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TECHNICAL REPORT

The Semipalatinsk Nuclear Test Site—Through My Own Eyes

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July 2014

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14. ABSTRACT In 1955 Doctor Saim B.Balmukhanov of the Ministry of Health visited the villages of Dolon and Sarzhal, north and west of the Semipalatinsk Test Site where USSR above ground nuclear detonations occurred. He saw similarities between the shepherds in this region and those affected by the atomic bomb detonated over Hiroshima. The following year he led a team of six doctors to study the region. In 1957 he influenced the Kazakhstan Academy of Science to write the Soviet Ministry of Defense regarding the adverse health effects on the public. But in 1959 he and his team were dismissed, and he was banned from visiting Semipalatinsk. However, he continued to follow the health situation and collect data. This document is an account of his personal experiences and professional findings on what happened at the test site, and its effects.					
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UNIT CONVERSION TABLE

U.S. customary units to and from international units of measurement*

U.S. Customary Units	Multiply by Divide by[†]	International Units
Length/Area/Volume		
inch (in)	2.54 × 10 ⁻²	meter (m)
foot (ft)	3.048 × 10 ⁻¹	meter (m)
yard (yd)	9.144 × 10 ⁻¹	meter (m)
mile (mi, international)	1.609 344 × 10 ³	meter (m)
mile (nmi, nautical, U.S.)	1.852 × 10 ³	meter (m)
barn (b)	1 × 10 ⁻²⁸	square meter (m ²)
gallon (gal, U.S. liquid)	3.785 412 × 10 ⁻³	cubic meter (m ³)
cubic foot (ft ³)	2.831 685 × 10 ⁻²	cubic meter (m ³)
Mass/Density		
pound (lb)	4.535 924 × 10 ⁻¹	kilogram (kg)
atomic mass unit (AMU)	1.660 539 × 10 ⁻²⁷	kilogram (kg)
pound-mass per cubic foot (lb ft ⁻³)	1.601 846 × 10 ¹	kilogram per cubic meter (kg m ⁻³)
Pound-force (lbf avoirdupois)	4.448 222	Newton (N)
Energy/Work/Power		
electron volt (eV)	1.602 177 × 10 ⁻¹⁹	joule (J)
erg	1 × 10 ⁻⁷	joule (J)
kiloton (kT) (TNT equivalent)	4.184 × 10 ¹²	joule (J)
British thermal unit (Btu) (thermochemical)	1.054 350 × 10 ³	joule (J)
foot-pound-force (ft lbf)	1.355 818	joule (J)
calorie (cal) (thermochemical)	4.184	joule (J)
Pressure		
atmosphere (atm)	1.013 250 × 10 ⁵	pascal (Pa)
pound force per square inch (psi)	6.984 757 × 10 ³	pascal (Pa)
Temperature		
degree Fahrenheit (°F)	[T(°F) - 32]/1.8	degree Celsius (°C)
degree Fahrenheit (°F)	[T(°F) + 459.67]/1.8	kelvin (K)
Radiation		
activity of radionuclides [curie (Ci)]	3.7 × 10 ¹⁰	per second (s ⁻¹ ‡)
air exposure [roentgen (R)]	2.579 760 × 10 ⁻⁴	coulomb per kilogram (C kg ⁻¹)
absorbed dose (rad)	1 × 10 ⁻²	joule per kilogram (J kg ⁻¹ §)
equivalent and effective dose (rem)	1 × 10 ⁻²	joule per kilogram (J kg ⁻¹ ***)

* Specific details regarding the implementation of SI units may be viewed at <http://www.bipm.org/en/si/>.

† Multiply the U.S. customary unit by the factor to get the international unit. Divide the international unit by the factor to get the U.S. customary unit.

‡ The special name for the SI unit of the activity of a radionuclide is the becquerel (Bq). (1 Bq = 1 s⁻¹).

§ The special name for the SI unit of absorbed dose is the gray (Gy). (1 Gy = 1 J kg⁻¹).

*** The special name for the SI unit of equivalent and effective dose is the sievert (Sv). (1 Sv = 1 J kg⁻¹).

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PREFACE

Professor Saim Baluanovich Balmukhanov, a radiologist by training, was considered a founder of radiation science and radiation biology in his native Kazakhstan. He became Chief Radiologist of the Ministry of Health of the then Kazakhstan SSR and also the head of the Kazakhstan National Research Institute for Oncology and Radiology at Alma-Ata (now Almaty). He became a member of the Kazakhstan Academy of Sciences in 1967. By the end of his career he had authored or co-authored 450 scientific publications and was on the editorial staffs of several scientific journals. Awards included several medals of the Union of Soviet Socialist Republics (USSR), two Orders of the Red Star, two Orders of the Patriotic War, and two Diplomas of the Supreme Soviet of the Republic of Kazakhstan.

