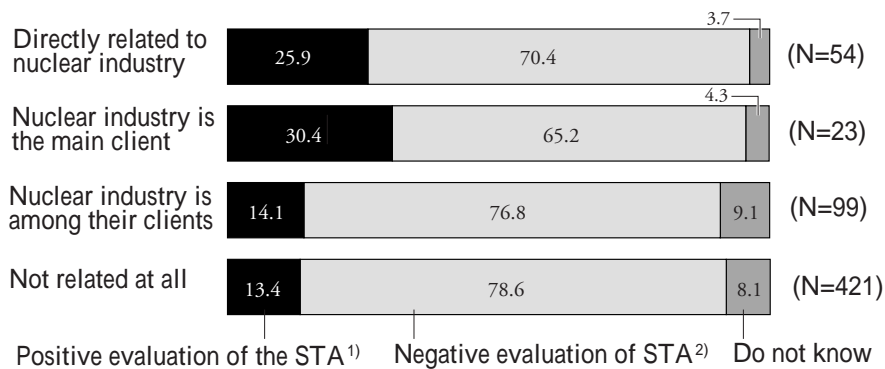
There are concerns over matters other than health damage and another accident, such as: “I was looked at dubiously when I said I was from Tokai Village when I was in another area following the accident (Resident of Tokai Village, 350 m radius)”; “An acquaintance who used to visit every year has not visited since (Resident of Tokai Village, 350 m radius).” The residents are extremely burdened mentally with anxieties over the fact that they have not been told their “exposure dose,” and are apprehensive that they will be discriminated against because they or their children are socially categorized as “hibakusha,” regardless of the actual seriousness of their exposure dose or even the fact that they may not have been exposed. “I am worried that even if there were no physical damage, my children will be discriminated against in the future just because they lived near the JCO plant at the time of the accident and will not be able to get married. Children of JCO employees are being bullied at school (Resident of Tokai Village, 350~500 m radius).”⁴⁾

It can be said that the national and local governments must be held responsible to take appropriate responses to alleviate the anxieties of the residents. Systems must be set up for long-term monitoring of radiation effects and for follow-up investigations. A number of local residents have formed the “Criticality Accident Victims’ Group” and are continually negotiating with the government and JCO for the issuance of accident victim IDs and coverage of medical expenses.

(4) Governmental responsibility

The former Science and Technology Agency (STA) as the administrative body has not officially admitted its responsibility over causing the JCO accident. However, close to 90% of the residents hold the Agency responsible not only as the supervising agency of JCO (89.8%) but also to investigate the cause of the accident (86.1%), to make clear the radiation exposure dose of the residents (86.2%), and to prepare/improve nuclear disaster prevention/response systems (86.2%). Though the percentage decreases slightly, about 70% of the respondents hold the Agency responsible for damage relief (77.8%), and making changes to nuclear policy (70.6%). In addition, 49.9% see a connection between the background leading to the accident and Japan’s nuclear promotion policy. There were only 11.6% who responded that there was no relation between the two. There were 31.4% who responded that the STA did a “terrible job” in responding to the accident. Together with 35.1% who responded that the STA did a “poor job,” there were 66.5% who were dissatisfied with the Agency’s responses.

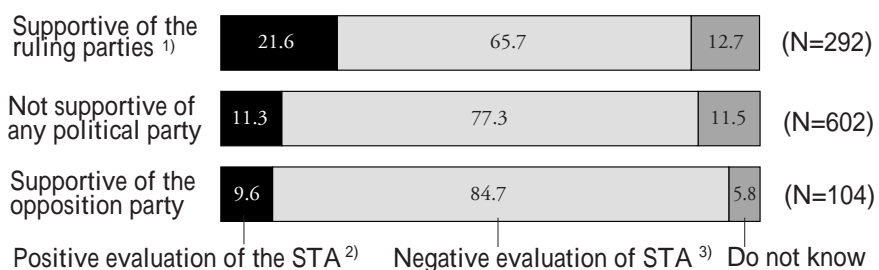
There were only 12.7% in total who responded that the Agency did a



Notes: 1) Sum of categories [very good job] and [fair job]
 2) Sum of categories [poor job] and [terrible job] $\chi^2=25.393$ d.f.=12 $p<0.05$

Fig. 1 Relation between respondents' holding nuclear-related jobs and the overall rating of the Science and Technology Agency (STA).

“very good job” or a “fair job” in responding to the accident. The residents’ rating of the then Obuchi Cabinet and the STA is considerably low⁵⁾; only slightly higher than the low rating of JCO’s parent company, Sumitomo Metal Mining Co. When the factors ruling the respondents’ rating of the STA are analyzed with partial correlation coefficient by controlling age and gender, those who are keen on permanent residency and supportive of the ruling party were significantly lenient in rating the STA’s response (see Fig. 1 and 2). Also, those respondents or those with family members who have strong occupational connections to nuclear power were relatively lenient in rating the Agency’s response. Among those who support the three ruling parties, the Liberal Democratic Party, the New Komeito, and the Liberal Party, 21.6% favorably rated the STA’s response, and likewise 25.9% of those who perform duties directly related to nuclear power rated the Agency’s response favorably. In comparison, only 9.6% of those who support opposition parties gave a favorable rating to the STA’s response, and only 11.3% of those who do not support any particular party. Among those who do not have any connections to the nuclear industry, only 13.4% gave a favorable rating of the STA’s response, but 25.9% of those who have direct connections to the nuclear industry and 30.4% of those who directly do business with the nuclear industry favorably rated the



Notes: 1) The Liberal Democratic Party, New Komeito and Liberal Party
 2) Sum of categories [very good job] and [fair job]
 3) Sum of categories [poor job] and [terrible job] $\chi^2=33.957$ d.f.=8 $p<0.001$

Fig. 2 Attitude towards the government and the overall rating of the STA.

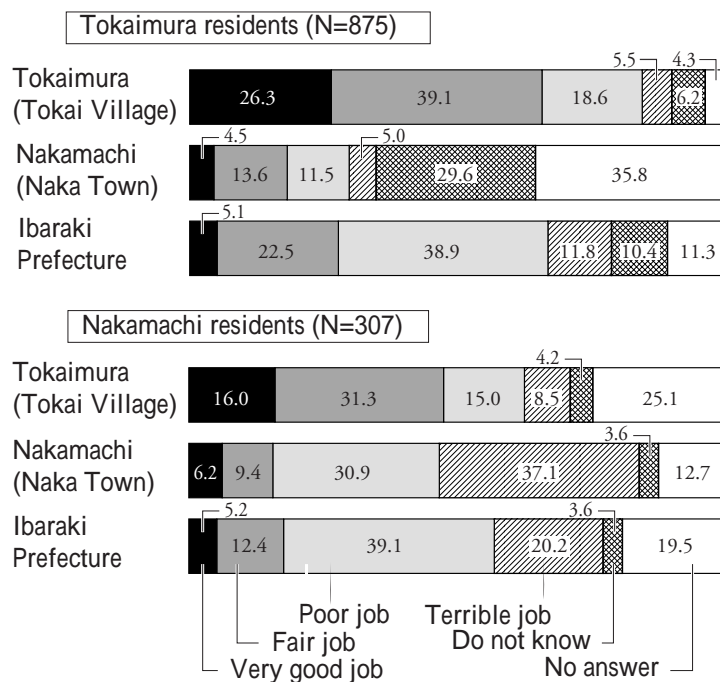


Fig. 3 Overall rating of how the local government dealt with the situation

STA's response. [Totalled with the exclusion of blank and irrelevant (unemployed subjects') responses]

(5) High rating of Tokai Village's response and critical rating of Naka Town

Tokai Village's response to the accident was favorably rated by 60.7% of the respondents, but the response by Naka Town was favorably rated by only 17.4%. Favorable rating of the response of Ibaraki Prefecture was low as well (25.1%). When the item "(the ... did) a very good job (in response to the accident)" is specifically examined, in comparison to Tokai Village which was cited by 23.6% of the respondents, the other eleven items were each cited only by about 1 to 7%. When Tokai Village residents are exclusively examined, there were 26.3% who responded that the Village did a "very good job" in responding to the accident, and 39.1% responded that the Village did a "fair job" (see Fig. 3). The rating of the response of Tokai Village is more favorable among the Tokai Village residents than residents of Naka Town. As for Naka Town residents, in total 15.6% responded that the Town did a "very good job" or a "fair job," 30.9% "not a very good job," and 37.1% a "terrible job." The rating of the Town is as low as the rating of the STA. There were only 16.5% of Tokai Village residents who were critical of Naka Town's response, but 35.8% gave a blank answer, and 29.6% responded that they had no idea. Naka Town's response is not very well known among residents of Tokai Village.

Many comments in the open answers were appreciative and praised the fact that Tokai Village made its own decisions to evacuate the residents without waiting for orders from the central government, and that the Village was con-

cerned for the residents. On the other hand, there were 97 people who criticized or accused the Village of being “slow in responding.” In addition, “improvement in supervision of the nuclear industry to secure residents’ safety” was most cited as the respondents’ expectation for the Village’s future policy. The residents’ utmost desire is to have the Village, as their representative, strongly supervise nuclear facilities. “As the top leader, the Mayor was splendid in his discernment and actions taken internally and externally in response to the accident. I believe he made the right decisions. The Village employees also fulfilled their responsibilities. (As for) the Village Assembly members, the Nuclear Issues Investigation Special Committee had been set up for a while but it is unclear if it made any contribution (Resident of Tokai Village, 350 m radius).” “I couldn’t grasp how much radioactivity was released even after hearing the explanation given at the *Komisen* (the community center) on the night of September 30. The Village’s response was delayed because it was its first experience with a nuclear accident. There were no facilities for gargling and washing hands. I had no idea if I was contaminated or if there was second-hand contamination. We measured (the atmosphere) with a survey meter around 9 p.m. It was too late even by then because it was radiation. We claimed in vain that if Tokai Village dispatched a monitoring vehicle, we could determine how much was leaking at that moment. We complained over such ridiculous handling of matters (Resident of Tokai Village, 350 m radius, who had experience working at Japan Nuclear Cycle Development Institute, a specified corporation which is mostly funded and strongly controlled by the government. Response given during in-person survey.)”

(6) Increase in negative feelings against nuclear power

How do local residents feel about nuclear power? The main arguments regarding nuclear power are: risks of accidents, construction of additional plants, and whether residents should be consulted by conducting a referendum when siting a plant. Respondents were surveyed on these issues. It must be highlighted that about 2/3 of the residents have become critical of nuclear power. In total, 63.4% agree or mildly agree that “it is impossible to completely prevent nuclear power accidents.” There were 63.7% who think “Japan should not build any more nuclear power plants,” and 65.5% who think that “the siting of nuclear power plants and nuclear-related facilities should be decided by referenda⁶⁾.” In total, only about 20% disagreed or mildly disagreed on the items concerning nuclear accidents and additional construction of nuclear plants in the country. In particular, there were only 14.6% who disapproved that referenda should be conducted.

