Remarkable Experiences of the Nuclear Tests in Residents Near the Semipalatinsk Nuclear Test Site: Analysis Based on the Questionnaire Surveys

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Semipalatinsk/Nuclear Tests/Hiroshima and Nagasaki.

The main objective of this paper is to identify salient experiences of those who were exposed to radiation by the nuclear tests at the Semipalatinsk Nuclear Tests Site (SNTS). In 2002, our research team of the Research Institute for Radiation Biology and Medicine, Hiroshima University, started to conduct some field research by means of a questionnaire survey. Through this, we expected to examine the health condition of the residents near the SNTS, identify their experiences from the nuclear tests, and understand the exposure path. This attempt at clarifying the reality of radiation exposure at Semipalatinsk through the use of a survey research method is the first of its kind.

Among the responses to our survey, the present paper focuses mainly upon responses to the questions concerning the experiences of the nuclear tests. It deals mainly with direct experiences of nuclear tests of the residents characteristic to Semipalatinsk, including some new experiences hitherto unnoticed. The present paper touches upon their concrete direct experiences of flash, bomb blast, heat, rain and dust. We also discuss distinct experiences in Semipalatinsk such as evacuation, through the additional use of their testimonies. The data have been compared with the results obtained in a similar survey made in Hiroshima and Nagasaki. For the data analysis, a statistical method called logistic multiple linear regression analysis has been used.

INTRODUCTION

The Semipalatinsk Nuclear Test Site (SNTS) was a major site for testing nuclear weapons used by the former USSR, where the first test was conducted on August 29, 1949. Since then, 456 nuclear explosions were carried out including 111 atmospheric events between 1949 and 1963.1 According to the Kazakh government, 1.6 million people were subjected to radiation and 1.2 million people are still suffering from its aftereffects.2 A preliminary study has shown that the exposure to radiation due to the tests has seriously affected the health of the population in the wide areas around the SNTS.3,4

The present research project of the Research Institute for Radiation Biology and Medicine, Hiroshima University, started in 2002 to conduct field research to explore the realities of the radiation exposed population in Semipalatinsk area by means of a questionnaire survey. The survey questions were prepared based on past surveys conducted by Hidankyo (Japan Confederation of A- and H- Bomb Sufferers Organizations), the former Ministry of Health and Welfare, and the municipality of Hiroshima and Nagasaki. We posed 20 questions to examine the experiences of the nuclear tests, health conditions, and exposure path. We also included an open-ended question asking the respondents to write their experiences and feelings concerning the nuclear tests. Personal interviews have been also made.

The present paper does not deal with all aspects of the responses to the questionnaire, but focuses mainly upon the direct experiences of the nuclear tests because they provide essential information to understand the realities of radiation exposure in Semipalatinsk. We have tried to identify their experiences of the nuclear tests on the basis of the answers to the questionnaire surveys and testimonies. The research on the realities of Semipalatinsk has been conducted from a medical and/or a physical point of view. With the addition of the sociological approach focusing on their experiences, we expected to better describe the whole picture of the actual conditions of those exposed to radiation in Semipalatinsk. Although this is the first attempt, we believe that the data strengthens description of the actual conditions concerning their radiation exposure.
MATERIALS AND METHODS

Our questionnaire surveys were conducted three times from 2002 to 2004 in ten villages near Semipalatinsk. They include Saryzhal, Dolon, Kainar, Burus, Bodene, Mostik, Cheremushki, Znamenka and Grachi with different radiation level (Fig. 1 and Fig. 2). The total number of replies was 706 and that of testimonies was 468. The details are shown in Table 1. The present paper uses two sets of data. 606 answers in the three surveys made in 2002-2004 and 199 testimonies collected in the 2002 and 2003 surveys. The answers and testimonies of the residents in Kokpekti were excluded from both sets because the village was selected as a control.

Table 2 shows a part of the 20 questions in the questionnaire. The study subjects are those above the age of 45, who resided in the ten villages between 1949 and 1962 and continued to reside there. The questionnaire also contained the following open-ended question asking respondents to write their nuclear test experiences.

Please write about anything concerning the nuclear tests that cannot be forgotten, that still haunts you, that you

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Fig. 1. Map of Semipalatinsk Nuclear Test Site and the surrounding villages.

