Human Suffering Effects of Nuclear Tests at Semipalatinsk, Kazakhstan: Established On the Basis of Questionnaire Surveys

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Semipalatinsk/Effects of Radiation Exposure/Hiroshima and Nagasaki.

The main objective of the present paper is to explore the effects of radiation exposure on the inhabitants near the Semipalatinsk Nuclear Tests Site (SNTS), Kazakhstan. Our research team of the Research Institute for Radiation Biology and Medicine, Hiroshima University, started in 2002 to conduct a field research study using questionnaire surveys. The present paper attempts to clarify health effects and mental problems on the inhabitants by using our questionnaire surveys.

Among the responses to our survey, the present paper focuses upon responses to the questions concerning their health and mental problems. The data in Semipalatinsk have been compared with the results obtained in a similar survey conducted by Hiroshima and Nagasaki cities. The results show: (1) 33% of the residents replied that they felt bad or had very bad health conditions. (2) 70% of the residents strongly recognized a causal relationship between their bad health conditions and the nuclear tests. (3) The diseases that over 30% of respondents possessed are arthralgia/ lower back pain/ arthritis, high-blood pressure, heart disease and digestive system disease. (4) Acute radiation injuries from 1949 to 1962 that over 20% of respondents experienced were headaches and general malaise. (5) Concerning their mental condition, 22% of respondents felt easily frustrated and agitated and 21% experienced nightmares.

INTRODUCTION

As is generally known, at Semipalatinsk Nuclear Tests Site (SNTS) in the republic of Kazakhstan, 456 nuclear tests were carried out from 1949 to 1989, including 111 atmospheric explosions between 1949 and 1963.1) Because of those tests, according to the Kazakh government, approximately 1.6 million people suffered from the tests, and about 1.2 million people are still now troubled with the aftereffects.2)

Our research team at the Research Institute for Radiation Biology and Medicine, Hiroshima University started questionnaire survey near the SNTS in 2002. The survey questions were prepared on the basis of the questionnaires of the former surveys by the former Ministry of Health and Welfare, municipality of Hiroshima and Nagasaki and Hidankyo (Japan Confederation of A- and H- Bomb Sufferers Organizations). We also collected testimonies concerning their experiences and feelings about the nuclear tests. They were the replies to an open-ended question appended to the survey questionnaire. To collect and leave behind these testimonies after they pass away is one of our research objectives.

The present paper focuses mainly upon the health conditions and mental diseases of the residents near the SNTS. For this research, we have tried to clarify their health and mental problems on the basis of the answers to the questionnaire survey. We expect to show an important part of the whole picture of the human suffering effects of the nuclear tests through this attempt. This study is the first attempt at the clarification of the effects of radiation exposure through a questionnaire survey.

In order to examine the effects of radiation exposure, we also try to demonstrate differences between the results in Semipalatinsk surveys and those in Hiroshima and Nagasaki surveys. Of course there are differences between Hiroshima/ Nagasaki and Semipalatinsk; the former is the real atomic-

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bomb damage and the latter is the nuclear tests. The radiation exposure in the former is instantaneous and direct, but the latter is protracted, chronic and indirect. Nevertheless, there are some points common to both. In this paper we try to highlight these points.

**DATA AND METHODS**

Our questionnaire surveys were conducted three times from 2002 to 2004 in ten villages near the SNTS. They are Saryzhal, Dolon, Karauyl, Kainar, Burus, Bodene, Mostik, Cheremushki, Znamenka and Grachi with different radiation levels (see Fig. 1 and Fig. 2). The total number of replies was 706 and that of testimonies is 468. The details of the results of the questionnaire surveys are shown in Table 1. The present paper uses two sets of data, 606 answers from the three surveys and 199 testimonies collected in the 2002 and 2003 surveys, excluding those from Kokpekti used as a reference.
control. According to the previous studies, Dolon, Bodene, Saryzhal, Mostik, Cheremushki were exposed to high radiation doses and Karauyl, Kainar, Znamenka, Burus received rather low doses (Table 2). The researchers of radiation dosimetry continue to study the estimated radiation dose in the Semipalatinsk area.