When factors related to opposition towards additional construction were analyzed by partial correlation coefficient by controlling age and gender, there was no significant relation between the distances from the scene of the accident. On the other hand, high numbers of complaints over physical and mental damages, anxiety over nuclear facilities from pre-accident times, and critical atti-

	Physical & mental symptoms	Knowledge of risks prior to the accident	Sympathetic to citizen groups	Desire permanent residency
Oppose additional construction	0.1656 p=.000**	0.2951 p=.000**	0.2263 p=.000**	-0.2290 p=.000**
	Work at nuclear or related industry	Family member works at nuclear or related industry	Positive evaluation of STA	
Oppose additional construction	-0.2763 p=.000**	-0.1094 p=.009**	-0.1039 p=.002**	

Notes: control variables: sex, age. **p<0.01 *p<0.05

Table 4 Partial correlation between the opposition towards additional construction of nuclear plants and related variables

tude towards additional construction of nuclear plants had significant correlation (see Table 4). The following factors had significant negative correlation with critical attitudes towards additional construction of nuclear plants in the country: the respondent or the respondent's family members have jobs related to nuclear power; preference for permanent residency; favorable rating of the STA's responses to the accident.

Before the accident, 43.9% had been proud of Tokai Village as a "leading site of nuclear research" (see Q21-3 p.31). There were 49.9% who thought so when the group was limited to residents of Tokai Village (excluding blank answers, there were 35.4% in Naka Town). It can be concluded that doubts and suspicions against nuclear power increased dramatically after the accident. Even among those who were proud of Tokai Village as a "leading site of nuclear research," 66.3% became critical of Japan building additional nuclear plants following the accident.

(7) Future of the Village

Respondents were given four options for the future of Tokai Village. The results were as follows: "co-exist with nuclear industry (44.9%); "mainly agrarian (4.5%); "industries other than nuclear (18.2%); and a "suburb" (6.4%)." There were more who chose "co-exist with nuclear industry" than expected. It is a reflection of practical understanding of the residents that it is unclear as to what alternative industries can be developed and that it is necessary to co-exist with nuclear industry for the time being.

In cross-totalling of responses to items on the future of Tokai Village (items were limited to the main ones) and the construction of additional nuclear power plants in the country, there were 43.2% who were "in general critical of constructing additional nuclear power plants but think that the village must co-exist with nuclear power" - this type being the most typical. There were 26.5% who were critical of constructing additional plants and keen on developing alternative industries. About as many people (26.3%) were positive on constructing additional plants and co-existing with nuclear power. As shown in Figure 4, when blank answers, "don't know" and infrequently cited items were excluded, the common responses could be divided into three types. Special attention should be given to the type with the largest share (43.2%): Critical of

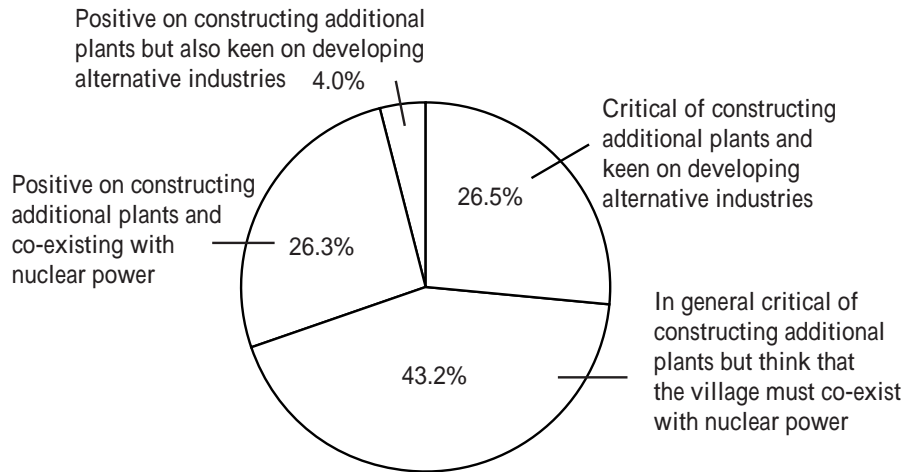


Fig. 4 Responses to items on construction of additional plants and the future of Tokai Village (N=654, Statistics for four most selected categories)

building additional nuclear power plants but sees co-existence with nuclear power as the future. It is observed that there is a large gap between the strong dissatisfaction towards the responses taken to the accident, anxiety over physical and mental damage from the accident, uncertainty over the future, and as seen so far, the practical choice for the future of the village.

However, there is a relatively large negative correlation of $r = -0.2965$ with critical attitude towards constructing additional plants and the item “(it would be favorable for Tokai Village to) co-exist with nuclear power” (significant at 1% level). Residents who were critical of constructing additional plants significantly showed expectations for alternative industries. Partial correlation coefficients were examined for items possibly related to the future prospects for area development.

The results were summarized in Table 5. Anxieties over nuclear facilities prior to the accident had a strong negative correlation with the item “co-exist

Table 5 Partial correlation between expectation for Tokai Village to “co-exist with nuclear power” and selective variables

	Physical abnormalities on the day of the accident	Family member works at nuclear or related industry	Knowledge of risks prior to the accident	Oppose additional building of nuclear plants
Expects Tokai Village to co-exist with nuclear power	-0.0908 p=.008**	0.1267 p=.003**	-0.3321 p=.000**	-0.2965 p=.000**
	Sympathetic to citizen groups	Desire permanent residency	Works at nuclear or related industry	Physical and mental symptoms
Expects Tokai Village to co-exist with nuclear power	-0.1995 p=.000**	0.2289 p=.000**	0.1690 p=.000**	-0.0828 p=.015*
	Support the incumbent government	Positive evaluation of STA		
Expects Tokai Village to co-exist with nuclear power	0.0996 p=.004**	0.1026 p=.003**		

Notes: control variables: sex, age. **p<0.01 *p<0.05

with nuclear power" ($r = -0.3321$). There was no significant correlation between residential areas (distance, Tokai Village, Naka Town) and future prospects. The following items had significant negative correlation and had an effect on preference for developing alternative industries other than nuclear: positive rating of responses taken by citizens' groups, large numbers of complaints of abnormality on the day of the accident, physical and mental symptoms following the accident.

Residents are divided over what to do with the existing nuclear facilities in Tokai Village (33.4% want them "shut down immediately" and 35.5% want them to "operate as status quo"), but more than half (53.1%) were interested in scaling down when the item "gradually reduce" is added to "shut down immediately." Figure 5 shows the result of a cross-totaling of items on the future of nuclear facilities in Tokai Village and additional construction of nuclear plants in the country.

Trends to support the closing of the Village's nuclear facilities had strong correlation with critical attitudes towards the additional construction of nuclear plants in the country and knowledge of risks prior to the accident. Significant correlation was seen between residents who are generally critical of additional construction of plants and those who favor the closure of nuclear facilities. However, it must be noted that 19.6% among those who were opposed to additional construction of nuclear plants in the country were in support of continuing the operation of nuclear facilities in the Village.

4. Conclusion

A picture of residents with a "torn consciousness" has emerged from the entire survey. While residents are experiencing strong anxiety over future accidents, dissatisfaction towards the responses to the JCO accident, and the extent of the physical and mental damage from this accident, they are ruled by the reality that they must continue to live in Tokai Village and nearby Naka Town, both of which are reliant on nuclear industry.

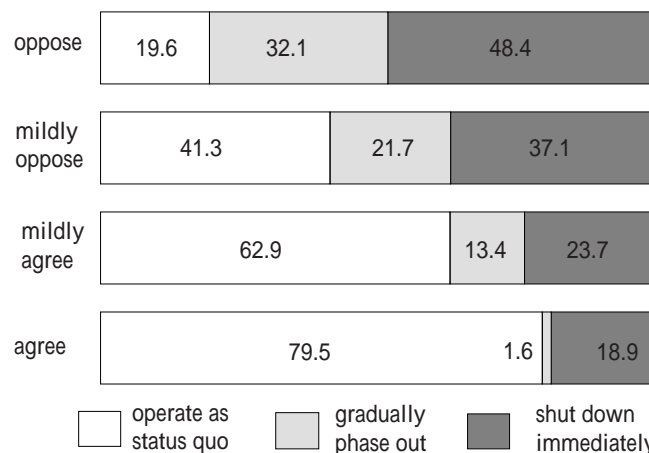


Fig. 5 Attitude towards additional construction of nuclear plants and the future of nuclear facilities in Tokai Village. (NA omitted)

To give a graphic image based on the results of this survey, there is a group of people affirmative of nuclear power who are strongly connected to the land, prefer permanent residence, are supportive of main parties such as the Liberal Democratic Party, are lenient on their rating of the responses taken by the former Science and Technology Agency to the accident, and are or have family members who are in posts directly connected with nuclear power. On the other hand, there is a group of people critical of nuclear policy who are relatively new to the place, do not hold jobs related to the nuclear industry, are supportive of opposition parties or do not support any particular party, and are sympathetic toward citizens' groups. Local residents are divided between these two groups which hold conflicting opinions. In addition, there is a second division within one of the two groups since, even among residents who are generally critical of the nuclear policy, there are those who chose to co-exist with nuclear power when asked about future area development and immediate shut-down of local nuclear facilities.

1) This article is a revised English version based on a translation of [Hasegawa, Takubo, and Nemoto 2000]. Statistical analysis was done by Hasegawa, and analysis of the open answers was done by Takubo.

2) There are studies based on quantitative research, such as [Kitada 2000], on changes in public opinion concerning nuclear energy following the JCO accident. [Kitada 2000] concludes that "negative reaction (against the accident) did not directly lead to opposition against the use of nuclear energy as an electricity source." However, such a conclusion is based on public opinion at large and did not look into changes in the opinions of local residents. No consideration was given on how local residents, forced to "co-exist" with risky facilities such as the JCO plant, view the JCO accident and the use of nuclear energy. Our survey was conducted under assumptions that local residents' thoughts on nuclear energy and "co-existing" with nuclear facilities became negative following the accident, and thus instead of examining the accident's effects to the general public, focused exclusively on finding out how local residents experienced the accident.

3) After Russia experienced the world's worst nuclear accident at its Chernobyl Plant, residents' anxiety worsened due to lack of risk communication and insufficient risk control, and negative public image of this disaster swelled [Linge and Melikhova 1998].

4) It is pointed out in [Takebe 2000] that the media's wide coverage of groundless anxieties such as "(I) will not be able to marry (because of the accident)" contributed to further swelling of local residents' anxieties, and that health examinations which caused unnecessary anxiety for those with no professional knowledge should not be conducted. However, our results clearly show that more than anything, local residents desired the disclosure of all data and information concerning the accident, and wished to make their own decisions based on such information. To avoid a situation like the JCO accident where there was no information other than that provided by the media to base

judgements on, the disclosure of data which can withstand the scrutiny of experts from various fields should be actively promoted, instead of regulating research and information release.

5) Tokai Village residents were distrustful of the government which, to them, seemed to be withholding information on the accident. Trust in government significantly affects risk perception of nuclear facilities. Desvousges et al. states that the U.S. Department of Energy (DOE)'s failure to reduce concerns about nuclear repository may, in part, be due to lack of trust in DOE and its one-way risk communication [Desvousges et al. 1993].

6) Local residents' view regarding the possibility of preventing serious accidents is much more pessimistic than that shown in a poll taken in 1998, where 37% of respondents said it is "impossible" or "not sufficiently possible" to secure the safety of nuclear plants, while 59% said it is "possible" or "possible to a certain degree" [Shibata and Tomokiyo 1999:122].

7) The original Japanese was "bed town." A Japanese word meaning a mainly residential town where people who commute to cities live.

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Afterword

Based on the results of this survey, the authors and the JCO Criticality Accident Comprehensive Assessment Committee (JCAC) call upon the government to act on the following recommendations:

1) Local residents' strongest concern is over the effects of radiation on themselves and their family. To provide accurate information in order to lessen their anxiety, the government must fund continuing health checks for all residents of Tokai Village and Naka Town at appropriate medical institutes.