Fig. 2. Map of Mostik, Cheremushki and Bodene.
regret, or any opinions about nuclear testing in detail in the space provided below. You may write about your experiences, or that of your family or your close neighbors. Also, if there is anything you wish to add or comment on the previous questions, please write them down here. (The original text is in Russian)

Interviews were also conducted on persons living near the SNTS; 14 residents in the 2003 survey and 13 residents in the 2004 survey. We paid special attention to protect the human rights and privacy of the respondents. In addition, we obtained their informed consent to publish the results of the analysis.

For the better understanding of Semipalatinsk experiences, the data were compared with those of similar surveys in Hiroshima and Nagasaki. They are the results of two previous investigations conducted by Nagasaki city in 1999-2000 and Hiroshima city in 2002. For the data analysis, a statistical method called logistic multiple linear regression analysis was used. Respondents age, sex and radiation dose were used as explanatory variables in order to see how they affected the experiences. The estimated radiation dose used in this analysis is given in the Table 3.

Instead of actual estimated radiation dose, we used the rank order of radiation dose of the villages. The rank order is as follows:

High radiation dose: Dolon, Bodene, Saryzhal, Mostik, Cheremushki

Low radiation dose: Karauyl, Kainar, Znamenka, Burus

RESULTS AND DISCUSSIONS

Age and Sex of the Subject

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 without a response. 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. Mean age of the objects in the 2004 survey was 65.1 ± 9.3 years old. There were 120 males and 160 females. In the following, several direct salient experiences of the nuclear tests in Semipalatinsk will be chosen and discussed in comparison with those in Hiroshima and Nagasaki.

Awareness of the Nuclear Tests and Their Late Effects

As is generally known, during the days of the nuclear tests at the SNTS, they were considered as top secret matters. The authorities concerned neither informed the residents they were doing nuclear tests nor taught about the late-effect of nuclear explosions. In the 2003 and 2004 surveys, 351 persons out of 436 respondents clarified this fact. The result showed that over 80% of the respondents were already aware by the 1960s that the explosions were nuclear tests. On the contrary, the other 20% did not know until then that

Table 1. The number of respondents and testimonies.

| Village     | Respondents in 2002 | Testimonies in 2002 | Respondents in 2003 | Testimonies in 2003 | Respondents in 2004 | Testimonies in 2004 | Total of Respondents in 2002–2004 | Total of Testimonies in 2002–2004 |
|-------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|----------------------------------|----------------------------------|
| Saryzhal    | 48                  | 48                  | 51                  | 20                  |                     |                     | 99                               | 68                               |
| Dolon       | 28                  | 20                  | 51                  | 10                  |                     |                     | 79                               | 30                               |
| Kainar      | 48                  | 48                  | 26                  | 7                   |                     |                     | 74                               | 55                               |
| Kokpekti    | 47                  | 23                  | 50                  | 9                   |                     |                     | 97                               | 32                               |
| Karauyl     |                     |                     | 50                  | 31                  |                     |                     | 50                               | 31                               |
| Znamenka    |                     |                     | 24                  | 15                  |                     |                     | 74                               | 50                               |
| Burus       |                     |                     |                     |                     | 50                  | 40                  | 50                               | 40                               |
| Bodene      |                     |                     | 50                  | 45                  |                     |                     | 50                               | 45                               |
| Mostik      |                     |                     | 50                  | 45                  |                     |                     | 50                               | 45                               |
| Cheremushki |                     |                     | 50                  | 41                  |                     |                     | 50                               | 41                               |
| Grachi      |                     |                     | 30                  | 28                  |                     |                     | 30                               | 28                               |
| KRIRME*     |                     |                     | 3                   | 3                   |                     |                     | 3                               | 3                                |
| Total       | 171                 | 139                 | 252                 | 92                  | 283                 | 237                 | 706                              | 468                              |

* Collected in the Kazakh Scientific Research Institute of Radiation Medicine and Ecology on July 31, 2004.
nuclear explosions were carried out at the SNTS. Table 4 shows the results in 5 year intervals. It is clear that many inhabitants in any particular village became aware of the nuclear tests early on. However, this does not necessarily imply that most residents became aware of the (after) effects of nuclear tests by the 1960s. Judging from their testimonies and interviews, few inhabitants knew the effect of nuclear tests even if they were aware of nuclear explosions in those early days. Or even if they knew, they may not seriously considered the effects in those days. Some testimonies referring to grazing cattle on the test site or swimming in the “Atomic Lake” are the examples for their understanding of the effect of the nuclear tests at that time. We consider that most inhabitants began to recognize the effects much later, perhaps after the Nevada-Semipalatinsk Movement in 1989 or after

Table 2. Summary of the questions.