In 1949, the USSR conducted its first above ground atomic weapon detonation at the Semipalatinsk Test Site or Polygon. Several weapons tests followed. In 1954, the first of several expeditions to assess public health status was conducted under the auspices of the Kazakhstan SSR Academy of Sciences. Balmukhanov went to the irradiated villages of Dolon' and Sarzhal in 1955 and noted several shepherds who had partial alopecia (hair loss) and large skin lesions on their arms. Because of his studies of the effects of the Hiroshima bombing in 1945, Balmukhanov noted similarities in the clinical presentations of the shepherds and the Japanese casualties. The following year he led a team of 6 doctors to study the region, which they did, carefully surveying eight settlements over the next 3 years and noting the rates of certain diseases to be several times higher in the areas exposed to fallout contamination compared with similar but unirradiated control villages. At his instigation the Academy of Sciences sent these findings to the Ministry of Defense in Moscow. But, as described in the report, the scientists came under considerable pressure from the Ministry of Defense and the Komitet Gosudarstvennoi Bezopanosti (KGB) because of their conclusions. They were told that these health effects were due to the poor diet, sanitation, and hygienic practices of the villagers. Balmukhanov was essentially prevented from publishing his findings, and he and his team were dismissed and banned from visiting Semipalatinsk. Nevertheless, he preserved some of the data (the other volumes which were submitted to the Ministry of Health are no longer available). After the collapse of the Soviet Union, he and other colleagues were able to publicly discuss their findings, and the Defense Nuclear Agency (DNA) received and published a contract report DTRA-TR-06-23, "Medical Effects and Dosimetric Data from Nuclear Tests at the Semipalatinsk Test Site" written by him and his colleagues in Alma-Ata.

Besides his scientific publications, Balmukhanov worked hard to make the international community aware of the tremendous health impacts that nuclear testing had cause on the Kazakh villagers near the test site. He was the president of the Kazakhstan branch of the presidium of the international "Nevada-Semey" movement, which worked actively to end testing both in Kazakhstan and the United States (U.S.). He was also a member of the international group "Doctors for the Prevention of Nuclear War". Earlier he had opposed the Brezhnev regime for its condemnation of Andrei Sakharov, the designer of the Soviet thermonuclear bomb who later became a dissident and strongly opposed the further testing of nuclear weapons.

This document was originally published in Russian in a journal called "Scope" in November of 1990. Professor Balmukhanov gave me a copy of the article in 1993 when, on behalf of the DNA, I met him in Alma-Ata to discuss work on collection and publication of data on the

medical effects of testing. The article was translated into English by Elisabeth Bykowsky later that year.

It should be noted that the article was first written in 1990 and reflects the scientific knowledge of the time. Balmukhanov and a colleague, Dr. B.I. Gusev, were able to retain much of the data pertaining to medical and biological effects from nuclear weapon testing which have been published as Defense Threat Reduction Agency (DTRA) technical reports and in several other scientific journals. The article also reflects his deep personal feelings and loyalty to the Kazakh people and their sufferings. Balmukhanov, who was born in 1922, was a young boy and teenager during the period of forced collectivization, which took the steppes of Kazakhstan used for livestock grazing and turned them into farms. As a result up to 22% of the Kazakh population either starved or emigrated. Though loyal to his nation (he once privately told me that the KGB did have an important role in protecting the country, despite his own personal experiences with them), he deeply felt the sufferings of his people during the period of forced collectivization and from the effects of fallout from the test site the USSR chose to place in northern Kazakhstan.

Balmukhanov's training and acknowledged expertise as a scientist, plus his personal kindness and generosity, gave him a unique perspective from which to evaluate the effects of nuclear weapons testing on the surrounding population. Accordingly, this document is translated essentially verbatim, with only minor edits to clarify dated material, etc. Both the medical data he collected and his opinions on their applications are preserved. **Of course the article's content and conclusions do not reflect or represent those of the U.S. government, the Department of Defense, DTRA or its predecessors, nor the corresponding entities in the then USSR or modern Kazakhstan.**

Dr. Saim B. Balmukhanov was a highly qualified scientist, physician, and an outstanding human being. He died in February 2014. The final sentence of his obituary, as published in the DailyNews.kz, very fittingly read: "The life and work of Professor Balmukhanov—a shining example of service to his cause and to his people."

