Overall Image of Nuclear Tests among Inhabitants in the Semipalatinsk Area

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Abstract

The present paper is an attempt at describing overall image of nuclear tests for the residents at Semipalatinsk, Kazakhstan. Our research team conducted the survey by interview from 2002 to collect testimonies of inhabitants. We analyzed testimonies using the hierarchical clustering method and the multi-dimensional scaling method. The result showed that there are two different types of appeal in residents’ mind. One is the complaint for the present condition – especially about the health of one’s family and one’s own. The other is the memory at the testing time.

Our results suggest that the most impressive memories for the inhabitants are “mushroom cloud”, “flash light”, “waving of the ground” and “Evacuation to the outside”. The experiences of “waving of the ground” and “evacuation to the outside” are peculiar to the Semipalatinsk residents. For the residents near the SNTS the greatest concern at present is their health problems. They still struggle with their diseases, family’s death even though 20 years has passed since the last nuclear test.

INTRODUCTION

From 1949 to 1989, over the four hundred times of nuclear tests had conducted at Semipalatinsk Nuclear Test Site (SNTS)12 - that is one of the negative legacy of the former Soviet Union. It is said that several hundred thousand people have been affected by radiation exposure around this area3. There is a possibility that most residents still have trouble with many kinds of symptoms4.

Our research team began interviewing the inhabitants of villages near the SNTS in 2002 to investigate their health status, their experiences of the nuclear explosions, psychological effects caused by those experiences, and the routes of exposure58. The present research focuses upon the inhabitants themselves, that is, we tried to clarify the realities of Semipalatinsk by listening to first-hand accounts from the victims. With the information about the victims’ personal experiences, we expected to be able to provide a more complete picture of the radiation effects in and around Semipalatinsk.

MATERIALS AND METHODS

For this research, we use the data from 2002 to 2007 surveys. In those years we have conducted surveys on six occasions covering 26 villages near the SNTS (see Figure 1). The study subjects comprise persons who experienced the nuclear tests on the ground between 1949 and 1962 in each village and persons who currently reside there. We selected the subjects at random.
All testimonies were translated into Japanese. As an exception, the survey in 2006 there are 88 testimonies in Kazakh language which haven’t been translated into Japanese. So we excluded them from our analysis.

First, we selected the words of high frequency from testimonies. Then we analyzed those words using the hierarchical clustering method and the multi-dimensional scaling method$^{[7],[8]}$.

The open-ended survey question about experience and testimonies concerning nuclear test is as follows;

"Please write about anything concerning the nuclear tests that cannot be forgotten, that still haunts you, that you regret, or any opinions about nuclear test in detail in the space provided below. You may write about your experiences, or that of your family or your close neighbors."
RESULTS AND DISCUSSIONS

Table 1 shows the number of respondents. There were 395 males and 549 females. The total number of testimonies was 944. Average age of the subjects was 64.88 ± 8.97 years old.

Table 2 shows the words which are used more than 50 times in testimonies. We selected all nouns, adverbs, adjectives and the verbs relating to the experiences of nuclear tests\(^9\),\(^10\). We analyzed testimonies in Japanese then translated into English for this paper. The words - “explosion”, “see”, “house”, “test”, “polygon” and “mushroom cloud”- are the highest frequency.