Table 3 shows the part of the 20 questions in the questionnaire discussed in the present paper. As a general rule, study subjects are those above the age of 45, who resided in the ten villages between 1949 and 1962 and who still reside there.

We took special care to protect the human rights and privacy of respondents. In addition, we obtained their informed consent to publish their responses and the results of our analysis of their information.

For better understanding of the effects of radiation exposure at Semipalatinsk, the authors attempted the comparison of the Semipalatinsk results with those of the surveys in Hiroshima and Nagasaki. The data are the results of two investigations conducted by Nagasaki city in 1999–2000 and Hiroshima city in 2002.

### RESULTS AND DISCUSSION

#### Age and sex of the subjects

Mean age of the subjects in the 2002 survey was 61.6 ± 6.8 years old. There were 84 males and 86 females excluding 1 person who gave no answer to the gender question. The average age of the subjects in the 2003 survey was 65.4 ± 7.1 years old. There were 115 males, 136 females and 1 unknown. The mean age of the subjects in the 2004 survey was 65.1 ± 9.3 years. There were 120 males and 160 females.

#### Health effects on the residents

1. **Present health condition**

We asked the residents near the SNTS their general health condition. As a result, 33% of respondents (198 of 606 persons) answered bad or very bad. 59% of respondents (358...
Table 3. Summary of the questions.

Question 1: How is your present health condition? For those answering this question, please circle the appropriate numbers from the following choices.

|   | 1. Very good | 2. Good | 3. Normal | 4. Bad | 5. Very bad |
|---|-------------|--------|-----------|-------|-------------|

For those who selected 4 or 5, proceed on to questions.

Question 2: If you do not mind, could you write down the name of your main ailment?

Question 3: If there are any other corresponding disease names, please select from below.

1. High-blood pressure  
2. Heart disease  
3. Eye disease  
4. Dermatological disease  
5. Digestive system disease  
   (gastrointestinal tract, gall bladder, pancreas)  
6. Liver disease  
7. Bone fracture and bone related disease  
8. Respiratory disease (lung/bronchus)  
9. Diabetes  
10. Anemia and blood related disease  
11. Arthralgia, lower back pain, arthritis  
12. Mental disease  
13. Ear, nose disease  
14. Thyroiditis  
15. Others ( )

Question 4: Do you think that the above mentioned disease was caused by nuclear test (radiation)?

1. I think so  
2. I do not think so  
3. I am not sure

Question 5: Have you had the following symptoms during the period between 1949 and 1962? Please circle the appropriate number from the following choices. Note that 1962 was the last year of the on-land nuclear test.

|   | Year | month | day of duration |
|---|------|-------|-----------------|
1. Headaches |  
2. General malaise |  
3. Nausea |  
4. Lack of appetite |  
5. Gastrointestinal problem, diarrhea |  
6. Hair loss |  
7. Dermatological irritation, mucositis |  
8. Bleeding |  
9. Fever |  
10. Other symptoms |  

Question 6: Have you experienced the following conditions from the period between 1949 and 1989? Circle the appropriate number from the following choices.

1. Loss of stamina  
2. Nightmare  
3. Fear from light and loud sounds  
4. Easily frustrated and agitated  
5. Feeling depressed  
6. Others (Please specify below)
persons) answered normal and only 7% (45 persons) answered good or very good. The result of comparison between the present health condition in Semipalatinsk and those in Hiroshima and Nagasaki is shown in Table 4. The percentages of bad health condition in Hiroshima and Nagasaki are somewhat higher than in Semipalatinsk. How-

### Table 4. Comparison between the present health condition in Semipalatinsk and those in Hiroshima and Nagasaki.

|                  | Semipalatinsk | Hiroshima/Nagasaki |
|------------------|---------------|---------------------|
| Very Good        | 0.5% (3)      | 0.6% (31)           |
| Good             | 6.9% (42)     | 3.2% (165)          |
| Normal           | 59.1% (358)   | 39.0% (1983)        |
| Bad              | 31.2% (189)   | 45.8% (2330)        |
| Very Bad         | 1.5% (9)      | 8.9% (450)          |
| No Answer        | 0.8% (5)      | 2.4% (123)          |
| Total            | 606           | 5082                |