Glen I. Reeves, MD
Editor

1.0 INTRODUCTION

1.1 PRECURSOR TO APOCALYPSE?

The scientific world usually argues over the grounds of various forecasts and implications of their findings and, in general, over any hypothesis, especially when it is difficult to verify by experiment. However, regarding one particular outcome, there never has been any difference of opinion among the world's scientists. This is the future of world civilization and the very fate of man relative to the danger of the outbreak of nuclear war. Fifty thousand nuclear warheads have accumulated; these are capable of destroying the planet three times over. Distinguished citizens of various countries and the leaders of many nations share the scientists' alarm. The celebrated Winston Churchill was most eloquent when he spoke of the promise for this "infatuation" with nuclear energy: "The Stone Age can return on the shining wings of science." If we understand the Stone Age to mean not only dwelling in caves and using primitive hunting tools but also an ecological catastrophe and increased illness, then Chernobyl and Semipalatinsk are forerunners of these horrors.

There are three points on the Earth which have been poisoned by excessive ionizing radiation. The first is Hiroshima and Nagasaki, where the tragedy occurred under the curtain of the Second World War, where the people, loyal to their leaders (who had lost their minds, blinded with fear and hatred), gave their all for the sake of victory. The price for this victory cost mankind too much. The tragedy of Hiroshima and Nagasaki will remain in the memory of mankind forever as the first appearance of the apocalypse. The second point is Chernobyl, where the catastrophe, although unintentional, was the natural result of violations in nuclear reactor use, carelessness and irresponsibility of the personnel, and of many other services related to the atomic power station, judging by press reports and other available information. Again, hundreds of thousands of people suffered, not one of whom had any tie to nuclear energy (i.e. not a radiation worker—Ed.). The third hot spot on the Earth is the Semipalatinsk Test Site (STS). The tragedy of Semipalatinsk is unique in and of itself. It is unique because the poisonous effect of radiation is occurring permanently and during peacetime. It is also unique in that it was planned ahead of time and was incorporated into an overall governmental plan which considered first and foremost the presence of convenient transportation (via the Irtysh River and by rail) and the nearness of the nuclear industry in the Southern Urals. But most important is the spaciousness of Kazakhstan, with its uncomplaining population that has since lost its faith.

In the postwar years, when the STS was under construction, our government (led by Stalin and Beria) completely ignored the fate of the people, cared nothing for human life and sacrificed the lives of hundreds of thousands of people in the name of realizing their goals and satisfying their vanity. Beginning in the 1930s, the Kazakhs along with the entire population survived force collectivization, massive repressions, lawlessness and tyranny, hunger and destitution, all in the name of the mirage of socialism.

The Degelen and Myrzhik Mountains, where the STS is located, are the continuation of the Saryarka, the Golden Ridge, the cradles of a unique steppe culture of the ancient Kipchaks and their descendants, the Kazakhs. These mountains and the Saryarka have been glorified by many generations of poets; they are the motherland of Abai and Ulakarim. The people who have populated this land endured a terrible disaster: almost half of them died from deliberate genocide, the artificially organized famine of 1930 to 1932 during the period of the forced

destruction of a multi-century way of life of a people, all in the name of a “bright future”. The people retain in their memory the earlier disaster, the “Aktaban Shuburyndy”, when the Kazakhs, having survived defeat at the hands of the Dzhungari, left their homeland behind and saved themselves from total annihilation. It turned out that the Kazakhs’ losses during this disastrous period were five times less than during the “Great Dzhut” of the 1930s. Those who survived the hungry exhaustion of the people after incredible sufferings and misfortune have come to have a mentality of “be prepared to suffer” through any disaster, if only to remain among the living. And for this reason, the people resigned themselves to endure these years; and they did endure through many years. But the people were unable to recover from the terrible physical and spiritual devastation of the famine years (which requires favorable conditions for a long period of time over several generations) because a new test fell upon them, a test, no less monstrous, a test in the form of a lengthy series of massive nuclear explosions. Here, I will stop my story for the time being, for a necessary (as it seems to me) statistical digression.