<table>
<thead>
<tr>
<th>Year of survey</th>
<th>Village</th>
<th>Male</th>
<th>Female</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002</td>
<td>Dolon</td>
<td>6</td>
<td>13</td>
<td>19</td>
</tr>
<tr>
<td></td>
<td>Kainar</td>
<td>29</td>
<td>19</td>
<td>48</td>
</tr>
<tr>
<td></td>
<td>Kokpekti</td>
<td>7</td>
<td>16</td>
<td>23</td>
</tr>
<tr>
<td></td>
<td>Saryzhal</td>
<td>29</td>
<td>19</td>
<td>48</td>
</tr>
<tr>
<td>2003</td>
<td>Dolon</td>
<td>4</td>
<td>5</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Kainar</td>
<td>1</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Karauyl</td>
<td>13</td>
<td>18</td>
<td>31</td>
</tr>
<tr>
<td></td>
<td>Kokpekti</td>
<td>3</td>
<td>6</td>
<td>9</td>
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<tr>
<td></td>
<td>Saryzhal</td>
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<td>6</td>
<td>19</td>
</tr>
<tr>
<td></td>
<td>Znamenka</td>
<td>7</td>
<td>6</td>
<td>13</td>
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<tr>
<td>2004</td>
<td>Bodene</td>
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<td>21</td>
<td>45</td>
</tr>
<tr>
<td></td>
<td>Burus</td>
<td>14</td>
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<td>40</td>
</tr>
<tr>
<td></td>
<td>Cheremushki</td>
<td>20</td>
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<td>41</td>
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<tr>
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<td>Grachi</td>
<td>9</td>
<td>19</td>
<td>28</td>
</tr>
<tr>
<td></td>
<td>Mostik</td>
<td>23</td>
<td>22</td>
<td>45</td>
</tr>
<tr>
<td></td>
<td>Znamenka</td>
<td>15</td>
<td>20</td>
<td>35</td>
</tr>
<tr>
<td></td>
<td>Institute*</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>2005</td>
<td>Borodulha</td>
<td>8</td>
<td>21</td>
<td>29</td>
</tr>
<tr>
<td></td>
<td>Kamyschenka</td>
<td>8</td>
<td>9</td>
<td>17</td>
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<tr>
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<td>Krasnyi</td>
<td>11</td>
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<td></td>
<td>Novopokrovka</td>
<td>16</td>
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<td>34</td>
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<tr>
<td></td>
<td>Zenkovka</td>
<td>8</td>
<td>15</td>
<td>23</td>
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<tr>
<td>2006</td>
<td>Akku</td>
<td>19</td>
<td>27</td>
<td>46</td>
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<td></td>
<td>Beskaragai</td>
<td>17</td>
<td>32</td>
<td>49</td>
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<tr>
<td></td>
<td>Dzhambul</td>
<td>20</td>
<td>26</td>
<td>46</td>
</tr>
<tr>
<td></td>
<td>Sherbakti</td>
<td>19</td>
<td>30</td>
<td>49</td>
</tr>
<tr>
<td>2007</td>
<td>Akjar</td>
<td>6</td>
<td>20</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td>Kentubek</td>
<td>10</td>
<td>24</td>
<td>34</td>
</tr>
<tr>
<td></td>
<td>Koktobe</td>
<td>10</td>
<td>11</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td>Malai</td>
<td>12</td>
<td>21</td>
<td>33</td>
</tr>
<tr>
<td></td>
<td>Mayskoe</td>
<td>10</td>
<td>28</td>
<td>38</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>395</td>
<td>549</td>
<td>944</td>
</tr>
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</table>

*In 2004 we interviewed the 3 patients at the hospital of Kazakh Scientific Research Institute of Radiation Medicine and Ecology.
Table 2. 60 words of high frequency used in testimonies (50 times or more)