### Table 5. The causal relationship between the bad health conditions and nuclear tests.

| Village    | I think so | I do not think so | I am not sure | No answer | Total |
|------------|------------|-------------------|---------------|-----------|-------|
| Saryzhal   | 88 (88.9%) | 3                 | 3             | 5         | 99    |
| Dolon      | 53 (67.1%) | 1                 | 22            | 3         | 79    |
| Karauyl    | 46 (92.0%) | 1                 | 2             | 1         | 50    |
| Kainar     | 60 (81.1%) | 0                 | 12            | 2         | 74    |
| Burus      | 34 (68.0%) | 2                 | 12            | 2         | 50    |
| Bodene     | 39 (78.0%) | 0                 | 11            | 0         | 50    |
| Mostik     | 1 (2.0%)   | 2                 | 35            | 12        | 50    |
| Cheremushki| 41 (82.0%) | 0                 | 8             | 1         | 50    |
| Znamenka   | 47 (63.5%) | 0                 | 18            | 9         | 74    |
| Grachi     | 15 (50.0%) | 1                 | 13            | 1         | 30    |
| Total      | 424 (70.0%)| 10 (1.7%)         | 136 (22.4%)   | 36 (5.9%) | 606   |

### Table 6. Present symptoms.

|                  | Saryzhal | Dolon | Karauyl | Kainar | Burus | Bodene | Mostik | Cheremushki | Znamenka | Grachi | Total |
|------------------|----------|-------|---------|--------|-------|--------|--------|-------------|----------|--------|-------|
| High-blood pressure | 66       | 38    | 25      | 40     | 14    | 16     | 20     | 15          | 32       | 14     | 280   |
| Heart disease    | 48       | 37    | 36      | 32     | 19    | 19     | 12     | 14          | 32       | 11     | 260   |
| Eye disease      | 35       | 21    | 21      | 23     | 2     | 4      | 6      | 9           | 9        | 7      | 137   |
| Dermatological disease | 25      | 12    | 2       | 2      | 1     | 8      | 1      | 1           | 1        | 0      | 61    |
| Digestive system disease | 38      | 21    | 19      | 30     | 14    | 17     | 13     | 17          | 26       | 5      | 200   |
| Liver disease    | 16       | 18    | 14      | 12     | 8     | 4      | 3      | 3           | 10       | 2      | 90    |
| Bone fracture and bone related disease | 2       | 0     | 0       | 0      | 4     | 2      | 1      | 0           | 1        | 1      | 15    |
| Respiratory disease | 26      | 22    | 2       | 14     | 4     | 0      | 5      | 3           | 6        | 1      | 83    |
| Diabetes         | 1        | 2     | 4       | 2      | 2     | 0      | 1      | 0           | 2        | 0      | 14    |
| Anemia and blood related disease | 15      | 6     | 3       | 9      | 0     | 0      | 0      | 0           | 3        | 0      | 33    |
| Arthralgia, lower back pain, arthritis | 68.7%   | 63.3% | 34.0%   | 81.1%  | 54.0% | 72.0%  | 70.0%  | 66.0%       | 73.0%    | 43.3%  | 64.9% |
| Mental disease   | 16       | 14    | 17      | 14     | 12    | 7      | 12     | 12          | 16       | 20.0%  | 18.8% |
| Ear, nose disease | 22      | 7     | 6       | 24     | 9     | 9      | 4      | 1           | 11       | 1      | 93    |
| Thyroiditis      | 26       | 17    | 6       | 11     | 4     | 7      | 10     | 3           | 8        | 2      | 94    |
| Others           | 17       | 5     | 0       | 1      | 25    | 16     | 16     | 10          | 19       | 7      | 116   |
|                  | 17.2%    | 6.3%  | 0%      | 1.4%   | 50.0% | 32.0%  | 32.0%  | 20.0%        | 25.7%    | 23.3%  | 19.1% |

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ever, we can point out that the inhabitants in Semipalatinsk share the perception of their bad health condition with those in Hiroshima and Nagasaki.