1.2 TEST SITES OF OTHER NATIONS

Today five countries (Great Britain, the U.S., France, China, and the USSR) conduct nuclear weapons tests. The U.S. first tested the atomic bomb on 16 July 1945, and by the beginning of 1989 had conducted 932 tests. Almost all of the thermonuclear bombs tested by the U.S. were on the Marshall Islands in the Pacific Ocean, on the atolls of Enewetok, Bikini, and Rongelap. The results of the 14.8 megaton thermonuclear device exploded on the island of Bikini on 1 March 1954 have become the property of the people. All 267 inhabitants of the island were subjected to radiation of doses greater than 200 rad. One day after the explosion American troops, in protective clothing, landed on the island. They measured radioactivity in the wells and then left the island, having done nothing for the population. On two other islands located 150 and 280 km away from the explosion, the external radiation exposure dose was 150 and 140 rad immediately after the test. Afterward, under public pressure, the authorities were forced to evacuate the aborigines from the polluted islands and to compensate them for the damage inflicted on their health and economy. The irradiated population was actually provided a pension for two decades. The Nevada Test Site located in the Yucca Mountains is used mainly for testing low yield nuclear weapons, especially underground, at a depth of 1000 meters.

Great Britain conducted close to fifty tests in Southern Australia and on the Polynesian Islands. An Australian governmental commission reported that after a series of tests in 1963, the entire population in the neighboring regions and close to 20,000 service personnel were subjected to high doses of irradiation. Thousands of square kilometers of earth turned out to be contaminated by plutonium and other radionuclides. The nuclear bombs exploded during those years on the territory of Australia contained 25 kg of plutonium, 8000 kg of uranium, and 100 kg of beryllium.

France conducts its tests on the Mururoa Atoll. The overall number of explosions is close to 180.

China has conducted significantly fewer tests, 34 in all, beginning in 1964. However, what signals alarm for us is the fact that China’s nuclear test site is located near our border, in the Sin’tziam-Uigursk autonomous region, meaning that the radioactive cloud frequently reached the southern regions of the Semipalatinsk oblast. The last test in China was conducted 18 August 1990.

1.3 WHAT IS HAPPENING AT OUR TEST SITE?

The Soviet Union conducted its first nuclear test on 29 August 1949 at the STS (see Figure 1-1). To date, 662 explosions have taken place, the majority of which were conducted at STS and only a small portion at Novaya Zemlya.



Figure 1-1. First Soviet Union test (RSD-1), detonated 29 August 1949

It is known that at one time so-called “peaceful” tests were conducted in Bashkiria and Siberia as were “military studies” employing nuclear weapons in Orenburzh. The cost of the tests in our country is a secret. According to estimates of Western specialists, the costs at Nevada were around \$12-17 million. The USSR Ministry of Defense pretends that it marches in step with time. Considering the irreversible trend of disarmament in the world, as confirmed by the press, the budget for creating and improving the nuclear arsenal of the Soviet States is equal to 1,970,000 rubles, as opposed to 2,900,000 for the preceding year. It is possible that the story applies only to military pay, since this sum (which is easily computed) is five to six times less than the cost of only one underground explosion.

From 1949 to 1963, the tests at STS were conducted at the earth’s surface and in the atmosphere. Hundreds of atomic, thermonuclear (hydrogen), and so-called plutonium bombs were tested. In 1988, 13 tests were conducted at STS, four of which reached 150 kt yield. In 1989, the Soviet Union conducted four additional tests.

1.4 TESTING HISTORY

The local population has known about the test site since 1949. The first atomic bomb test (29 August 1949) occurred before the harvest. Despite meteorologists’ predictions, according to which prevailing southwesterly winds were expected to move the cloud in a direction where there was less population, the radioactive cloud moved southeast, and radioactive dust settled on the villages of Dolon’, Besterek, Mostik, Samiyarovka, and other villages with a total population of over 10,000. The military had taken no precautions, and the population remained in complete ignorance of what had happened for a long time.

Tests were conducted more intensively later, especially from 1951 to 1953. The locals from surrounding villages remember powerful explosions with a bright flash, incomparable thunder, and the formation of mushroom clouds which rose up to the “very sky”. As some of the inhabitants from Kainar village tell it, “In 1951 a powerful explosion was conducted here: adobe walls collapsed, telegraph poles fell, roofs collapsed, and animals scattered...”). Half an hour later, a partial eclipse occurred, and the sky was clouded over by a black cloud which moved to the west. A sticky white-colored dust settled upon people’s skin. However, the people looked

upon all of this more with curiosity and astonishment than with fear, since no one was forewarned of any possible danger.

In 1953 an explosion of similar yield was repeated, but this time a column of military vehicles arrived two hours before the test. The population was loaded into the vehicles. Each vehicle carried two bottles of vodka, a loaf of bread, and several cans of food. The people were taken 80 to 100 km into the steppes and unloaded into the open country. Many returned later to the village and found it covered with a fine dust, soft to the touch. The animals, especially the milking cows, were listless; they neither grazed nor ate provided feed.