2) The results show that 35.0% of the residents living within a 2 km radius have complained of physical abnormalities. It can be concluded that for effective disaster prevention, all nuclear facilities must be isolated from residential areas. In Japan, there are many large-scale nuclear facilities, such as nuclear power plants, which are located only a couple of hundred meters away from residential areas. Either existing nuclear facilities must be relocated, or if that is not possible, residents must be relocated with ample compensation. If neither is possible, the facility must be shut down.

3) Special attention should be paid to the fact that only 14.1% of those surveyed knew that the JCO plant was a nuclear fuel processing company. To supplement disaster prevention manuals which are to be distributed to households under the new disaster prevention law, it is necessary for the government to thoroughly disseminate the location and nature of nuclear facilities to local residents. Local governments and fire departments must work together and conduct nuclear disaster drills more than once a year. In addition, the operators must conduct annual briefings for the purpose of holding discussions with local residents on the facilities' safety and safety control systems, and accident countermeasure systems.

4) Local residents hold the former Science and Technology Agency (STA), the controlling agency at the time of the accident, responsible for making clear the causes of the accident. The government, in particular the controlling agency, has the responsibility to have an independent thorough examination conducted on the causes of the accident. In order to make that possible, all

data concerning the accident must immediately be disclosed to allow experts independent of the nuclear industry to carry out a critical review.

With the results of this survey and other investigations carried out by the committee, the JCAC published its final report on 22 September 2000, which included seven policy suggestions to the government:

- 1) To conduct a re-investigation of the accident by an independent body.
- 2) To provide necessary assistance for the physical and mental care of those who were exposed.
- 3) To conduct a thorough review of the current licensing review system for nuclear facilities.
- 4) To provide better radiation training for employees.
- 5) To conduct a thorough review of the current nuclear disaster prevention and response systems.
- 6) To conduct strict mass control of nuclear materials.
- 7) To thoroughly examine the current state of nuclear energy in Japan and review the nuclear energy policy, including the nuclear fuel cycle program.

The Nuclear Safety Commission (NSC) responded to these policy suggestions on 9 November 2000, basically asserting that the government's investigation carried out under the NSC was an independent investigation, and that various improvements had been made with the nuclear administration. Our committee, not satisfied with the limited improvements and the government's insufficient investigation, has since had continual discussions with the NSC, as well as holding an open debate with the government's accident investigation committee members on 24 February 2001. Limited, but positive, improvements have been made regarding the structure of NSC and disaster prevention/response measures, which deserve mention. However, discussed below are points related to this study which need further attention and improvements.

First of all, a long-term health monitoring system for the exposure victims has not been set up yet. The survey result shows that residents had various physical symptoms following the accident. This was one of the most important findings of this survey. Special attention should be paid to the fact that some experienced metallic tastes in their mouths.

There are many scientific uncertainties with the assumptions and calculations made for the government's exposure dose estimation, and it is likely that in reality, residents were exposed to doses higher than the government's estimation. Moreover, with no scientific backing, the government has been explaining to local residents that no health effects will arise from exposure under 200mSv - a completely arbitrary figure.

The government asserts that health examinations have been given to those who wished for them, but doctors and government alike tell residents

with physical symptoms that these symptoms are not related to radiation exposure. As of June 2001, there are residents who are still experiencing physical symptoms, and those who were admitted to the hospital or visited hospitals have had to do so at their own expense.

As shown by this study, the physical symptoms experienced by local residents following the accident fundamentally reverse the government's claim that no effects will arise from the exposure due to this accident. The government should respond to this study's result instead of blindly denying such findings. Following the accident, local residents formed the "Criticality Accident Victims' Group," which has been negotiating with the government for the issuance of accident victim IDs and coverage of medical expenses. The government should immediately respond to these demands.

Secondly, further improvements are needed with nuclear disaster prevention and response systems. It was found from this survey that local residents obtained more information on the accident and disaster response from private media than from the government. This accident was the first one of its kind where orders for evacuation and curfews were given based on the government's nuclear disaster prevention and response plan, but that plan was not sufficient enough for a real life accident, and as a result, the government could not keep the exposure of the general public - including children - to the minimum.

The new disaster countermeasure law has introduced much needed improvements with the distribution of disaster countermeasure manuals. However, as it was prior to the accident, the guideline for this law is based on an accident of a scale equal to the Three Mile Island accident (a Level 5 accident on the International Nuclear Event Scale), and thus these measures will not be adequate in the event of an accident with a scale worse than Level 5 (while the JCO accident was Level 4, the Chernobyl accident was Level 7). The government should not be satisfied with such insufficient improvements, and should prepare for accidents of all levels. Moreover, the government must inform local residents precisely of the risks posed by nuclear facilities in their locality.

The government must take the results of this study seriously. The damage to and symptoms of the local residents and their newly arisen skepticism towards nuclear technology following this accident must receive maximum attention. Not only the local residents, but Japanese citizens at large have become skeptical and anxious over the use of nuclear energy. The government must respond to such public opinion, and comprehensively review its energy policy - with complete nuclear phase-out as one of the options.

Survey on Impact of JCO Criticality Accident on Nearby Citizens

Simple Totals of Form A and B

Following are the compiled results for the survey forms A and B. We composed two survey forms in order to collect information from multiple respondents within one household. Form A was prepared for those most interested in filling out the survey as representatives of households. (Thus Form A respondents are not necessarily the heads of the households.) Form B was prepared for other members of households. Such method was taken under the assumption that it is preferable to survey as many household members as possible - including those young and old, and both genders - in order to better understand damages and effects particular to nuclear accidents.

All question items in Form B were identical to Form A but questions regarding household information were omitted to avoid redundancy and to lessen respondents' burden. The collection number of Form A was 662 forms and of Form B, 520 forms. Question numbers correspond to Form A. "NA" means no response. Answers for open questions were omitted.

There are 1,182 respondents unless otherwise specified. When totals are 662, it means they are Form A items only. Percentages for questions allowing multiple answers were calculated by dividing the number of respondents (1,182), such as question 6-6. or by the total of number of answers, such as question 6-4. Totals sometimes do not equal 100% because of rounding. SPSS 10.0J for Windows was used for totaling.

[Survey introduction as it appeared on the survey form.]

This survey is part of the survey activities by the "JCO Criticality Accident Comprehensive Assessment Committee," and is conducted jointly by the Citizens' Nuclear Information Center, the Japan Congress Against A- and H-Bombs (Gensuikin), the Sociology Research Office in the Tohoku University Department of Literature, and citizen groups in order to ascertain the accident's impact on the lives of people living in Tokai Village and its environs. Your cooperation will be of inestimable help in scientifically elucidating the situation. Form A should be filled out by the member of your family currently at home who has the most interest in this matter. Anyone else who can cooperate in the survey should fill out Form B him/herself, and then have it checked by the survey worker.

February 2000

Survey administrator: Koichi Hasegawa,
Professor of environmental sociology,
Tohoku University Department of Literature, Sociology Research Office

A. About your area of residence.

* Q1: What administrative district do you live in?

1. Tokai Village.	491 (74.2%)
2. Naka Town.	165 (24.9%)
3. Hitachinaka City.	0 (0.0%)
4. Other.	0 (0.0%)
NA	6 (0.9%)
Total	662 (100.0%)

* Q2: How long have you been living here?

1. Since I was born.	170 (25.7%)
2. At least 20 years.	211 (31.9%)
3. Ten to 20 years.	92 (13.9%)
4. Five to 10 years.	91 (13.7%)
5. Fewer than five years.	86 (13.0%)
NA	12 (1.8%)
Total	662 (100.0%)

* Q3: Why do you live here?

1. I was born and raised in this area.	186 (28.1%)
2. It's convenient for family members to commute to work and school.	116 (17.5%)
3. It's close to my parents' or relatives' homes.	80 (12.1%)
4. I married someone from this area.	100 (15.1%)
5. It's inexpensive to live here.	27 (4.1%)
6. It has a good natural environment.	35 (5.3%)
7. Other.	97 (14.7%)
NA	21 (3.2%)
Total	662 (100.0%)

* Q4: About how far is it from your home to JCO in a straight line?

1. Within a 350-meter radius.	65 (9.8%)
2. Within a 500-meter radius.	127 (19.2%)
3. Within a 1-kilometer radius.	239 (36.1%)
4. Within a 2-kilometer radius.	201 (30.4%)
5. Outside of a 2-kilometer radius.	22 (3.3%)
NA	8 (1.2%)
Total	662 (100.0%)

* Q5: Is your home inside one of the evacuation zones established by Tokai Village or Naka Town?

1. It's within the Tokai Village evacuation zone.	157 (23.7%)
2. It's within the Naka Town evacuation zone.	64 (9.7%)
3. It's within neither.	408 (61.6%)
NA	33 (5.0%)
Total	662 (100.0%)

B. About the time immediately after the accident.

* Q6-1: Where were you when the JCO accident occurred at about 10:35 AM on September 30?

1. At home (indoors).	246 (20.8%)
2. Near home (outdoors).	193 (16.3%)
3. At work (indoors).	367 (31.0%)
4. At work (outdoors).	100 (8.5%)
5. At school (indoors).	38 (3.2%)
6. At school (outdoors).	6 (0.5%)
7. I was out (for example, shopping or visiting), but in Tokai Village or Naka Town.	69 (5.8%)
8. I was out, and not in Tokai Village or Naka Town.	135 (11.4%)
NA	28 (2.4%)
Total	1,182 (100.0%)

* Q6-2: When did you first hear about the JCO criticality accident?

Date Approximate time
(Open question. Responses omitted.)

* Q6-3: How did you first hear about the accident?

1. The local emergency broadcast system.	228 (19.3%)
2. Local government public announcement vehicle.	18 (1.5%)
3. Television.	359 (30.4%)
4. Radio.	65 (5.5%)
5. From someone at work.	190 (16.1%)
6. From a family member.	101 (8.5%)
7. From a neighbor.	29 (2.5%)
8. Telephone call from an acquaintance, relative, etc.	63 (5.3%)
9. Newspaper.	2 (0.2%)
10. Other.	117 (9.9%)
NA	10 (0.8%)
Total	1,182 (100.0%)

* Q6-4: What did you do immediately upon hearing about the accident? (More than one answer OK.)

1. I went indoors.	239 (13.9%)
2. Contacted family members.	306 (17.8%)
3. Turned on the TV or radio.	402 (23.4%)
4. Called the municipal office to get information.	46 (2.7%)
5. Closed the windows.	291 (16.9%)
6. Took iodine tablets or other medication.	0 (0.0%)
7. Nothing in particular.	335 (19.5%)
8. Other.	100 (5.8%)
Total	(100.0%)

* Q6-5: What extent were you outdoors between about 10:35 AM on September 30 and 10:00 AM on October 1 (when it was announced that criticality had been contained)? Please write times and activities as shown in the example.

Time Activities

(Open question. Responses omitted.)

* Q6-6: Did you sense anything out of the ordinary between about 10:35 AM on September 30 and the morning of October 1? (More than one answer OK.)