(2) Causal relationship between health condition and the nuclear tests

On average, 70% of the residents (424 persons) strongly recognize a causal relationship between their bad health condition and the nuclear tests (Table 5). In the cases of Saryzhal, Karauyl, Kainar and Cheremushki, over 80% of the respondents recognize the causal relationship between the phenomena. Saryzhal and Cheremushki were regarded as high radiation dose village, and Karauyl and Kainar were considered to receive rather a low dose. In addition, in the case of Mostik, regarded as a high radiation dose village, few persons admitted a causal relationship between the phenomena. We could not detect a causal relationship between their recognition and radiation dose. However, we have to point out that in the Mostik case, very few (only 4% of respondents) denied the causal relationship. Furthermore, more than half of the testimonies expressed the relationship between bad health condition and nuclear tests (see Appendix).

The residents near the SNTS are still troubled with ill health. Most of the residents recognize strongly that their bad health condition is caused by the nuclear tests.

(3) The diseases at present

The result of the survey of present symptoms is shown in Table 6. The diseases that over 30% of respondents possessed are arthralgia/ lower back pain/ arthritis, high-blood pressure, heart disease and digestive system disease. Table 7 shows the result of the comparison with the Hiroshima and Nagasaki surveys. The ratio of those having arthralgia/ lower

### Table 6. The diseases at present

| Disease                                | Semipalatinsk | Hiroshima and Nagasaki |
|-----------------------------------------|---------------|------------------------|
| Arthralgia, lower back pain, arthritis | 64.9% (393)   | 53.6% (5867)           |
| High-blood pressure                     | 46.2% (280)   | 38.3% (4187)           |
| Eye disease                             | 22.6% (137)   | 33.3% (3642)           |
| Ear, nose disease                       | 15.3% (93)    | 18.1% (1975)           |
| Heart disease                           | 42.9% (260)   | 20.5% (2244)           |
| Anemia and blood related disease        | 5.4% (33)     | 12.9% (1415)           |
| Respiratory disease                     | 13.7% (83)    | 11.8% (1295)           |
| Diabetes                                | 2.3% (14)     | 12.7% (1386)           |
| Liver disease                           | 14.9% (90)    | 10.6% (1163)           |
| Bone fracture and bone related disease  | 2.5% (15)     | 11.1% (1210)           |

### Table 7. The diseases at present

| Disease                                | Semipalatinsk | Hiroshima and Nagasaki |
|-----------------------------------------|---------------|------------------------|
| Arthralgia, lower back pain, arthritis | 64.9% (393)   | 53.6% (5867)           |
| High-blood pressure                     | 46.2% (280)   | 38.3% (4187)           |
| Eye disease                             | 22.6% (137)   | 33.3% (3642)           |
| Ear, nose disease                       | 15.3% (93)    | 18.1% (1975)           |
| Heart disease                           | 42.9% (260)   | 20.5% (2244)           |
| Anemia and blood related disease        | 5.4% (33)     | 12.9% (1415)           |
| Respiratory disease                     | 13.7% (83)    | 11.8% (1295)           |
| Diabetes                                | 2.3% (14)     | 12.7% (1386)           |
| Liver disease                           | 14.9% (90)    | 10.6% (1163)           |
| Bone fracture and bone related disease  | 2.5% (15)     | 11.1% (1210)           |

### Table 8. Present symptoms (the 2003 survey)

| Disease                                | Exposed area (n=202) | Control area (n=50) | p   |
|-----------------------------------------|----------------------|---------------------|-----|
| High-blood pressure                     | 91 (45.0%)           | 11 (22.0%)          | 0.003 |
| Heart disease                           | 94 (46.5%)           | 9 (18.0%)           | 0.001 |
| Respiratory disease                     | 25 (12.4%)           | 8 (16.0%)           | NS  |
| Diabetes                                | 3 (1.5%)             | 0 (0%)              | NS  |
| Thyroiditis                             | 28 (13.9%)           | 0 (0%)              | 0.020 |
| Digestive system disease                | 56 (27.7%)           | 3 (6.0%)            | 0.001 |
| Liver disease                           | 44 (21.8%)           | 2 (4.0%)            | 0.004 |
| Anemia and blood related disease        | 6 (3.0%)             | 3 (6.0%)            | NS  |
| Mental disease                          | 12 (5.9%)            | 1 (2.0%)            | NS  |
| Bone fracture and bone related disease  | 2 (1.0%)             | 1 (2.0%)            | NS  |
| Arthralgia, lower back pain, arthritis  | 96 (47.5%)           | 23 (46.0%)          | NS  |
| Eye disease                             | 45 (22.3%)           | 11 (22.0%)          | NS  |
| Ear, nose disease                       | 25 (12.4%)           | 9 (18.0%)           | NS  |
| Others                                  | 2 (1.0%)             | 1 (2.0%)            | NS  |