That same year the population in the regions surrounding the test site were witnesses to still one more bomb test. Its explosive yield exceeded that of all preceding explosions many times over. The flash and the subsequent mushroom cloud were visible at a distance of close to 300 km. The city of Semipalatinsk suffered an earthquake; window panes were blown out and furniture (such as buffets filled with dishes and other objects) was knocked over. This time the big radioactive cloud flew over Sarzhal village and the district center at Karaul. All small and large population centers for a great distance were subjected to radioactive contamination. Afterward, according to test site data, it became known that the radioactive trace reach Balkhash Lake. No measurements were taken at further distances. The population of the Karaul district center was evacuated in time; close to 60 people were left in the village, however. After the explosion they were taken for check-ups: radioactivity levels on their clothing and exposed skin were measured, and blood samples were taken for analysis several times at multi-hour intervals. It is clear that a premeditated experiment was conducted on the people; the results of this experiment have been kept secret until now. Running a little ahead of myself, I will say that by the time of the scientific-industrial conference in Semipalatinsk in July 1989, the majority of these “hibakusha” [Japanese word meaning survivors of the Hiroshima/Nagasaki bombings—Ed.] had died.

This was the first “hydrogen bomb” (thermonuclear weapon), which was exploded at a low altitude. The yield was 470 kilotons. The explosive wave lifted a huge amount of earth mixed with radionuclides and threw it about the district to a distance of hundreds of kilometers, while a finely dispersed dust rose to the stratosphere, subsequently contaminating the entire planet (sic) with a radioactive layer. The population in the nearby village of Sarzhal was subjected to a very high dose of radiation.

1.5 ATOM CITY

The city is named Kurchatov. It was earlier referred to as simply the “Objective” or “Final” with the postal index “Moscow-400”. Atom City is located on the steppe western bank of the Irtysh. The population today is close to 30,000. [It now numbers only a few thousand—Ed.] The city is protected against the outside world by two rows of barbed wire. In order to gain access, one had to pass through three check points. Inside, the city was divided into a series of sections consisting of a complex of highly classified Scientific Research Institutes (NII, in Russian) and experimental plants which served to test site. The latter were located 70 to 80 kilometers to the northwest. Earlier, during the period of open nuclear weapons testing, homes were built on the test site, military hardware such as tanks, weapons, and other items were kept there, and domesticated tests animals including dogs were kept for studying the power of the shock wave and the effects of thermal and radiation emanations. During the time of experimental testing, the epicenter of the test site was located 70 to 80 km from the city. To our reasonable question on the reason for moving underground tests further away from the city of Kurchatov, the test site

leaders just shrugged their shoulders. But from ordinary workmen we heard that they were sick of “constantly undergoing earthquakes” and that “it’s better further from the filth”. The move may have been further away from Atom City, but it took the tests closer to the residents of the Abaisky region. Now the stock breeding farms of the Sarzhal state farm are located 6 to 210 km away from the explosion shafts.

Construction of the city began in 1946 by forces who were under the watchful eye of Lavrenti Beria [head of the Narodnyy Komissariat Vnutrennikh Del (NKVD), or Soviet security apparatus—Ed.], as was always done. The so-called “Beria House”, in the midst of greenery, surrounded by ordinary poplars, was finally shown to us in 1957 (Figure 1-2). Barrack huts were kept closed until 1955, at which time they were leveled to the ground. This city, isolated from the outside world, “represented a rather strange product of an epoch” in the words of A.D. Sakharov. This was a city where the nation’s talented people such as Sakharov, Iu.B. Khariton, and Ya.B. Zel’dovich created weapons of mass destruction. It was a city which prided itself on its achievements, but completely forgot about the fate of the people who lived around the test site. Later on, Sakharov wrote in his memoirs:

“...peasants in the neighboring, poverty-stricken countryside saw a dense barrier made of barbed wire which enveloped a huge territory. They say that they came up with a completely original explanation for this: ‘There they have set up experimental communism’. This ‘experimental communism’ is a site which represents kind of a symbiosis of the latest scientific institutes, experimental plants, test sites, and a large prison camp. Prisoners’ hands built the plants, the test area, roads, and homes for future coworkers. The prisoners lived in the barracks and walked to work in a convoy accompanied by shepherds.”



Figure 1-2. Former home of Lavrenti Beria in Kurchatov

Kurchatov City is still called the city of immortals: there is no cemetery here, and archaeologists, centuries from now, will not know where the dead were buried. Here, in this city, they don't die, and if this should happen, the deceased are taken somewhere farther away. It is clear that many in this town live only to a defined age, and then, as they retire, they are given an apartment in another (prestigious) area, for example, on the picturesque banks of the Dnepr, in the city of Yellow Waters in the Dnepropetrovsk oblast.