1. There was a metallic taste in my mouth.	6 (0.5%)
2. There was a strange odor.	20 (1.7%)
3. I was affected with nausea.	13 (1.1%)
4. I felt dizzy.	5 (0.4%)
5. I had palpitations.	10 (0.8%)
6. My body felt weak.	25 (2.1%)
7. I had a headache.	33 (2.8%)
8. I got a rash.	5 (0.4%)
9. My skin felt itchy.	7 (0.6%)
10. I perspired abnormally.	7 (0.6%)
11. Other.	85 (7.2%)

* Q7: How did you feel immediately after first hearing about the accident? Freely describe what you felt.

(Open question. Responses omitted.)

* Q8: Did you evacuate or take shelter indoors?

1. I evacuated to a designated location (Funaiishikawa Community Center, or Naka Town Yokobori Community Center).	51 (4.3%)
2. I evacuated to a place other than a designated location.	128 (10.8%)
3. I took shelter indoors.	813 (68.8%)
4. I neither evacuated nor took shelter indoors. -> Go to SQ1.	128 (10.8%)
NA	62 (5.2%)
Total	1,182 (100.0%)

* SQ1: Why didn't you evacuate?

1. I was not within 350 meters of JCO.	32 (25.0%)
2. I didn't think it was necessary.	15 (11.7%)
3. I didn't know about the evacuation notice or the request to take shelter indoors.	16 (12.5%)
4. I couldn't go anywhere because I or a family member was ill.	0 (0.0%)
5. I had to work, so I couldn't go anywhere.	20 (15.6%)
6. I had something to do in the house.	1 (0.8%)
7. I thought it was useless to evacuate or take shelter.	6 (4.7%)
8. Other.	28 (21.9%)
NA	10 (7.8%)
Total	128 (100.0%)

* Q9-1: What did you think about the accident during the period of criticality from the night of September 30 to the next morning? (More than one answer OK.)

1. Perhaps my life or health, or those of my family, would be seriously affected.	431 (36.5%)
2. My work would be affected.	96 (8.1%)
3. Tokai Village would look bad.	272 (23.0%)
4. I might have to move away.	201 (17.0%)
5. Nothing in particular.	139 (11.8%)
NA	43 (3.6%)
Total	(100.0%)

* Q9-2: Write specifically what you strongly felt, or if you felt uneasy, discontented, or some other emotion at that time (concerning, for example, JCO's attitude, nuclear power-related disaster prevention/response systems, the action taken by national or local governments, or media reporting). (Open question. Responses omitted.)

* Q10-1: Do you or did you have any of the following symptoms? Indicate the extent (1: feel it all the time and can't endure it; 2: feel it all the time but can endure it; 3: feel it sometimes and can endure it; 4: worries me just a little; 5: nothing at all). (More than one answer OK.) (Replies of people who chose 1 through 4 were totaled.)

1. Nausea.	17 (1.4%)
2. Headache.	68 (5.8%)
3. Dizziness.	24 (2.0%)
4. Rash or itching.	29 (2.5%)
5. My body feels weak.	60 (5.1%)
6. I get tired more easily.	70 (5.9%)
7. I catch colds more easily.	51 (4.3%)
8. I get a slight fever sometimes.	10 (0.8%)
9. I readily get nosebleeds.	10 (0.8%)
10. I have palpitations.	29 (2.5%)
11. I have no appetite.	30 (2.5%)
12. I can't sleep.	75 (6.3%)
13. I have nightmares.	30 (2.5%)
14. I suddenly have vivid flashbacks of the accident.	111 (9.4%)
15. I'm afraid to approach the accident site.	214 (18.1%)
16. I feel uneasy and irritable.	81 (6.9%)
17. I can no longer concentrate.	45 (3.8%)
18. I don't want to see any news about the criticality accident.	113 (9.6%)
19. I've become lethargic.	44 (3.7%)
20. I feel extremely anxious.	233 (19.7%)

* Q10-2: Were you examined by a physician after the accident?

1. Yes.	207 (17.5%)
2. No.	813 (68.8%)
NA	162 (13.7%)
Total	1,182 (100.0%)

* SQ1: When were you examined, for what symptoms, and what was the diagnosis? Please be specific. (Open question. Responses omitted.)

* Q11-1: During the approximately one week after the accident, did you do or was there anything out of the ordinary? (More than one answer OK.)

1. I didn't go to work.	262 (22.2%)
2. Our children didn't go to school.	95 (8.0%)
3. I stayed indoors as much as possible.	329 (27.8%)
4. I avoided locally produced food.	348 (29.4%)
5. Prices went up.	24 (2.0%)

* Q11-2: Has anything changed in addition to items in Q11-1 in your life or in your neighborhood following the accident? (Open question. Responses omitted.)

* Q12: Have any of the following things happened since the JCO accident? (More than one answer OK.)

1. My income and/or assets have decreased.	78 (6.6%)
2. My expenses have increased.	70 (5.9%)
3. My health or that of my family members has deteriorated.	51 (4.3%)
4. I feel uneasy thinking that in the future the effects of radiation might appear.	645 (54.6%)
5. I feel uneasy thinking that another nuclear power-related accident might occur.	637 (53.9%)
6. I'd like to move away from here.	224 (19.0%)
7. My family relationships have deteriorated.	15 (1.3%)
8. My relationships with local people have deteriorated.	14 (1.2%)
9. I have been pursued by media people.	84 (7.1%)
10. People from other areas have said offensive things about the accident.	151 (12.8%)
11. Other.	44 (3.7%)
12. Nothing in particular.	239 (20.2%)

* Q13: What worries you most about the JCO accident now? (More than one answer OK.)

1. The effects of radiation on me and my family.	606 (30.1%)
2. The mental effects on my children and others.	120 (6.0%)
3. The uneasy feeling that there might be another serious accident.	494 (24.5%)
4. Economic impacts such as perceived damage, or declining land prices.	254 (12.6%)
5. I wonder if we'll get as much compensation as we want.	93 (4.6%)
6. I wonder if JCO will resume operations.	297 (14.7%)
7. Other.	33 (1.6%)
8. No worries in particular.	117 (5.8%)
Total	(100.0%)

C. Information about the accident.

* Q14: During the two days after the accident, what was your most trustworthy source of information overall? (More than one answer OK.)

1. The local government. (Village / Town)	325 (23.0%)
2. The prefectural government.	16 (1.1%)
3. The national government (Science and Technology Agency, Nuclear Safety Commission, etc.).	39 (2.8%)
4. TV/radio.	803 (56.8%)
5. Newspapers.	99 (7.0%)
6. Family.	30 (2.1%)
7. Neighbors (including the neighborhood association).	10 (0.7%)
8. Friends and acquaintances.	17 (1.2%)
9. Citizen groups, etc.	3 (0.2%)
10. Experts.	46 (3.3%)
11. Other.	26 (1.8%)
Total	(100.0%)

* Q15: What did you most want to know about the accident soon after it happened? (More than one answer OK.)

1. Whether my family and I had been exposed to radiation.	593 (38.7%)
2. To what extent I should evacuate or take shelter.	335 (21.8%)
3. Cause of the accident.	168 (11.0%)
4. [Question missing.]	
5. If the criticality reaction had stopped.	253 (16.5%)
6. What had happened to the JCO employees involved in the accident.	40 (2.6%)
7. Impacts on crops, etc.	128 (8.3%)
8. Other.	17 (1.1%)
Total	(100.0%)

* Q16: What kind of action have you taken regarding the accident? (More than one answer OK.)

1. Protested or complained.	60 (5.1%)
2. Sought compensation.	99 (8.4%)
3. Looked for or gathered other people with whom to protest or seek compensation.	17 (1.4%)
4. Joined citizen groups or other organizations working on environmental or nuclear power issues.	10 (0.8%)
5. Participated in citizens' gatherings or attended public lectures or other events concerning the accident.	188 (15.9%)
6. Signed petitions.	93 (7.9%)
7. Made appeals to local assembly members, influential politicians, etc.	38 (3.2%)
8. Sought advice from an attorney, etc.	7 (0.6%)
9. Other.	48 (4.1%)
10. Have not done anything in particular.	666 (56.3%)

* Q17: How much did you know about JCO before the accident?

1. I knew it was a nuclear fuel processing plant.	167 (14.1%)
2. I knew the facility was related to nuclear power or other nuclear use.	165 (14.0%)
3. I knew it was some sort of manufacturing facility.	219 (18.5%)
4. I knew of its existence, but not what it was.	152 (12.9%)
5. I wasn't even aware of its existence.	439 (37.1%)
NA	40 (3.4%)
Total	1,182 (100.0%)

* Q18: Where do you usually get information on the environment and nuclear power? Choose your three major sources from among the following.

1. TV/radio.	877 (35.9%)
2. Newspapers/magazines/books.	578 (23.7%)
3. The Internet.	17 (0.7%)
4. Family members.	105 (4.3%)
5. Acquaintances and friends.	97 (4.0%)
6. Workplace.	98 (4.0%)
7. [Question missing.]	
8. Public information from local government.	371 (15.2%)
9. Environmental organizations, etc.	19 (0.8%)
10. Public information from businesses and electric utilities.	208 (8.5%)
11. Through activities with groups like consumer cooperatives.	5 (0.2%)
12. Other.	16 (0.7%)
13. No major sources in particular.	51 (2.1%)
Total	(100.0%)

* Q19-1: What do you think about the following opinions? From among the five responses, choose the one that is closest to what you think.

* A. "It's impossible to completely prevent nuclear power accidents."

Q19-1 A:

1. I agree.	449 (38.0%)
2. I mildly agree.	300 (25.4%)
3. I mildly disagree.	91 (7.7%)
4. I disagree.	183 (15.5%)
5. Don't know.	120 (10.2%)
NA	39 (3.3%)
Total	1,182 (100.0%)

* B. "Japan should not build any more nuclear power plants."

Q19-1 B:

1. I agree.	489 (41.4%)
2. I mildly agree.	263 (22.3%)
3. I mildly disagree.	100 (8.5%)
4. I disagree.	133 (11.3%)
5. Don't know.	161 (13.6%)
NA	36 (3.0%)
Total	1,182 (100.0%)

* C. "The siting of nuclear power plants and nuclear-related facilities should be decided by referenda."

Q19-1 C:

1. I agree.	530 (44.8%)
2. I mildly agree.	245 (20.7%)
3. I mildly disagree.	65 (5.5%)
4. I disagree.	107 (9.1%)
5. Don't know.	185 (15.7%)
NA	50 (4.2%)
Total	1,182 (100.0%)

* Q19-2: Did your thinking on any of the following things change after the accident?

* A. "It's impossible to completely prevent nuclear power accidents."

Q19-2 A:

1. I am much more sure of this than before.	560 (47.4%)
2. I feel the opposite of what I felt before.	188 (15.9%)
NA	434 (36.7%)
Total	1,182 (100.0%)

* B. "Japan should not build any more nuclear power plants."

Q19-2 B:

1. I am much more sure of this than before.	479 (40.5%)
2. I feel the opposite of what I felt before.	197 (16.7%)
NA	506 (42.8%)
Total	1,182 (100.0%)

* C. "The siting of nuclear power plants and nuclear-related facilities should be decided by referenda."

Q19-2 C:

1. I am much more sure about this than before.	516 (43.7%)
2. I feel the opposite of what I felt before.	151 (12.8%)
NA	515 (43.6%)
Total	1,182 (100.0%)

E. Your future, and that of your community.

* Q20-1: Do you want to continue living in this area?

1. Yes, I want to live here for the rest of my life.	427 (36.1%)
2. I want to live here for a while.	158 (13.4%)
3. I'd like to move away if possible.	177 (15.0%)
4. I'd like to move away, but I can't. -> Go to SQ1.	293 (24.8%)
5. Don't know.	93 (7.9%)
NA	34 (2.9%)
Total	1,182 (100.0%)

* SQ1: What's the reason why you can't move away even if you want to?