NS: Not Significant
(authors’ emphasis)
back pain/ arthritis, high-blood pressure, heart disease, respiratory disease and liver disease was higher in the Semipalatinsk survey than that of the Hiroshima and Nagasaki surveys. However, we could not find large differences between Semipalatinsk and Hiroshima/Nagasaki. It can be safely said that people in Semipalatinsk have many symptoms in the same way and in the same degree as Hibakusha (A-bomb survivors) in Hiroshima and Nagasaki.

Table 8 shows the result of the 2003 survey. The prevalences of high-blood pressure, heart disease, arthralgia/ lower back pain/ arthritis, and digestive system disease are relatively higher than for other diseases. And the percentages of those who had high-blood pressure, heart disease, thyroiditis and digestive system disease in the exposed group is higher than those in the control group.

(4) Prevalence of acute radiation injury from 1949 to 1962

Table 9 shows the result of acute radiation injury from 1949 to 1962. Table 10 shows the comparison with those of Hiroshima and Nagasaki. The ratios of those who had fever, dermatological irritation, or mucositis are the almost the same. We can point out that the residents in Semipalatinsk suffered from acute radiation injury in the same way as the Hiroshima and Nagasaki Hibakusha.

Table 9. Prevalence of acute radiation injury from 1949 to 1962.

|                  | Saryzhal | Dolon | Karauly | Kainar | Burus | Bodene | Mostik | Cheremushki | Znamenka | Grachi | Total |
|------------------|----------|-------|---------|--------|-------|--------|--------|-------------|----------|--------|-------|
| Headaches        | 52       | 43    | 25      | 38     | 1     | 2      | 0      | 2           | 12       | 1      | 176   |
| 52.5%            | 54.4%    | 50.0% | 51.4%   | 2.0%   | 4.0%  | 0%     | 4.0%   | 16.2%       | 3.3%     | 29.0%  |
| General malaise  | 42       | 41    | 16      | 39     | 1     | 3      | 0      | 1           | 15       | 1      | 159   |
| 42.4%            | 51.9%    | 32.0% | 52.7%   | 2.0%   | 6.0%  | 0%     | 2.0%   | 20.3%       | 3.3%     | 26.2%  |
| Nausea           | 27       | 29    | 11      | 19     | 0     | 3      | 2      | 1           | 12       | 0      | 104   |
| 27.3%            | 36.7%    | 22.0% | 25.7%   | 0%     | 6.0%  | 4.0%   | 2.0%   | 16.2%       | 0%       | 17.2%  |
| Lack appetite    | 13       | 19    | 1       | 15     | 1     | 4      | 1      | 1           | 11       | 2      | 68    |
| 13.1%            | 24.1%    | 2.0%  | 20.3%   | 2.0%   | 8.0%  | 2.0%   | 2.0%   | 14.9%       | 6.7%     | 11.2%  |
| Gastrointestinal| 10       | 16    | 1       | 9      | 0     | 2      | 0      | 1           | 6        | 1      | 46    |
| problem, diarrhea| 10.1%   | 20.3% | 2.0%    | 12.2%  | 0%    | 4.0%   | 0%     | 2.0%        | 8.1%     | 3.3%   | 7.6%  |
| Hair loss        | 14       | 10    | 9       | 14     | 0     | 0      | 0      | 0           | 10       | 0      | 57    |
| 14.1%            | 12.7%    | 18.0% | 18.9%   | 0%     | 0%    | 0%     | 0%     | 13.5%       | 0%       | 9.4%   |
| Dermatological   | 5        | 8     | 1       | 10     | 0     | 0      | 0      | 0           | 1        | 0      | 25    |
| irritation, mucositis | 5.1%  | 10.1% | 2.0%    | 13.5%  | 0%    | 0%    | 0%     | 0%          | 1.4%     | 0%     | 4.1%  |
| Bleeding         | 11       | 10    | 2       | 9      | 0     | 1      | 2      | 0           | 3        | 0      | 38    |
| 11.1%            | 12.7%    | 4.0%  | 12.2%   | 0%     | 2.0%  | 4.0%   | 0%     | 4.1%        | 0%       | 6.3%   |
| Fever            | 10       | 4     | 1       | 14     | 0     | 0      | 0      | 0           | 5        | 0      | 34    |
| 10.1%            | 5.1%     | 2.0%  | 18.9%   | 0%     | 0%    | 0%     | 0%     | 6.8%        | 0%       | 5.6%   |
| Other symptoms   | 0        | 1     | 10      | 1      | 8     | 11     | 9      | 8           | 7        | 6      | 61    |
| 0%               | 1.3%     | 20.0% | 14.0%   | 16.0%  | 22.0% | 18.0%  | 16.0%  | 9.5%        | 20.0%    | 10.1%  |