(Q1) As you might already be aware, the former Soviet Union's nuclear test began in 1949. When did you become aware of these nuclear tests?

Response | Around year:
--- | ---
(Q2) Did you experience something from the nuclear tests?
1. Yes | 2. No
For those who selected 1, please answer question 3.

(Q3) What did you experience? Circle the appropriate number from the following choices.

| Light | 1. Saw it | 2. Did not see it | 3. Do not know |
| Bomb blast | 1. Felt it | 2. Did not feel it | 3. Do not know |
| Heat | 1. Felt it | 2. Did not feel it | 3. Do not know |
| Rain | 1. Exposed (a lot · little) | 2. Not exposed | 3. Do not know |
| Dust | 1. Exposed (a lot · little) | 2. Not exposed | 3. Do not know |

Table 3. The estimated radiation dose of each village.

| Village | Estimated Radiation Dose (Sv) |
| --- | --- |
| Gordeev et al. | Rosenson, Gusev et al. |
| Saryzhal | 1.51 | 2.46 |
| Dolon | 1.30 | 4.47 |
| Karaul | 0.83 | 0.87 |
| Kainar | 0.12 | 0.68 |
| Burus | 0.0058 | No Data |
| Bodene | No Data | 3.47 |
| Mostik | No Data | 2.25 |
| Cheremushki | No Data | 2.25 |
| Znamenka | No Data | 0.62 |
| Grachi | No Data | No Data |

Table 4. The year when they become aware of about the nuclear tests. (%) shows percentage.

| Village | 1949 | 1950–1954 | 1955–1959 | 1960–1964 | 1965–1969 | 1970–1974 | 1975–1979 | 1980– Total |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Saryzhal | 16 | 3 | 22 | 4 | 1 | 1 | 0 | 1 | 0 | 48 |
| Dolon | 12 | 9 | 0 | 18 | 6 | 1 | 0 | 0 | 0 | 46 |
| Karaul | 12 | 13 | 9 | 1 | 4 | 0 | 0 | 0 | 0 | 39 |
| Kainar | 11 | 4 | 6 | 2 | 1 | 0 | 0 | 0 | 0 | 24 |
| Burus | 11 | 8 | 7 | 6 | 3 | 0 | 0 | 0 | 7 | 42 |
| Bodene | 10 | 4 | 2 | 6 | 0 | 0 | 0 | 1 | 2 | 25 |
| Mostik | 4 | 8 | 3 | 10 | 10 | 2 | 1 | 1 | 4 | 43 |
| Cheremushki | 4 | 2 | 1 | 7 | 8 | 1 | 3 | 0 | 4 | 30 |
| Znamenka | 23 | 3 | 6 | 11 | 1 | 0 | 0 | 0 | 0 | 44 |
| Grachi | 0 | 2 | 0 | 3 | 2 | 3 | 2 | 0 | 5 | 17 |
| Total | 103 | 56 | 56 | 68 | 36 | 8 | 6 | 3 | 22 | 358 |

(29) (16) (16) (19) (10) (2) (2) (1) (6)
Experiences at Semipalatinsk

Experiences of the Nuclear Tests

The direct experiences are summarized in Table 5. On average, 93% of respondents (564 of 606 persons) somehow directly experienced the nuclear tests. There is little difference among the villages. Unlike the cases of Hiroshima and Nagasaki, the target villages are located at a long distance from the SNTS. For example, Karauyl village is approximately 200 km from the hypocenter. In spite of such a long distance, 80% of the respondents had some nuclear test related experiences. The main reason must be the scale of the explosions at the SNTS. As is generally known, a shock wave increases in proportion as the energy of the explosion increases. For instance, a nuclear explosion conducted on November 22, 1955 was 100 times larger than that of Hiroshima bomb. It is thus likely that the shock wave was also 100 times greater. Therefore, we can assume that, though experienced at a great distance, the responses are reliable enough considering the scale of explosions. Of course, there are other reasons. For example, large quantities of dust were carried long distance because of the huge explosion near the ground. The following is an analysis of specific direct experiences.