1. My job.	46 (15.7%)
2. My children's schooling.	12 (4.1%)
3. My parents or other relatives live here.	22 (7.5%)
4. My family has been here for generations.	119 (40.6%)
5. The price of real estate has declined because of the accident.	35 (11.9%)
6. Other.	46 (15.7%)
NA	13 (4.4%)
Total	293 (100.0%)

* Q20-2: Do you want your children to live in this area?

1. Yes.	111 (16.8%)
2. I'd rather they live somewhere else if possible.	166 (25.1%)
3. I'll leave it up to my children.	285 (43.1%)
4. Don't know.	57 (8.6%)
NA	43 (6.5%)
Total	662 (100.0%)

* Q20-3: Has your thinking on the following two items changed since the accident?

* A. About continuing to live here.

Q20-3 A: From Form A

1. Yes, it's changed.	211 (31.9%)
2. No, it hasn't changed.	392 (59.2%)
NA	59 (8.9%)
Total	662 (100.0%)

Q20-3 A: From Form B

1. Yes, it's changed.	167 (32.1%)
2. No, it hasn't changed.	308 (59.2%)
NA	45 (8.7%)
Total	520 (100.0%)

* B. About where your children will live.

Q20-3 B:

1. Yes, it's changed.	230 (34.7%)
2. No, it hasn't changed.	303 (45.8%)
NA	129 (19.5%)
Total	662 (100.0%)

* Q21-1: What would be a favorable future for Tokai Village? (Answer even if you live in Naka Town)

1. I want it to coexist with the nuclear power industry.	531 (44.9%)
2. I'd like agriculture to be the main industry.	53 (4.5%)
3. Some new industry other than nuclear power should be the main industry.	215 (18.2%)
4. It should be a bedroom suburb for nearby cities.	76 (6.4%)
5. Other.	17 (1.4%)
6. Don't know.	231 (19.5%)
NA	59 (5.0%)
Total	1,182 (100.0%)

* Q21-2: What should be done with the many nuclear power facilities in Tokai Village? (Answer even if you live in Naka Town.)

1. They should continue operating as at present, with attention to safety.	420 (35.5%)
2. They should be gradually reduced.	233 (19.7%)
3. Dangerous facilities should be shut down immediately.	395 (33.4%)
4. Other.	27 (2.3%)
5. Don't know.	65 (5.5%)
NA	42 (3.6%)
Total	1,182 (100.0%)

* Q21-3: Before the accident, how did you feel about the many nuclear power facilities in Tokai Village? (Answer even if you live in Naka Town.)

1. I was proud that the area was on the cutting edge of nuclear power research.	519 (43.9%)
2. I felt uneasy because I thought a serious accident might happen someday.	393 (33.2%)
3. Other.	90 (7.6%)
4. Don't know.	113 (9.6%)
NA	67 (5.7%)
Total	1,182 (100.0%)

* Q21-4: Write your thoughts about how your community (Tokai Village or Naka Town) should develop in the future, and about your hopes and anxieties. (Open question. Responses omitted.)

F. Please answer the following questions based on the overall course of events since the accident.

* Q22-1: What do you think about the responsibility of the Science and Technology Agency regarding this accident?

* A. Responsibility to supervise JCO.

Q22-1 A:

1. Heavy responsibility.	1,062 (89.8%)
2. Light responsibility.	20 (1.7%)
3. Don't know.	37 (3.1%)
NA	63 (5.3%)
Total	1,182 (100.0%)

* B. Responsibility to determine the accident's cause.

Q22-1 B:

1. Heavy responsibility.	1,018 (86.1%)
2. Light responsibility.	24 (2.0%)
3. Don't know.	52 (4.4%)
NA	88 (7.4%)
Total	1,182 (100.0%)

* C. Responsibility to ascertain the extent of radiation exposure to local citizens and others.

Q22-1 C:

1. Heavy responsibility.	1,019 (86.2%)
2. Light responsibility.	24 (2.0%)
3. Don't know.	54 (4.6%)
NA	85 (7.2%)
Total	1,182 (100.0%)

* D. Responsibility to make restitution for damage.

Q22-1 D:

1. Heavy responsibility.	920 (77.8%)
2. Light responsibility.	69 (5.8%)
3. Don't know.	78 (6.6%)
NA	115 (9.7%)
Total	1,182 (100.0%)

* E. Responsibility to prepare/improve nuclear disaster prevention/response systems.

Q22-1 E:

1. Heavy responsibility.	1,019 (86.2%)
2. Light responsibility.	26 (2.2%)
3. Don't know.	49 (4.1%)
NA	88 (7.4%)
Total	1,182 (100.0%)

* F. Responsibility to change nuclear power policy.

Q22-1 F:

1. Heavy responsibility.	834 (70.6%)
2. Light responsibility.	74 (6.3%)
3. Don't know.	166 (14.0%)
NA	108 (9.1%)
Total	1,182 (100.0%)

* Q22-2: To what extent is Japan's policy of promoting nuclear power involved in the accident?

1. A great deal.	590 (49.9%)
2. Not much.	137 (11.6%)
3. Don't know.	329 (27.8%)
NA	126 (10.7%)
Total	1,182 (100.0%)

* Q23: What is your overall rating of how the officials in the following places and organizations dealt with the accident?

* A. Tokai Village.

Q23 A:

1. Very good job.	279 (23.6%)
2. Fair job.	438 (37.1%)
3. Poor job.	209 (17.7%)
4. A terrible job.	74 (6.3%)
5. Don't know.	67 (5.7%)
NA	115 (9.7%)
Total	1,182 (100.0%)

* B. Naka Town.

Q23 B:

1. Very good job.	58 (4.9%)
2. Fair job.	148 (12.5%)
3. Poor job.	196 (16.6%)
4. A terrible job.	158 (13.4%)
5. Don't know.	270 (22.8%)
NA	352 (29.8%)
Total	1,182 (100.0%)

* C. Ibaraki Prefecture.

Q23 C:

1. Very good job.	61 (5.2%)
2. Fair job.	235 (19.9%)
3. Poor job.	460 (38.9%)
4. A terrible job.	165 (14.0%)
5. Don't know.	102 (8.6%)
NA	159 (13.5%)
Total	1,182 (100.0%)

* D. Science and Technology Agency.

Q23 D:

1. Very good job.	37 (3.1%)
2. Fair job.	113 (9.6%)
3. Poor job.	415 (35.1%)
4. A terrible job.	371 (31.4%)
5. Don't know.	118 (10.0%)
NA	128 (10.8%)
Total	1,182 (100.0%)

* E. Nuclear Safety Commission.

Q23 E:

1. Very good job.	41 (3.5%)
2. Fair job.	151 (12.8%)
3. Poor job.	401 (33.9%)
4. A terrible job.	294 (24.9%)
5. Don't know.	178 (15.1%)
NA	117 (9.9%)
Total	1,182 (100.0%)

* F. Prime Minister Obuchi's Cabinet.

Q23 F:

1. Very good job.	42 (3.6%)
2. Fair job.	108 (9.1%)
3. Poor job.	389 (32.9%)
4. A terrible job.	366 (31.0%)
5. Don't know.	151 (12.8%)
NA	126 (10.7%)
Total	1,182 (100.0%)

* G. JCO's parent company, Sumitomo Metal Mining Co., Ltd.

Q23 G:

1. Very good job.	45 (3.8%)
2. Fair job.	61 (5.2%)
3. Poor job.	275 (23.3%)
4. A terrible job.	519 (43.9%)
5. Don't know.	163 (13.8%)
NA	119 (10.1%)
Total	1,182 (100.0%)

* H. Diet members representing local districts.

Q23 H:

1. Very good job.	41 (3.5%)
2. Fair job.	83 (7.0%)
3. Poor job.	319 (27.0%)
4. A terrible job.	378 (32.0%)
5. Don't know.	249 (21.1%)
NA	112 (9.5%)
Total	1,182(100.0%)

* I. The coalition government.

Q23 I:

1. Very good job.	18 (1.5%)
2. Fair job.	51 (4.3%)
3. Poor job.	324 (27.4%)
4. A terrible job.	359 (30.4%)
5. Don't know.	298 (25.2%)
NA	132 (11.2%)
Total	1,182(100.0%)

* J. Minority political parties.

Q23 J:

1. Very good job.	22 (1.9%)
2. Fair job.	75 (6.3%)
3. Poor job.	321 (27.2%)
4. A terrible job.	324 (27.4%)
5. Don't know.	290 (24.5%)
NA	150 (12.7%)
Total	1,182(100.0%)

* K. The media.

Q23 K:

1. Very good job.	87 (7.4%)
2. Fair job.	292 (24.7%)
3. Poor job.	324 (27.4%)
4. A terrible job.	171 (14.5%)
5. Don't know.	183 (15.5%)
NA	125 (10.6%)
Total	1,182(100.0%)

* L. Citizen groups.

Q23 L:

1. Very good job.	72 (6.1%)
2. Fair job.	221 (18.7%)
3. Poor job.	250 (21.2%)
4. A terrible job.	117 (9.9%)
5. Don't know.	367 (31.0%)
NA	155 (13.1%)
Total	1,182(100.0%)

* Q24: Describe your views about the following involved entities.

- A. JCO (its management, how the company assumed responsibility, how it compensated people, etc.).
 - B. National government, Science and Technology Agency, Nuclear Safety Commission, etc. (supervision, nuclear power disaster prevention, post-accident response, nuclear power policy, etc.).
 - C. Administrative personnel, mayors, assembly members, and other officials of Tokai Village and Naka Town (post-accident response; dealing with the national government, prefectural government, and JCO; relationship with nuclear power, future community development; etc.).
 - D. Ibaraki Prefecture (post-accident response; dealing with the national government, JCO, and local governments; relationship with nuclear power; etc.).
 - E. Mass Media (the way they covered the accident, their stance in reporting the story, etc.).
- (Responses omitted)

* Q25: Let us know if, in regard to the accident, you feel any questions or suspicions, or something that makes you feel uneasy about the future. (Open question. Responses omitted.)

G. Finally, we would like to ask about your background. Answers to these items are needed to statistically process your responses to this questionnaire. (This information will be kept completely confidential).

* F1: Your age bracket. (Statistics will be compiled by 10-year age brackets.)

10-19 years old	38 (3.2%)
20s	106 (9.0%)
30s	176 (14.9%)
40s	148 (12.5%)
50s	214 (18.1%)
60s	147 (12.4%)
70s	108 (9.1%)
NA	245 (20.7%)
Total	1,182 (100.0%)

* F2: Gender.

1. Female.	546 (46.2%)
2. Male.	587 (49.7%)
NA	49 (4.1%)
Totals	1,182 (100.0%)

* F3: What is the highest-level educational institution you graduated from (including any institution you are presently attending)?

1. Middle school. (Age 12-15)	212 (17.9%)
2. High school (including middle school under the old system).	556 (47.0%)
3. Vocational school or junior college.	172 (14.6%)
4. University or above (including high school under the old system).	136 (11.5%)
NA	106 (9.0%)
Total	1,182 (100.0%)

* F4: What political party do you usually support? Choose only one.