<table>
<thead>
<tr>
<th>Order</th>
<th>Word</th>
<th>Frequency in total</th>
<th>Order</th>
<th>Word</th>
<th>Frequency in total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>explosion</td>
<td>868</td>
<td>31</td>
<td>ravine</td>
<td>97</td>
</tr>
<tr>
<td>2</td>
<td>see</td>
<td>600</td>
<td>32</td>
<td>give</td>
<td>96</td>
</tr>
<tr>
<td>3</td>
<td>house</td>
<td>445</td>
<td>33</td>
<td>go up</td>
<td>93</td>
</tr>
<tr>
<td>4</td>
<td>test</td>
<td>436</td>
<td>34</td>
<td>close</td>
<td>90</td>
</tr>
<tr>
<td>5</td>
<td>polygon</td>
<td>346</td>
<td>35</td>
<td>cloud</td>
<td>89</td>
</tr>
<tr>
<td>6</td>
<td>mushroom cloud</td>
<td>312</td>
<td>36</td>
<td>lie down</td>
<td>81</td>
</tr>
<tr>
<td>7</td>
<td>nuclear</td>
<td>260</td>
<td>37</td>
<td>school</td>
<td>80</td>
</tr>
<tr>
<td>8</td>
<td>window</td>
<td>260</td>
<td>38</td>
<td>strong</td>
<td>79</td>
</tr>
<tr>
<td>9</td>
<td>remember</td>
<td>253</td>
<td>39</td>
<td>get (sick)</td>
<td>78</td>
</tr>
<tr>
<td>10</td>
<td>disease</td>
<td>251</td>
<td>40</td>
<td>die</td>
<td>77</td>
</tr>
<tr>
<td>11</td>
<td>child</td>
<td>234</td>
<td>41</td>
<td>resident</td>
<td>73</td>
</tr>
<tr>
<td>12</td>
<td>outside</td>
<td>208</td>
<td>42</td>
<td>many</td>
<td>72</td>
</tr>
<tr>
<td>13</td>
<td>influence</td>
<td>201</td>
<td>43</td>
<td>now</td>
<td>71</td>
</tr>
<tr>
<td>14</td>
<td>soldier</td>
<td>197</td>
<td>44</td>
<td>at that time</td>
<td>69</td>
</tr>
<tr>
<td>15</td>
<td>village</td>
<td>171</td>
<td>45</td>
<td>door</td>
<td>67</td>
</tr>
<tr>
<td>16</td>
<td>shake</td>
<td>167</td>
<td>46</td>
<td>break</td>
<td>66</td>
</tr>
<tr>
<td>17</td>
<td>everyone</td>
<td>163</td>
<td>47</td>
<td>cancer</td>
<td>62</td>
</tr>
<tr>
<td>18</td>
<td>die</td>
<td>144</td>
<td>48</td>
<td>shake</td>
<td>62</td>
</tr>
<tr>
<td>19</td>
<td>be taken to</td>
<td>137</td>
<td>49</td>
<td>husband</td>
<td>61</td>
</tr>
<tr>
<td>20</td>
<td>sky</td>
<td>132</td>
<td>50</td>
<td>parent</td>
<td>61</td>
</tr>
<tr>
<td>21</td>
<td>feel</td>
<td>130</td>
<td>51</td>
<td>district</td>
<td>60</td>
</tr>
<tr>
<td>22</td>
<td>person</td>
<td>130</td>
<td>52</td>
<td>blast wave</td>
<td>58</td>
</tr>
<tr>
<td>23</td>
<td>glass</td>
<td>128</td>
<td>53</td>
<td>bright</td>
<td>57</td>
</tr>
<tr>
<td>24</td>
<td>ground</td>
<td>121</td>
<td>54</td>
<td>be born</td>
<td>57</td>
</tr>
<tr>
<td>25</td>
<td>health</td>
<td>116</td>
<td>55</td>
<td>invalid</td>
<td>57</td>
</tr>
<tr>
<td>26</td>
<td>now</td>
<td>115</td>
<td>56</td>
<td>blow (off, away)</td>
<td>55</td>
</tr>
<tr>
<td>27</td>
<td>people</td>
<td>113</td>
<td>57</td>
<td>son</td>
<td>54</td>
</tr>
<tr>
<td>28</td>
<td>first</td>
<td>110</td>
<td>58</td>
<td>dish</td>
<td>53</td>
</tr>
<tr>
<td>29</td>
<td>all</td>
<td>109</td>
<td>59</td>
<td>receive (pension)</td>
<td>52</td>
</tr>
<tr>
<td>30</td>
<td>light</td>
<td>102</td>
<td>60</td>
<td>pension</td>
<td>51</td>
</tr>
</tbody>
</table>

Some verbs have various meanings, we provided the objects or adverbs in ( ) due to understand clearly.

Next we calculated the distances of each word based on the frequency of appearance simultaneously in the same testimonies of one person. Then we classified those 60 words through the hierarchical clustering method (see Figure 2). It means that if the distance is closer, the possibility of using these words simultaneously will be greater. The following testimony is one of examples, which includes the words of “die”, “cancer” and “husband” together;

Test site took millions of people’s lives, mortality is very high. Almost all my relatives died. Husband died of cancer as well as my son. Many people died in my house and all of them died of cancer. We need peace, quite life, welfare. We spend a lot for medicine. Free medical service is needed. (Female, 76 years old, Borodulicha)

The result shows that the testimonies of inhabitants are divided into two groups. In the upper group, we can see the words of “health”, “die”, “invalid”, “disease” and “cancer” and so on. These words are related to their health condition. The words like “child”, “son”, “parent” and “husband” indicate the family
experience of shaking of the ground. (5) The words of “ravine”, “outside” and “lie down” suggest the experience of evacuation to the outside.