Table 10. Comparison between the acute radiation injuries in Semipalatinsk and those in Hiroshima and Nagasaki.

|                        | Semipalatinsk | Hiroshima/Nagasaki |
|------------------------|---------------|-------------------|
| Fever                  | 5.6% (34)     | 6.2% (674)        |
| Dermatological irritation, mucositis | 4.1% (25) | 3.9% (431) |
| Gastrointestinal problem, diarrhea | 7.6% (46) | 15.7% (1717) |
| Other symptoms         | 10.0% (61)    | 7.7% (838)        |

(multiple answers)

Mental diseases of the residents

Table 11 shows the mental condition of the residents from 1949 and 1989. 22% of respondents (134 residents) felt frustrated/agitated. 23% (125 residents) experienced nightmare and 13% (81 persons) felt depressed. The percentages of those in the four villages; Saryzhal, Dolon, Karaul and Kainar were higher than in other villages. We could not demon-
strate a causal relationship between their mental condition and radiation dose. Table 12 shows the results of comparison with those of Hiroshima. Judging from almost the same numerical ratios, both sets of people were troubled by nightmare and easily frustrated and agitated. It is pointed out that Hibakusha in Hiroshima and Nagasaki suffered from PTSD (posttraumatic stress disorder) as the aftereffects of radiation exposure. Taooka also reported on the possibility of the PTSD symptoms among the inhabitants in Semipalatinsk by using our 2003 surveys. We can safely say that not a few inhabitants around the SNTS have suffered from mental diseases. In addition, we indicate that 14 persons of 199 respondents mentioned suicide which relates to mental disease. We even came across in interviews with people accounts of many young people committing suicide. There are also other testimonies related to mental diseases. Those examples are shown in the Appendix.

### Table 11. Mental diseases of the residents from 1949 to 1989.

| Malignity                      | Saryzhal | Dolon | Karauyl | Kainar | Burus | Bodene | Mostik | Cheremushki | Znamenka | Grachi | Total |
|--------------------------------|----------|-------|---------|--------|-------|--------|--------|------------|----------|--------|-------|
| Loss of stamina                | 27       | 12    | 2       | 14     | 0     | 0      | 0      | 0          | 2        | 2      | 606   |
|                               | 27.3%    | 15.2% | 4.0%    | 18.9%  | 0%    | 0%     | 0%     | 0%         | 4.0%     | 2.7%   | 0%    |
| Nightmare                      | 48       | 16    | 19      | 28     | 0     | 0      | 2      | 1          | 11       | 0      | 125   |
|                               | 48.5%    | 20.3% | 38.0%   | 37.8%  | 0%    | 0%     | 4.0%   | 2.0%       | 14.9%    | 0%     | 20.6% |
| Fear from light and loud sounds| 12       | 12    | 7       | 13     | 0     | 0      | 0      | 1          | 3        | 0      | 48    |
|                               | 12.1%    | 15.2% | 14.0%   | 17.6%  | 0%    | 0%     | 0%     | 2.0%       | 4.1%     | 0%     | 7.9%  |
| Easily frustrated and agitated| 41       | 35    | 10      | 30     | 2     | 0      | 4      | 2          | 10       | 0      | 134   |
|                               | 41.4%    | 44.3% | 20.0%   | 40.5%  | 4.0%  | 0%     | 8.0%   | 4.0%       | 13.5%    | 0%     | 22.1% |
| Feeling depressed              | 17       | 26    | 2       | 21     | 2     | 1      | 2      | 2          | 8        | 0      | 81    |
|                               | 17.2%    | 32.9% | 4.0%    | 28.4%  | 4.0%  | 2.0%   | 4.0%   | 4.0%       | 10.8%    | 0%     | 13.4% |
| Others                         | 2        | 0     | 1       | 1      | 2     | 0      | 0      | 0          | 0        | 0      | 6     |
|                               | 2.0%     | 0%    | 2.0%    | 1.4%   | 4.0%  | 0%     | 0%     | 0%         | 0%       | 0%     | 1.0%  |