1.6 THE "HYDROGEN BOMB"

In our country, the test of the first thermonuclear bomb, or as they still call it, the "hydrogen bomb", was conducted in August of 1953. In a session of the Supreme Soviet of the USSR, G.K. Malenkov, then-President of the Soviet of Ministers, announced with great enthusiasm the completion and test of a new contemporary weapon with an explosive yield equivalent to 530,000 tons of TNT. The creator of this bomb, Academician A.D. Sakharov, describes this test in his memoirs:

I saw a shining white-yellow ball which rapidly grew over the horizon. After some fractions of a second it became orange, then bright red. Just touching the

horizon, the ball flattened at the bottom; between the cloud and the rolling dust, the leg of a thermonuclear mushroom began to form. Suddenly, far off on the field which spread before us, there appeared the trail of the shock wave. The wave came at us. (Figure 1-3)

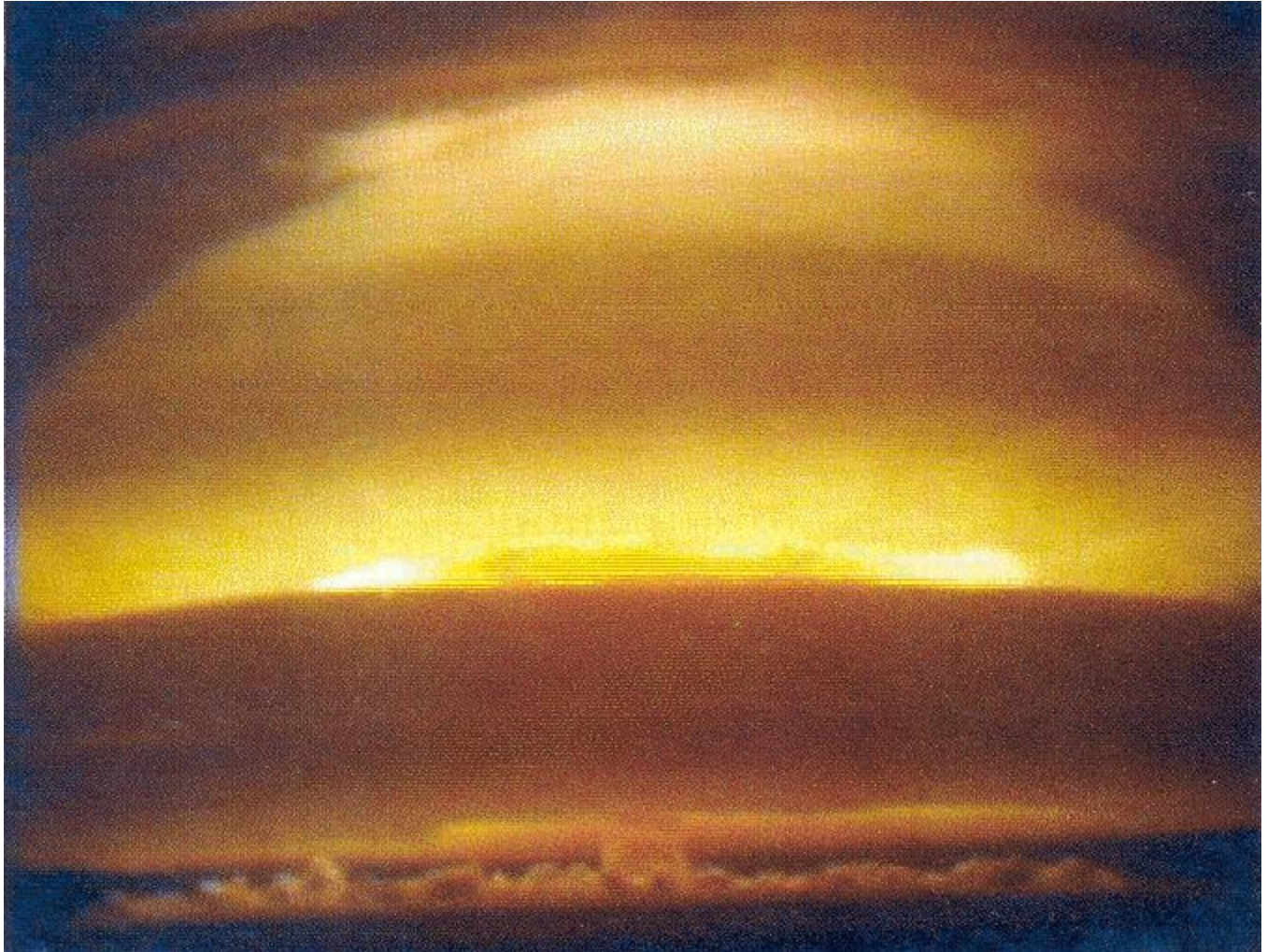


Figure 1-3. First Soviet thermonuclear bomb, detonated 12 August 1953

Journalist Svyatoslav Polyutin was also a witness to this phenomenon. He was 35 km away from the epicenter on the outskirts of Atom City. “The first shock wave reached the city 39 seconds later and passed, but the new wave knocked all of us down. We were lifted off the ground a little and stuck to the walls by our backs and the backs of our heads. My cassette was wrenched from my hands and thrown on the railing.” The author lost consciousness from the blast. Many correspondents who photographed this event died from radiation illness. Polyutin enumerates the following friends of his: O. Lebedinskiy, N. Shumov, and I.Ya. Gasyuk.

1.7 FATHERS OF THE NUCLEAR BOMB

A.D. Sakharov was already wavering about the fate of mankind in 1969, and as he states in his memoirs, this greatly facilitated the “realization of personal responsibility...especially the participation in the development of the most horrible weapon threatening the existence of mankind.”

Theodore Taylor, the creator of the nuclear bomb in the U.S., was also an active supporter of prohibiting and destroying the entire nuclear arsenal. At an international conference the end of May 1990 entitled “World Constituency against Nuclear Weapons”, he called again as he did many years ago for a complete and universal ban on nuclear testing on Earth. In addition, Taylor feels it is necessary to fight as well against the uncontrolled use of nuclear energy for peaceful purposes, since there is an inextricable link between the use of nuclear energy for peaceful and military purposes.

2.0 RADIATION CONTAMINATION

2.1 ON DOSIMETRY AND RADIATION CONTAMINATION