Figure 3 described the distances among the words more visually by using multi-dimensional scaling method. This figure also shows the same result as figure 2. The words can be divided into two groups. One is the complaint for the present condition. The other is the memory at the testing time. Some remarkable samples of testimonies are in the Appendix.

**CONCLUSION**

As a result of the statistical analysis, testimonies were divided into two main components. One is the memory at the testing time. The most impressive memories for the inhabitants are (1) mushroom cloud, (2) blast wave, (3) flash light, (4) waving of the ground, (5) evacuation to the outside. Especially, the experiences of “waving of the ground” and “evacuation to the outside” are unique to Semipalatinsk inhabitants.

The other is the complaint for the present condition. Particularly, residents near the SNTS suffered from some kinds of diseases. Their family also struggle with their diseases and have the fear of death. The experiences of nuclear tests at Semipalatinsk still have an influence upon the inhabitants’ health, life and mind even though more than 20 years has passed since the last nuclear test.
members. These facts show that this group indicates residents’ mind of the complaint for the present condition, especially about the health of one's family and one's own.

The other group includes the words of “shake”, “ground”, “blast wave”, “mushroom cloud”, “ravine”, “light”, and “bright” and so on. These words indicate the memory at the testing time of residents’. Five kinds of experiences are suggested by those words. (1)The words of “mushroom cloud”, “cloud”, “go up” and “sky” suggest the experience of seeing mushroom cloud. (2)The words of “blast wave”, “blow off” “blow away” suggest the experience of blast wave. (3)The words of “light”, “bright” suggest the experience of flash light. (4)The words of “shake”, “ground”, “break”, “glass” and “window” suggest the
REFERENCES

Appendix. Examples of the testimonies including the high frequency words

<table>
<thead>
<tr>
<th>The complaint for the present condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>• All my life I never suspected that the nuclear tests could do so much damage to people's health. Now I experience the consequences of nuclear tests myself. My parents died from cancer, one of my grandchildren is a cripple from birth, and I myself have acute leukemia, which is a death sentence. I feel fear for the future of my children, as these consequences will never leave them. ---(F 1935 Saryzhal)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>The memory at the testing time</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Mushroom cloud</td>
</tr>
<tr>
<td>• •••There was something in the shape of a mushroom in the sky, the dark cloud rose into the sky. For us children it was interesting, and we watched the sky. ---(M 1942 Kainar)</td>
</tr>
<tr>
<td>• In the fall of 1955 I saw the burning fire and a mushroom cloud. The clay rained from our wooden house, the fire from the stove dropped on the floor, and the windows were smashed.---(F 1927 Dolon)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>(2) Blast wave</th>
</tr>
</thead>
<tbody>
<tr>
<td>• •••First, there was thunder and then blast wave went through. It was like a very strong wind howling in the forest. Some houses had their windows broken and the stoves' shut opened.---(M 1929 Mostik)</td>
</tr>
<tr>
<td>• •••I felt underground jerks, blast-wave. Furniture was shaking in houses.--(M 1959 Dzhambul)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>(3) Flash light</th>
</tr>
</thead>
<tbody>
<tr>
<td>• •••We were grazing cattle when a glint flashed as bright as the sun, then the blast wave came, smut erupted out of the stove.--(M 1927 Dolon)</td>
</tr>
<tr>
<td>• •••But I remember that I saw the bright flashes, the rumble, like a thunder, the earth trembled and the windowpanes were smashed.--(M 1941 Kainar)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>(4) Shaking of the ground</th>
</tr>
</thead>
<tbody>
<tr>
<td>• I remember that when I was about 10 years old, dishes, panes, windows in our house were shaking and clinking. I thought that it was an earthquake.--(F 1941 Zenkovka)</td>
</tr>
<tr>
<td>• I haven't seen explosions themselves but I felt when the ground was shaking. We all knew that that were explosions.--(F 1924 Novopokrovka)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>(5) Evacuation to the outside</th>
</tr>
</thead>
<tbody>
<tr>
<td>• •••When we were children, it was announced that we all must go outside, we had been hiding in a ravine; for us, children, that was very interesting.--(M 1946 Dolon)</td>
</tr>
</tbody>
</table>

Note: ( ) indicates Male or Female/ birth year/ village. ---- indicates omission of sentences.