“Seeing the Flash”

According to the present survey, 546 of 606 respondents (90%) saw the flash of the nuclear explosions. The results of statistical analysis are shown in Table 6. The analysis showed a significantly high frequency of age value, i.e., the older the respondents, the greater number who saw the flash. The same trend was also the case in the testimonies, 36 of 199 respondents mentioned seeing the flash (see Appendix).

Table 7 shows the results of the comparison with the experiences in Hiroshima and Nagasaki. From the table, we may tentatively conclude that the percentages are not different among Semipalatinsk and Hiroshima/Nagasaki residents, and they share the same probability of direct experience of the flash. Of course, the number of the Semipalatinsk samples may not be large enough to make this conclusion reliable.

A fireball was created in mid-air at the time of the explosion. At the instant of detonation, the temperature reached a maximum of approximately one million degrees centigrade. That could be a reason why the scene of the flash still remains vivid in the memories of Semipalatinsk, Hiroshima and Nagasaki.

Table 5. Experiences of the nuclear tests.

| Village      | Experience | No Experience | No Answer | Total |
|--------------|------------|---------------|-----------|-------|
| Saryzhal     | 94 (95%)   | 0             | 5         | 99    |
| Dolon        | 72 (91%)   | 5             | 2         | 79    |
| Karauyl      | 40 (80%)   | 5             | 5         | 50    |
| Kainar       | 66 (89%)   | 6             | 2         | 74    |
| Burus        | 47 (94%)   | 1             | 2         | 50    |
| Bodene       | 49 (98%)   | 0             | 1         | 50    |
| Mostik       | 50 (100%)  | 0             | 0         | 50    |
| Cheremushki  | 50 (100%)  | 0             | 0         | 50    |
| Znamenka     | 67 (91%)   | 1             | 6         | 74    |
| Grachi       | 29 (97%)   | 0             | 1         | 30    |
| Total        | 564 (93%)  | 18            | 24        | 606   |

Table 6. Estimate of regression coefficients on flash.

| Variable          | Standardized | Plain | SE  | t    | p     |
|-------------------|--------------|-------|-----|------|-------|
| CONSTANT           | 2.3242       | -3.174| 0.0193 | 3.85 | 0.00012 |
| Age               | 0.6186       | 0.0745| 0.0193 | 3.85 | 0.00012 |
| Sex: Male vs. Female | 0.2678     | 0.5352| 0.2996 | 1.79 | 0.07402 |
| Exposure Status   | 0.2294       | 0.1714| 0.1150 | 1.49 | 0.13600 |

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The results show that 424 of 606 respondents (70%) felt a bomb blast at the nuclear tests and 55 respondents (9%) did not. In case of the Hiroshima A-bomb, there were testimonies attesting to the experience of bomb blast in the Eba district (approximately 4 km from epicenter).

Assuming that the shock wave is proportional to the explosion energy, it would be possible that the inhabitants at approximately 100 km, such as those in Saryzhal, Chere-mushki and Dolon, felt the 400 kilo-tonne nuclear explosion bomb blast. Figure 3 shows the answers to this question. Approximately half the inhabitants in Kainar and Karauyl at a long distance from the SNTS did not feel the bomb blast at the explosion. This is probably because of the long distance. However, in the Grachi village, only 60% felt the bomb blast though this village was closer to the SNTS than other villages. The reason is not clear. The results of statistical analysis in Table 8 show a significantly high frequency in age, sex and radiation exposure status. Namely, if they are older, if they are male, and if they live in higher radiation dose villages, the possibility of feeling the bomb blast would be greater. The percentages of those who felt the bomb blast was 70% (424 respondents) in Semipalatinsk survey, 68% (2459 respondents) in the Hiroshima survey, and 71% (5027 respondents) in the Nagasaki survey. The result shows that Semipalatinsk and Hiroshima/Nagasaki had a similar experience of the bomb blast.

Table 7. The comparison with Hiroshima and Nagasaki. (%) shows %.

|             | Saw it | Did not see it | Do not know | Total |
|-------------|--------|----------------|-------------|-------|
| Semipalatinsk | 546 (90%) | 22 (4%) | 38 (6%) | 606   |
| Hiroshima    | 2960* (82%) | 54 (1%) | 600 (17%) | 3614  |
| Nagasaki     | 5643 (80%) | 54 (1%) | 1371 (19%) | 7068  |

* Including the answers, “strongly felt the flash,” “weakly felt the flash,” and “felt the flash but the strength and weakness are unknown”.