First about terminology. In radiometry, as in any areas of metrology, some defined values are accepted: ¹ PDD—maximum permissible dose [of radiation, i.e. lifetime accumulated dose—Ed.]; PDK—maximum permissible concentration (of radioactive matter) [internal dose equivalent—Ed.]; and PDP—maximum annual permissible dose of radioactive matter [annual internal dose equivalent—Ed.] There is yet another variable: VDU—temporarily permissible levels of radiation [dose limits for emergency or lifesaving situations—Ed.]. In most countries VDUs are used only for a short time in very special situations.

But the VDU for the population in regions neighboring the STS was notoriously set at 50 rad/y in the 1950s. Perhaps this was the reason the command structure took no preventive measures nor gave treatment to the suffering populations of Dolon', Besterek, Mostik, and dozens of other villages and settlements which were subjected to irradiation in 160 rad doses. In 1949 the scientific world possessed reliable information on the harmful effects of radiation when its value exceeds 100 rad. According to the press in Hiroshima and Nagasaki, it was known that a radiation dose of 150-200 rad caused radiation illness of moderate severity with a fatality rate of 5% among those who fell ill. Somewhat later, a report appeared in the press on the unsuccessful fate of several hundreds of aborigines on the Marshall Islands in the Pacific Ocean, where the U.S. conducted nuclear bomb tests. Despite this fact, test site workers not only ignored the health of the population which was subjected to irradiation, but they also did not feel it necessary to publicize the dangers to local authorities and local organizations for civilian health. Nonetheless, they decided to evacuate the population in 1953 for the thermonuclear bomb test. And even then, only those who lived in defined zones where the radiation dose was expected to exceed 200 rad.

A VDU, temporarily allowable level, of 50 rad/y was maintained until 1956, when the levels underwent a tenfold reduction to 5 rad/y. In 1960, it was set at 0.5 rad/y. On the suggestion of the National Committee on Radiation Protection of the USSR (NKRZ), the idea was accepted that irradiation is considered dangerous at 35 rem accumulated lifetime dose (assuming a 70 year life span). But this standard is not accepted by all. Specifically, the State Expert Commission chaired by academician N.N. Moiseyev considers that the establishment of an allowable level was done without sufficient substantiation and thus it does not meet safety requirements.

The dose of 0.5 rem/y is accepted by a number of countries, for example, by Great Britain for a selected health contingent of those people who are allowed to work in a radioactive zone (for example, at nuclear power stations). As was already noted, the NKRZ and the test site confirmed this dose value for the entire population around the test site, 40-50% of whom are children and elderly women (sic), whose bodies are extremely sensitive to radiation.