1. Liberal Democratic Party.	283 (23.9%)
2. The Democratic Party of Japan.	66 (5.6%)
3. New Komeito.	33 (2.8%)
4. Liberal Party.	14 (1.2%)
5. Social Democratic Party.	39 (3.3%)
6. Japanese Communist Party.	9 (0.8%)
7. Other parties.	4 (0.3%)
8. I don't support any party.	637 (53.9%)
NA	97 (8.2%)
Total	1,182 (100.0%)

* F5: What type of residence do you live in?

1. Single-family dwelling, owned.	495 (74.8%)
2. Single-family dwelling, rented.	14 (2.1%)
3. Condominium.	2 (0.3%)
4. Apartment owned by private developer.	71 (10.7%)
5. Local government-run housing.	48 (7.3%)
6. Company housing or dormitory.	8 (1.2%)
NA	24 (3.6%)
Total	662 (100.0%)

* F6: How many people live in your home, including you? (Statistics will be compiled by numbers of household members and children.)

Number of household members		Number of children in middle school or below	
1	56 (8.5%)	1	88 (13.3%)
2	130 (19.6%)	2	102 (15.4%)
3	132 (19.9%)	3	38 (5.7%)
4	120 (18.1%)	4 or more	16 (2.4%)
5	68 (10.3%)	Sub total	244 (36.9%)
6 or more	48 (7.3%)	0	277 (41.8%)
NA	108 (16.3%)	NA	141 (21.3%)
Total	662 (100.0%)	Total	662 (100.0%)

* F7-1: What is your occupation?

1. Employed by a private enterprise (excluding the construction industry).	365 (30.9%)
2. Construction industry.	42 (3.6%)
3. School teacher.	21 (1.8%)
4. Public employee.	25 (2.1%)
5. Agriculture, forestry, or fishing.	70 (5.9%)
6. Self-employed in commerce or industry.	38 (3.2%)
7. Full-time housewife.	224 (19.0%)
8. No occupation.	159 (13.5%)
9. Student.	41 (3.5%)
10. Other.	140 (11.8%)
NA	57 (4.8%)
Total	1,182 (100.0%)

* F7-2: To what extent is your workplace connected to the nuclear power industry?
(Statistics compiled for employed respondents only.)

1. We perform duties that are directly related to nuclear power. -> Go to SQ1.	57 (8.1%)
2. Nuclear power -related places of business and companies are our main clients, or the main places where we perform jobs.	23 (3.3%)
3. Nuclear power -related places of business and companies are among our main clients, or the main places where we perform jobs.	100 (14.3%)
4. No connection at all.	454 (64.8%)
NA	67 (9.6%)
Total	701 (100.0%)

* SQ1: To what category does your workplace or place of business belong?

1. Makers of nuclear power-, nuclear power generation-, or nuclear fuel-related products.	22 (38.6%)
2. Subcontractors of makers in 1, above.	5 (8.8%)
3. Electric power- or energy-related companies.	1 (1.8%)
4. Services related to the nuclear-power or electric-power industries.	1 (1.8%)
5. Nuclear power-related research institute.	18 (31.6%)
6. Other.	6 (10.5%)
NA	4 (7.0%)
Total	57 (100.0%)

* SQ2: About how many employees does your place of business have?

1. Fewer than 10.	2 (3.5%)
2. 10-49.	1 (1.8%)
3. 50-99.	2 (3.5%)
4. 100-499.	16 (28.1%)
5. 500-999.	9 (15.8%)
6. 1,000 or more.	25 (43.9%)
NA	2 (3.5%)
Total	57 (100.0%)

* SQ3: What kind of work do you perform at your place of business?

1. Managerial duties.	5 (8.8%)
2. Technical or R&D (Research and Development).	17 (29.8%)
3. Clerical duties.	7 (12.3%)
4. I work in a factory or workshop.	8 (14.0%)
5. Repairs, inspections, or maintenance.	6 (10.5%)
6. Operating machinery or equipment.	3 (5.3%)
7. Construction work.	0 (0.0%)
8. Other.	8 (14.0%)
NA	3 (5.3%)
Total	57 (100.0%)

* F7-3: Do any of your family members work at places of business that are directly related to nuclear power?

1. Yes.	84 (12.7%)
Breakdown 1 person	71
2 persons	13
2. No.	482 (72.8%)
NA	96 (14.5%)
Total	662 (100.0%)

* F7-4: Do any of your relatives work at places of business that are directly related to nuclear power?

1. Yes.	151 (22.8%)
Breakdown 1 person	86
2 persons	38
3 persons	14
4 or more	10
NA	3
2. No.	396 (59.8%)
NA	115 (17.4%)
Total	662 (100.0%)

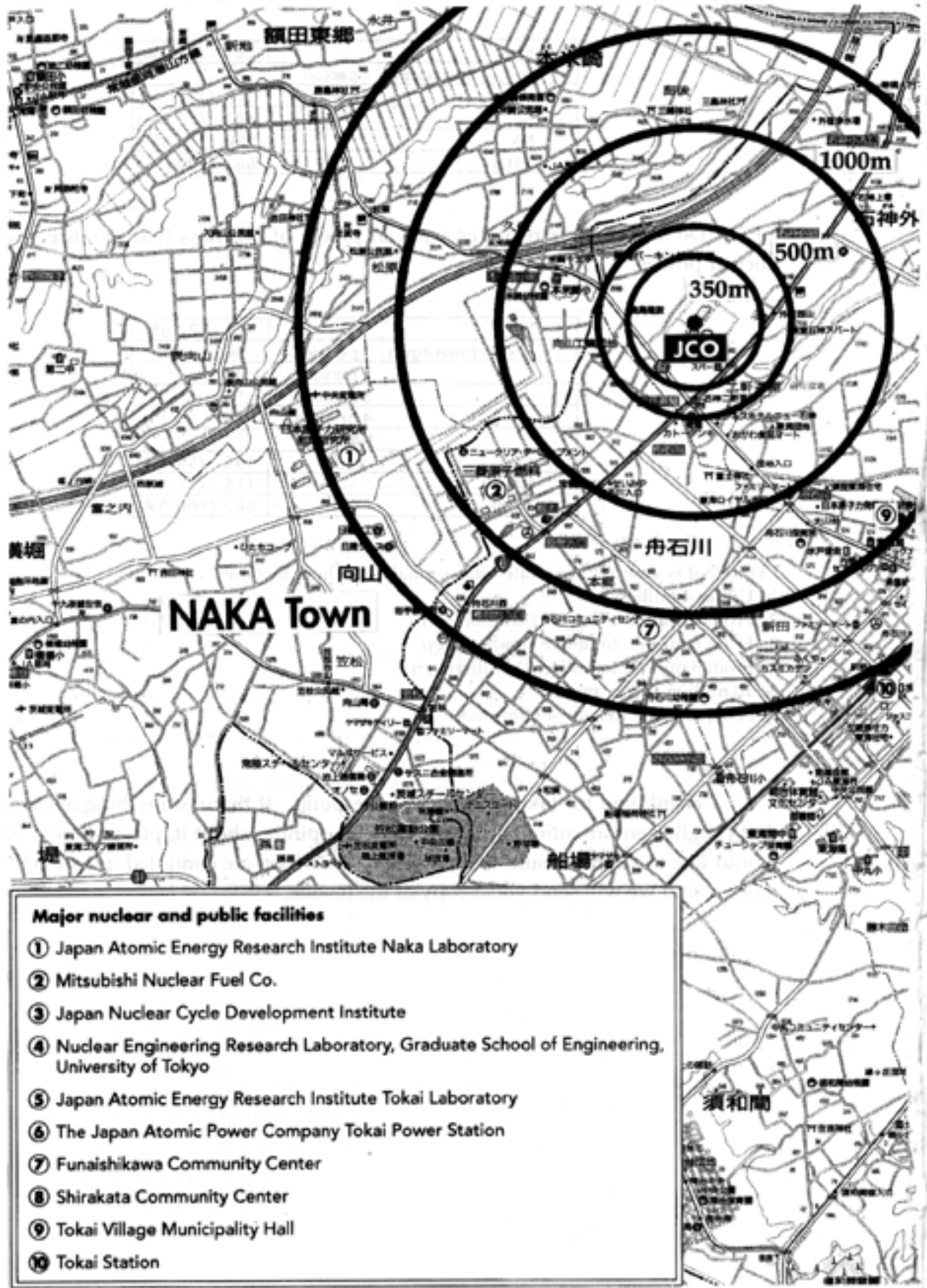
* F8: What is your approximate total annual household income?

1. Under 4 million yen.
2. From 4 million to under 6 million yen.
3. From 6 million to under 8 million yen.
4. From 8 million to under 10 million yen.
5. 10 million yen or more.

(Open question. Responses omitted.)

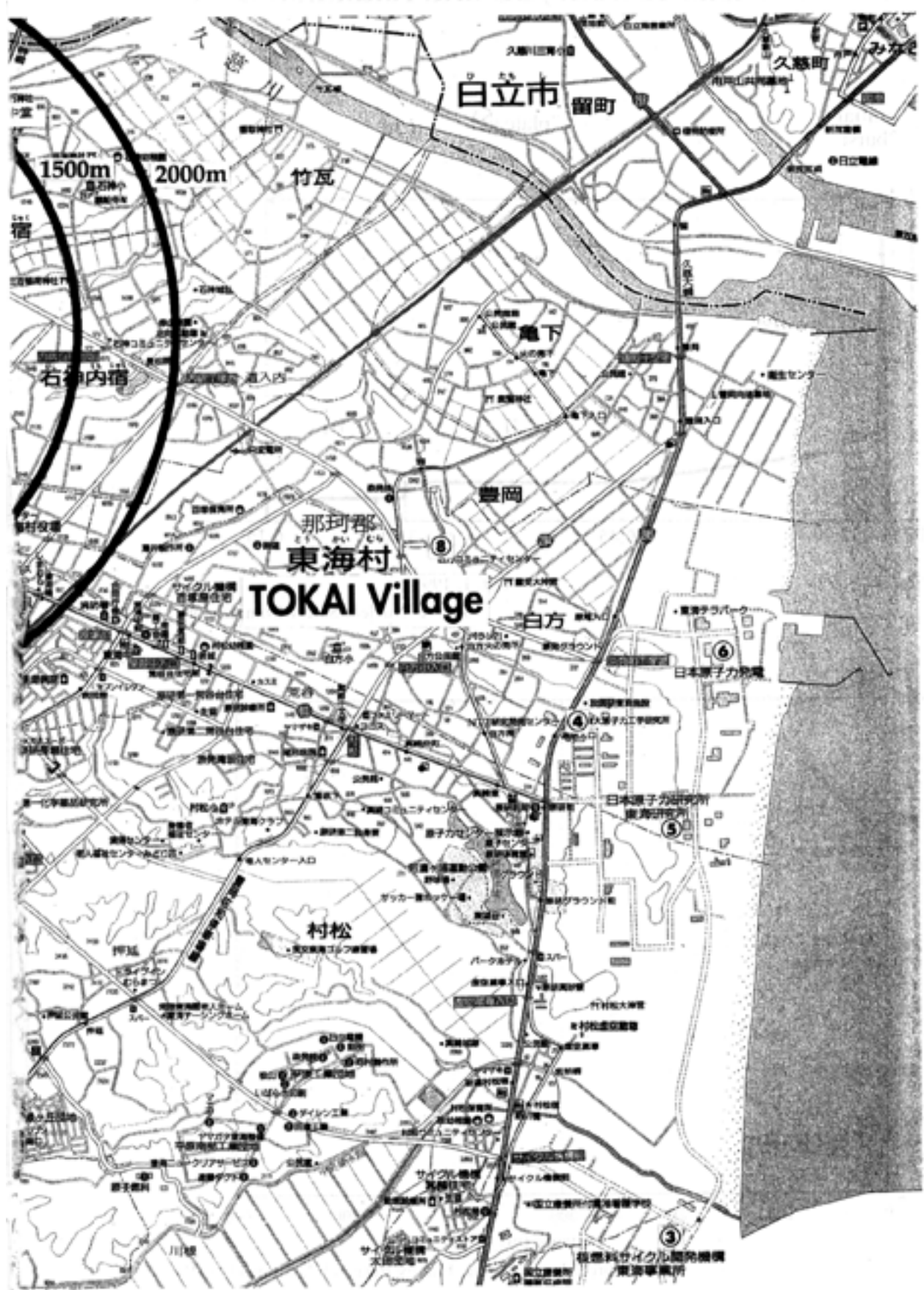
Thank you for taking the time to respond. If there is anything about this survey that caught your attention, or if you have an opinion about it, please note it here. If you would like to see the results of this survey after they are compiled, please tell the survey worker, and we will send you a copy of the results.