Feeling the Bomb Blast

“The feeling of the Bomb Blast”

Among 606 respondents, 108 persons (18%) felt heat at the time of nuclear explosions, 139 (23%) did not, and 359 (59%) answered that they did not know. In the case of Hiroshima A-bomb, the temperature reached a maximum of approximately one million degrees centigrade at the instant of detonation. Within 3 seconds of the explosion, 99% of thermal radiation emitted by the fireball affected the surface of the ground. The heat caused the scorching of wood etc. at a distance of approximately 3 km from the hypocenter and at a distance of 3.5 km, caused the burning of any human flesh that was not covered with clothes. The burns resulting in Fig. 3. The result of feeling bomb blast.

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from exposure to the thermal radiation proved fatal to any unprotected people within about 1.2 km of the blast; and estimates attributed 20–30% of the total deaths to these burns.\textsuperscript{10,12}

In case of the SNTS, it cannot be supposed that the inhabitants in the villages at a distance of approximately 100 km died because of burns. However, there is a testimony in Hiroshima attesting to feeling heat in the area at a distance of approximately 9 km from the hypocenter.\textsuperscript{6} Considering this experience in Hiroshima, it is not surprising that 17 of 50 respondents in Karauyl at a distance of approximately 200 km from the SNTS felt heat.

The result of regression analysis significantly shows high frequency in age value. The percentage of persons who felt heat was 18\% (108 respondents) in the Semipalatinsk survey, 31\% (1126 respondents) in the Hiroshima survey, and 41\% (2886 respondents) in the Nagasaki survey. The value from the Semipalatinsk survey was lower than those of the Hiroshima and Nagasaki surveys. It is probably because thermal radiation energy per unit area attenuates with the distance from the burst point; which is a totally different phenomenon from that of a shock wave. There are two kinds of attenuations: one is inversely proportional to the square of the distance; and the other is brought about by absorption and scattering as radiation passes through air.\textsuperscript{13}

**“Exposure to Dust”**

In the questionnaires, 26\% (155 respondents) experienced exposure to rain, 9\% (54 respondents) had no such experience, and 66\% (397 respondents) did not know or gave no answer. The result of statistical analysis shows a significantly high frequency in radiation exposure status value ($p=0.02$). It means that, if they live in higher radiation dose villages, the possibility of exposure to rain will be greater. We assume that the results express their anxieties for a possibility that they were exposed to rain containing radioactive fallout. Indeed, 26\% (155 respondents) in Semipalatinsk survey and 32\% (1155 respondents) in Hiroshima survey answered that they were exposed to rain at the time of the explosions. The percentage is not different. Semipalatinsk and Hiroshima can be considered to have had the same experience of exposure to rain.

**“Exposure to Dust”**

For the exposure to dust, 30\% (179 respondents) were exposed, 7\% (44 respondents) were not exposed, and 63\% (383 respondents) did not know nor give any answer. The results of statistical analysis showed a significantly high frequency in age ($p=0.02$) and exposure status values ($p=0.03$). Older persons in higher radiation village tended to report the exposure to dust. We assume that the experiences were somehow biased by their recognition that they were exposed to radiation. The value was comparable to that in Hiroshima survey, where 38\% (1370 respondents) answered that they were exposed to dust at the explosions. It can be pointed out again that both Semipalatinsk and Hiroshima have the same experience in this respect.

**“Other Remarkable Experiences observed in Testimonies”**

The five experiences discussed above do not exhaust the direct experiences of nuclear explosions. Many inhabitants in Semipalatinsk referred to other various scenes at the nuclear tests. The testimonies indicated other important and remarkable experiences of the nuclear tests. These experiences are unique to Semipalatinsk and differed from those of Hiroshima and Nagasaki.

A small number of testimonies attested to witnessing of the mushroom cloud. Out of 199 respondents, 57 persons (28\%) saw the mushroom clouds, which included 18 persons (26\%) in Saryzhal, 15 persons (50\%) in Dolon, 15 persons (48\%) in Karauyl, and 9 persons (16\%) in Kainar. The statistical analysis showed a significantly high frequency in radiation exposure status value ($p=0.04$), i.e., those who referred to mushroom clouds in testimonies become greater in number if they resided in higher radiation dose village.

Thirty-three persons (16\%) mentioned a deafening roar in their testimonies. Such testimonies indicate some scenes like glass windows breaking in their homes, the roof blowing off, and their homes filling with dust (see Appendix).