(multiple answers)

### Table 12. Comparison to Hiroshima for mental diseases.

|                         | Semipalatinsk | Hiroshima |
|-------------------------|---------------|-----------|
| Loss of stamina         | 9.7% (59)     | 27.6% (1067) |
| Nightmare               | 20.6% (125)   | 21.9% (849)   |
| Fear from light and loud sounds | 7.9% (48) | 29.4% (1140) |
| Easily frustrated and agitated        | 22.1% (134) | 21.3% (823)   |
| Feeling depressed        | 13.4% (81)    | 26.3% (1019) |
| Others                  | 1.0% (6)      | 8.9% (346)   |

(multiple answers)

### CONCLUSION

The present paper focused on the effects of radiation exposure through the aspects of health effects and mental problems. First, we pointed out that 33% of respondents (198 persons) answered that they suffered bad or very bad health. Second, we showed that approximately 70% of the residents (424 persons) strongly recognize a causal relationship between their bad health condition and the nuclear tests. Third, we pointed out that over 30% of respondents possessed arthritis, high-blood pressure, heart disease and digestive system disease. We also pointed out that the residents in Semipalatinsk have many symptoms in the same way and to the same degree as Hibakusha in Hiroshima and Nagasaki. Next, we showed that the residents experienced some acute radiation injuries such as headaches, general malaise and nausea and lacked appetite from 1949 to 1989, and that the residents near the SNTS suffered from acute radiation injury in the same way as Hiroshima and Nagasaki Hibakusha. Furthermore, we showed that 22% of respondents (134 residents) were frustrated/ agitated, 21% (125 residents) experienced nightmare and 13% (81 persons) felt depressed. We pointed out that both the residents near the SNTS and the Hiroshima/Nagasaki Hibakusha were troubled by nightmare and easily frustrated and agitated.

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Appendix

…I believe that my parents, sister - they all died as a result of the nuclear tests. My grandson was born in 1990 having infantile cerebral palsy; we treated his disease for 10 years. In 2000 he died. I also believe that he became sick as a result of the nuclear tests and all people in the area are the victims of the nuclear tests. (Karauyl, M, 1946)

…My daughter was born in 1970, she was also sick from the moment of birth, had dystrophy in feet and lower legs and she was a mentally defective child. She died in 1997. In 1976, my son was born also mentally defective; he is the 2nd category invalid. I think they all suffered because we live close to the nuclear test site. (Dolon, F, 1938)

(Here and in what follows, emphases in citations are all authors’.)

When talking about the consequences of the nuclear explosions, there standing before my eyes is the image of my innocent daughter born in 1976, who became a victim of nuclear tests. She graduated from teachers’ training college and became a teacher. Her life had just begun, yet at the age of 20 she committed suicide. This is a result of nuclear tests. I curse the Soviet Union, which put the testing ground about 12 kilometers from epicenter. Nagasaki City. (in Japanese).

…People who used to swim in Irtysh River before had some skin disease. Later on it became clear that, especially in the testing ground area (epicenter), an increase in the number of invalid kids and people who committed suicide, and an increase in kinds of illnesses that people were not aware of, were due to the explosions. … (Karauyl, M, 1946)

…I remembered every nuclear test, because we waited for them in fear. It seemed the earth would tumble down at any moment. Such fears have certainly affected our nerves. There are many mentally ill and mentally handicapped people in the village. … (Saryzhal, F, 1945)

*Village, Male or Female, Birth Year

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