APPENDIX A: Map of JCO Co. and the Survey Area



Major nuclear and public facilities

- ① Japan Atomic Energy Research Institute Naka Laboratory
- ② Mitsubishi Nuclear Fuel Co.
- ③ Japan Nuclear Cycle Development Institute
- ④ Nuclear Engineering Research Laboratory, Graduate School of Engineering, University of Tokyo
- ⑤ Japan Atomic Energy Research Institute Tokai Laboratory
- ⑥ The Japan Atomic Power Company Tokai Power Station
- ⑦ Funaishikawa Community Center
- ⑧ Shirakata Community Center
- ⑨ Tokai Village Municipality Hall
- ⑩ Tokai Station



白立市

留町

久慈町

みなと

竹瓦

1500m

2000m

右神内宿

龜下

豊岡

那珂郡

東海村

TOKAI Village

白方

日本原子力発電

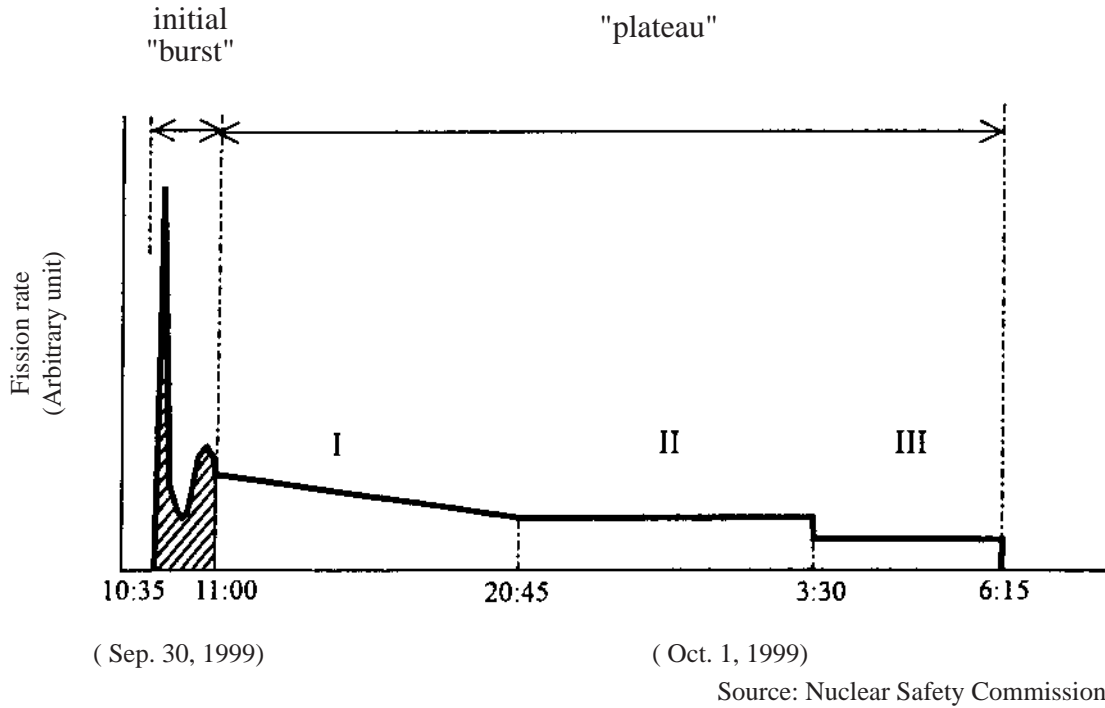
日本原子力研究所
東海研究所

村松

核燃料サイクル開発機構
東海事業所

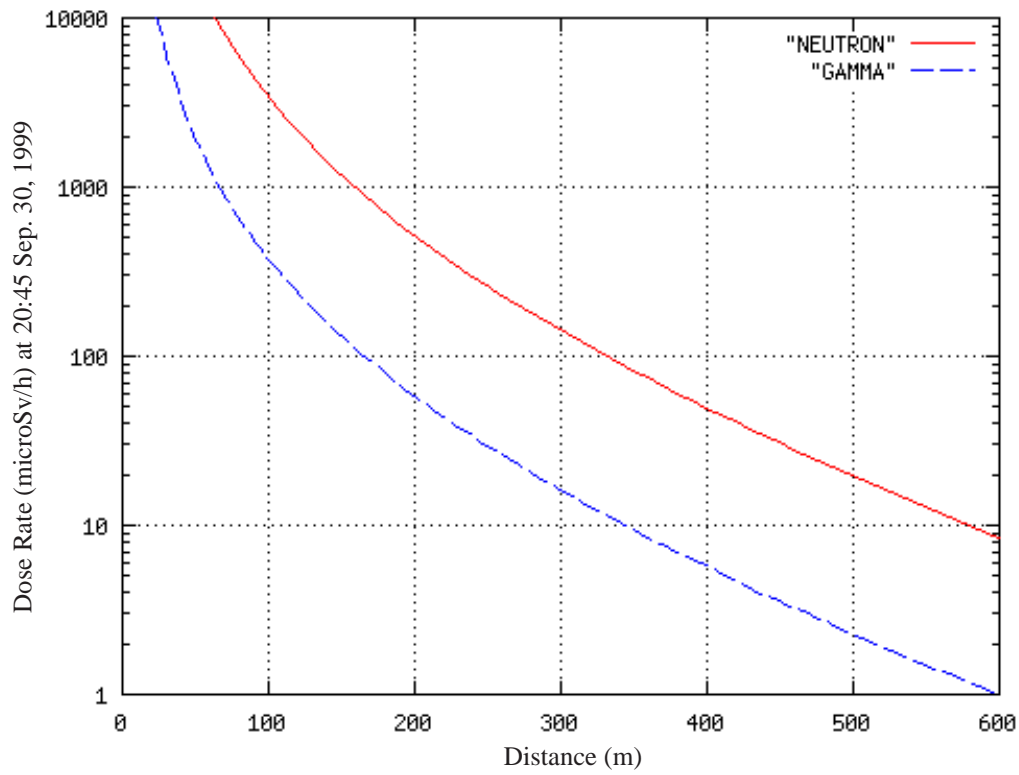
APPENDIX B: Distance from JCO and Radiation Dose

Fig. 1



Source: Nuclear Safety Commission

Fig. 2



Source: Japan Atomic Energy Research Institute (JAERI)

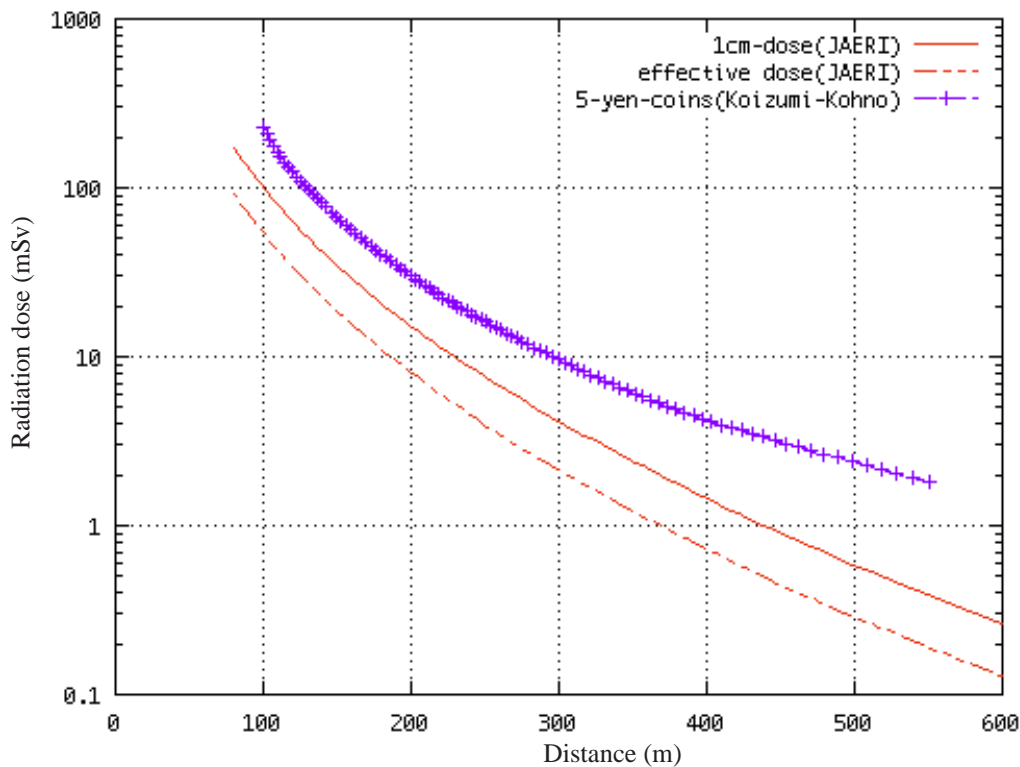
The Japan Atomic Energy Research Institute (JAERI) estimated dependence of fission rate on time (Fig. 1), and collected data of neutrons and gamma-ray measurements in the vicinity of the JCO plant (Fig 2). Based on those results, the institute then calculated the “1cm-dose” and “effective dose” which were released on 4 November 1999 by the former Science and Technology Agency (STA) as an estimate of local residents' exposure dose (Fig 3).

A separate calculation of radiation dose was reported by Yoshinobu Koizumi (Isotope Center, University of Tokyo) and Masuchika Kohno (Department of Nuclear Engineering, Kyoto University) in the 17 August 2000 issue of Nature (Vol 406, p. 693). They measured Zn 65 produced in 5-yen coins collected from nearby households and calculated radiation doses from the disintegration rates they determined. Their results are also presented in Fig. 3.

A revised effective dose estimation was released by the STA on 31 January 2000. This time, shielding effects and other factors were taken into consideration. On 13 October 2000, STA reported an increase in its list of exposed people, but the estimated radiation dose was not revised (see Appendix C).

CNIC considers that accurate calculations of radiation dose cannot be obtained at the present stage due to the lack of necessary information. There is an urgent need for disclosure of information and refined studies based on such data.