Bald animals like dogs, cats, hares or horses are regarded as a typical example of the effect of radiation. Fourteen persons (7\%) referred to the animals that had lost their hair. Hair loss (epilation) is one of the remarkable subacute radiation injuries also occurred in Hiroshima and Nagasaki. Hair loss was conspicuous up to 8 weeks after exposure and at the latest by the 10th week.\textsuperscript{14} The testimonies referring to bald animals indicate a reality of radiation exposure. On the other hand, testimonies in Hiroshima and Nagasaki referred only to human hair. This is a remarkable difference (see Appendix).

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**Table 8.** Estimate of regression coefficients on bomb blast.

| Variable            | Standardized | Plain   | SE     | t     | p       |
|---------------------|--------------|---------|--------|-------|---------|
| CONSTANT            | 0.9107       | −3.502  |        |       |         |
| Age                 | 0.4250       | 0.05120 | 0.01266| 4.04  | 0.00005 |
| Sex: Male vs. Female| 0.2756       | 0.5509  | 0.2006 | 2.75  | 0.00602 |
| Exposure Status     | 0.4966       | 0.3710  | 0.08008| 4.63  | 0.00000 |
dix).

One of the remarkable contents of the testimonies was those concerning the evacuation orders from the authorities. The testimonies in Saryzhal, Karauyl and Kainar refer to both the forced evacuation to other places and evacuation to only outside the house. In the cases of Saryzhal, Karauyl and Kainar, they moved to Taldy, Bakanas or Ayagoz. The enforced evacuation to these places was mentioned in 36 testimonies. The places of evacuation have not been reported previously, and the evacuation period has been regarded as short as 3 or 4 days. According to the present testimonies, however, the evacuated places were Taldy, Bakanas and Ayagoz, and the evacuated periods were longer than those previously documented. The testimonies indicate that the evacuation periods could be 2 weeks or longer (see Appendix).

On the other hand, the testimonies from Dolon and Znamenka only mentioned the evacuation in the context of getting out of their houses and voluntary evacuation. They were ordered to evacuate their houses and not see the explosion. This type of evacuation was found in 52 testimonies, which differed from the evacuation types in Saryzhal, Karauyl and Kainar (see Appendix). The reasons for the differing types of evacuation remain an area for further examination.

CONCLUSION

The present paper focused on the direct experiences of the nuclear tests. First, we mentioned that 93% (546 persons) experienced something directly from the nuclear tests. We also showed that over 80% of the residents were already aware that the explosions were nuclear tests by the 1960s. Then we discussed various scenes of the nuclear explosions; 90% of the respondents saw the flash, 70% felt the bomb blast, 18% felt the heat, 26% recognized the rain and 30% were exposed to dust. We also compared the experiences of Semipalatinsk with those of Hiroshima and Nagasaki. There was a close similarity in their experiences (memory) between Semipalatinsk and Hiroshima/Nagasaki as far as those direct experiences are concerned. However, some other remarkable experiences were specific to Semipalatinsk. They include a deafening roar, bald animals and two different types of evacuations. Furthermore, we discovered that the evacuated places were Bakanas, Ayagoz and Taldy. In addition, the evacuated period is approximately two weeks or longer.

Finally it should be noted that nuclear tests in SNTS were conducted not far from a lot of inhabited settlements and as a result the testimonies of persons who suffered are important indications of psychological stress.

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Appendix

I saw the flashes of light, there was a red cloud after the nuclear explosion. (Dolon, M, 1950)*

We were outside. First, we heard a loud thunder, then a mushroom cloud appeared, next the blast wave came. (Saryzhal, M, 1940)

I ran with my two children, went out of the house, it was scary. The earth trembled so much that I thought it could swallow my children and me. (Dolon, F, 1935)

The cats and dogs were dying, their hair fell out. We didn’t know then what was happening? (Kainar, F, 1937)

When there were explosions we were taken outside and were told to lie down. After those cattle’s hair fell out. (Karauyl, F, 1936)

In 1953 we were resettled to Taldy? (Saryzhal, F, 1928)

In 1953 we stayed at Bakanas for 15 days, we were taken there as some exercise was going to take place. (Karauyl, F, 1923)

I know that everybody was ordered to go out of the houses, so that nobody was left inside. Then a bright flash appeared, and a big mushroom cloud formed. Then it was announced that everybody should go back home. (Dolon, F, 1936)

* Village, Male or Female, Birth Year