Fig. 3



APPENDIX C: Exposure Dose Estimate by the Science and Technology Agency (STA)

Exposure Dose Estimate Released by the former STA on 13 Oct. 2000

Description of the exposed people		number	Dose
Nuclear-related employees		172	
JCO employees directly involved in the process leading to the accident (measured)		3	16-20 GyEq ¹⁾ 6.0-10 GyEq ²⁾ 1-4.5 GyEq ³⁾
Employees involved in containing criticality (extraction of coolant etc.) (measured)		18	3.8-48 mSv
Employees involved in containing criticality (ones who poured borate solution) (measured)		6	0.7-3.5 mSv
Others at the site at the time of the accident	(measured)	49	0.6-48 mSv
	(estimated)	96	0.06-17 mSv
Accident response task-force members		260	
Employees of government associated Japan Atomic Energy Research Institute and Japan Nuclear Cycle Development Institute (measured)		56	0.1-9.2 mSv
Fire fighters involved in the rescuing of the three JCO employees (measured)		3	4.6-9.4 mSv
Officials of local governments (estimated)		167	0.0002-7.2 mSv
Officials of the central government (estimated)		8	0.49-2.1 mSv
Media (estimated)		26	0.014-2.6 mSv
Citizens in the locality at the time of the accident		235	
Local residents (measured)		7	6.7-16 mSv
Residents and area employees (estimated)		200	0.01-21 mSv
Temporary transients (estimated)		28	0.01-3.8 mSv
TOTAL		667	

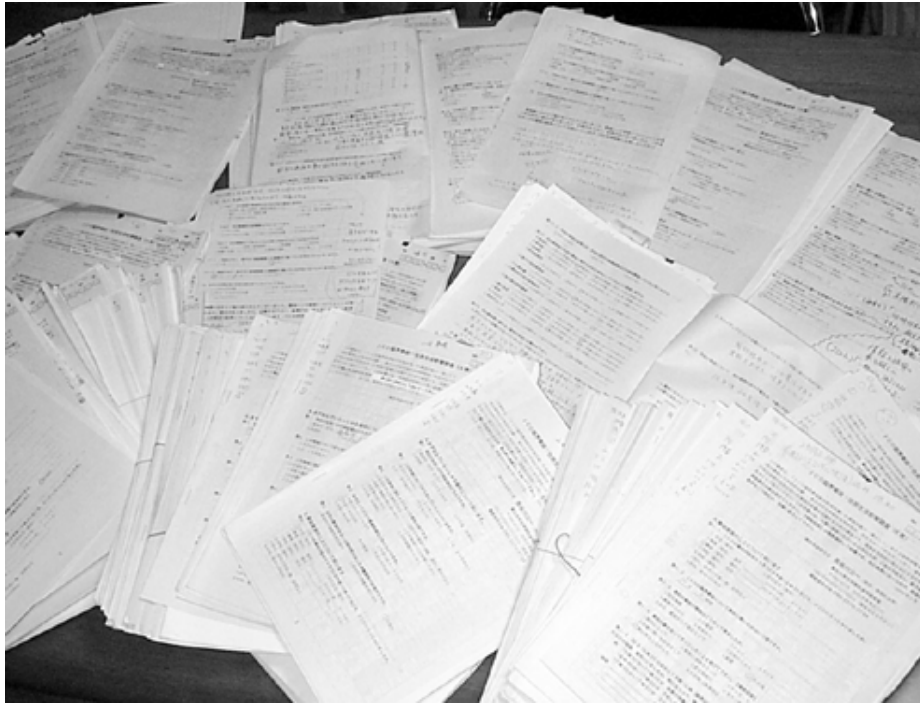
1) Mr. Ouchi, died on 21 December, 1999

2) Mr. Shinohara, died on 27 April, 2000

3) Mr. Y okokawa, left hospital on 20 December, 1999

The government reviewed its exposure dose estimation twice, and yet doubts remain over the scientific validity of the calculations (see Appendix B). After releasing its final estimation in January 2000, the government began to promote its claim that no health effects will be experienced from exposure under 200 mSv, an arbitrary figure insufficient scientific reasoning.

APPENDIX D: Photos from the Field Survey



(Left)
Contrary to prior expectations of the researchers, local residents were eager to express what they had experienced. 12 February, 2000
Ishigami-tojyuku, Tokai Village
(Photo courtesy of Ibaraki Newspaper)

(Above)
The open question sections were filled with expressions of anger and anxiety. (Photo courtesy of Anti-Nuke Ibaraki Action Coalition)

(Below)
The JCO Plant.
(Photo courtesy of Kenji Higuchi.)



APPENDIX E: Media Coverage of the Field Survey

Many newspapers were interested in this survey and reported in detail each step of the survey: that it was about to begin; that it began; the report session held locally; and suggestions to the government based on the survey results.

TOKYO Newspaper ,
30 April, 2000
Survey of Effects on Local Residents' Lives:
60% Worried about Health Effects:
40% Desire Co-existence:
Gap Between Reality and Hope




Photo: Prof. Hasegawa reporting on the survey results to local residents.

YOMIURI Newspaper,
Ibaraki Edition,
13 February, 2000
Specific Symptoms Surveyed: Citizens' Group Begins Survey of Effects on Local Residents




Photo: Local resident (on left) responds to questions asked by an interviewer.

ASAHI Newspaper, Ibaraki Edition,
30 April, 2000
Survey of JCO Accident's Effects on Daily Life:
Strong Mental Anguish:
"Radiation Effects" Still Worrisome



ASAHI Newspaper, Ibaraki Edition,
10 February, 2000
Criticality Accident: Citizens' Group Conducts Residents' Survey: Health Conditions, Effects on Daily Life, Governments' Responses



The fallout from Tokaimura

Japan's nuclear power quandary shows power of public opinion

By Koichi Hasegawa
and Jeffrey Broadbent

In recent months, prompted by a string of accidents that revealed startling corporate and government neglect, the Japanese government's stance on nuclear power has undergone a sea change. This change holds enormous implications for setting safer global standards on the use of nuclear power, and for the development of alternative energy sources.

Safer Japanese nuclear regulatory laws and practices will provide a model for the rest of Asia's rush toward nuclear power. By curbing use of both nuclear power and oil, Japan will have to develop safer energy sources, such as wind, solar and fuel cells, as well as energy conservation. The resulting new technologies should have beneficial payoffs for the global environment.

We in the United States should encourage Japan in this direction. The Japanese experience makes us in Minnesota wonder how risky are our own nuclear power practices, and how sustainable our own energy sources overall?

Over the past two months, the Japanese government announced rethinking its entire energy supply strategy, possibly canceling at least five of 20 planned nuclear plants. Electric power companies went even further, saying they would build no more than 13 ad-

ditional nuclear plants. After admitting sloveness in responding to last fall's Tokaimura nuclear fuel accident, the government revoked the offending nuclear company's license and canceled out a nuclear emergency drill at a reactor. It also passed new nuclear safety laws, improved the regulatory bureaucracy, and postponed the use of imported recycled plutonium fuel.

The catalyst for these changes was last fall's Tokaimura accident. Under company orders, workers had been using short-cut methods to mix nuclear fuel. This caused a chain reaction and bursts of radiation. Two workers have died as a result; more than 400 people were irradiated, with uncertain consequences.

The town of Tokaimura, host of Japan's first public nuclear power plant and many other nuclear power facilities, should have been a center of safe practice. But the accident revealed corporate illegality and dismal government regulation, oversight and disaster preparation. Neither company nor local government had an effective emergency plan.

The Tokaimura accident was only the latest in a string of Japanese nuclear accidents: the 1995 sodium leak and fire at the Mosele reactor, a 1997 explosion at another Tokaimura plant, identification of data about incidents. Moreover, government fumbling of response to the Kobe earth-

quake and the financial crisis added to public unease.

These incidents have shattered public confidence in government and corporate nuclear oversight. The Japanese government claims that most people still support its nuclear power expansion program. In a recent poll, though, only 11 percent supported government plans to increase nuclear power. One-third wanted to reduce or stop nuclear power. People feeling "very uneasy" about nuclear power went from one-fifth before the Tokaimura accident to over half afterward (Japan Public Opinion Corp., Oct. 23 poll). A majority preferred non-nuclear options, such as solar, wind generation and conservation. Clearly, the Japanese public does not buy government arguments that nuclear power is safe, necessary and ecological.

The reigning Liberal Democratic Party fears an electoral backlash if it does not deal with the dangers of nuclear power. Given its 1993 electoral loss, the party's current rule is no longer so certain. Moreover, public resistance has made the siting of nuclear plants increasingly problematic. In 1996, the residents of Maki, in Japan's first citizen referendum, rejected a nuclear plant. This spring, the governor of Mie Prefecture rejected a long-planned nuclear power plant.

Japan's basic problem is that it has no independent nuclear reg-

ulatory "watchdog," and no law with teeth. There have been no criminal charges in the Tokaimura accident. In the United States, the autonomous Nuclear Regulatory Commission (NRC) imposes strong oversight and disposes preparation. Japan's Nuclear Safety Council, in contrast, is tiny in budget and staff (1 percent of NRC) and lacks regulatory power. Pro-nuclear agencies "regulate" the plants.

The situation demands reform. To rebuild public support, the government must make a truly independent nuclear power regulatory and enforcement agency, with a large budget and staff. It must pass and enforce strict laws and regulations covering all phases of nuclear power, with strict criminal sanctions for violation.

There must be full public disclosure of information on all nuclear operations and accidents. The government must encourage and reward "whistle-blowers" to report illegal practices, and permit citizen teams to inspect plants and to file lawsuits when necessary.

Such reforms run contrary to the "we know better" attitude of Japan's bureaucrats. But otherwise, citizen resistance may well halt Japan's nuclear power program.

Japan's nuclear power quandary illustrates the growing power of public opinion — a healthy trend for Japanese democracy. The radioactive cloud from To-



Agence France-Press
A little boy at a community center in Japan is checked for exposure to radiation shortly after 150 people were forced to leave Tokaimura following a Sept. 30 accident at a uranium plant.

University of Minnesota, is author of the book "Environmental Politics in Japan: Network of Power and Protest." Koichi Hasegawa teaches sociology at Teikoku University in Japan.

— Jeffrey Broadbent, an associate professor of sociology at the

About the Authors

Koichi HASEGAWA is a professor of environmental sociology at the Graduate School of Arts and Letters, Tohoku University. He specializes in environmental sociology, social movement and social change. He is a board member of the International Sociological Association's Research Committee 24 "Environment and Society". He was a visiting scholar of sociology at University of California, Berkeley in the U.S.A. during 1990-91, and in 1993. He has written a number of articles, including "Global Climate Change and Japanese Nuclear Policy" in *International Journal of Japanese Sociology*, No.8, 1999. His publications include *Vision versus Results in a Large-scale Industrial Development Project in the Mutsu-Ogawara District* (1998, University of Tokyo Press, co-author, in Japanese) and *A Choice for Post-Nuclear Society: The Age of New Energy Revolution* (1996, Shinyo-sha, in Japanese).

E-mail: hasegawa@sal.tohoku.ac.jp

Yuko TAKUBO is an assistant professor of sociology at the College of Environment and Disaster Research, Fuji Tokoha University. Her primary interests are the study of social movements and political processes in general, with particular interest in environmental and energy issues. Her written work includes "Emergence, Development and the Success of 'Association for Doing the Referendum' in Maki" *Journal of Environmental Sociology*, vol.3, 1997. She is currently researching the dynamics between social movements and conventional politics with special reference to nuclear energy issues.

E-mail: takubo@fuji-tokoha-u.ac.jp

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E-mail: cnic-jp@po.ijnet.or.jp

URL: <http://www.cnic.or.jp>