2.2 WHAT DO FIELD MEASUREMENTS INDICATE?

Test site workers did not have information concerning the level of radioactivity in population points around the test site. This could have been because this dose so exceeded the allowable standards that they were required up till now to keep this information highly secret. We doctors

¹ Several of the following concepts, e.g. maximum allowable dose of radiation (cumulative dose), are no longer used in the setting of radiation safety standards. The acronyms used (PDD, PDK, etc.) are the transliterated (Russian) initials of the concepts defined.

were for a long time in the position of the student to whom, according to an old anecdote, the professor shows the tail feathers and then asks the student to determine to what type of bird they belong. They [the test site directors—Ed.] only showed us the “tail feathers”, that is, some random figures which allegedly corresponded to the allowable norms.

An astonishing coincidence: The State Expert commission chaired by academician N.N. Moiseyev was required to state (within four years of the Chernobyl catastrophe) that the Ministry of Health of the USSR, Goskomgidroment (State Committee on Hydrology and Meteorology), and the Committee on Atomic Energy do not want to recognize their miscalculations and their obvious mistakes. Add to the number of crimes committed by the aforementioned organizations their arbitrary change in the temporarily allowable level of radiation, without scientific substantiation.

In the 1950's the test site was kept deeply secret and our attempts to obtain some information on radiation doses received by the population met with deaf ears. Only after our expedition joined forces with the Institute of Biophysics of the USSR Ministry of Health did a tiny way through open up. The radiological group of the Institute of Biophysics in 1980, after comparing test site archival data to its own measurements, roughly estimated the level of external irradiation in population points (see Table 2-1). But in 1989, S.L. Turapin, a retired lieutenant and former chief of the department for predictions and studies of radioactive contamination of the Semipalatinsk Test Site, generated some recalculations showing higher levels.

Table 2-1. Measurements of external irradiation levels (in rad) in villages near the STS

Village	Institute of Biophysics (1980) (rad)	Lieutenant Turapin (1989) (rad)
Dolon'	134	160
Sarzhai	42	55.7
Kainar	7	41.5
Karaul	10	30.2

These calculations were made with the assumption that the population in these villages was removed for no less than 20 days. The radiation dose which those people received who remained from the very beginning and those who returned sometime after the explosion can be 2 to 4 times greater than the calculations (except for Dolon', where no one was evacuated).

Lieutenant Turapin's calculations differ greatly in relation to Kainar, which was “contaminated” during a nuclear weapons test in 1951; however, no one was evacuated from the villages and all its residents received not 41.5 rad (according to Turapin's calculations) but 4 times more, that is, 166 rad. This number is close to our data.

I know of a number of examples of total lack of reporting of radioactive contamination after tests. In 1954 for example, during the spring month of March, 30 to 40 tests were conducted. However, the test site refused to inform us of the results of radioactivity measurements in the population points surrounding the test site. Here we only get approximate information on the dose of external gamma radiation; however, we know very little concerning the amount of radioactivity obtained by the human organism when inhaling radioactive dust, or the

radioactivity which occurs from contaminated food products and water. Yes, and as we can see, the test site does not possess such information, since all of this was not monitored.

The amount of radioactivity in external irradiation according to results obtained using aerial surveying, which is constantly done at the test site, is not correct. The measurements must be taken at populated points, among the people, where they live. The radioactivity of food and water must also be determined.

All of these gross faults occurred because the monitoring of the radioactivity levels in populated points was entrusted to the STS itself and to departments which were subordinate to the Minsredmash (Ministry of Medium Machine Building). Earlier, for the sake of secrecy, that was what the Ministry for Production of Nuclear Products was called. How can one otherwise regard the declaration of Professor L. Buldakov, Deputy Director of the Institute of Biophysics, concerning the fact that the PDD (sic) at which no harmful effects occur for an adult is 5 rad/y? This he said so as to prove that there are no harmful effects to the Semipalatinsk population from the many years of testing. However, he does not mention that in a number of population points the doses of external irradiation varied from 50 to 150 rad according to the test site data. If we add to this the internal radiation which occurs from inhaling the air, then it is not difficult to calculate a total dose of close to 200 rad (and more), that is, a dose which is fully capable of causing radiation illness.

2.3 POISONED FOOD

In the years 1958 to 1959, an expedition of the Academy of Sciences of the Kazakhstan SSR took measurements of radioactivity in the environment and in food products in Sarzhal, Kainar, Karaul and, for comparison, in Chubarta and Aktogai (Karaganda oblast). These results are astounding in and of themselves. In 1958, the milk products from a farm in Sarzhal contained seventy times more strontium-90 than the average across the country. This unhappy picture also was drawn in a similar analysis of mutton. The content of strontium in the soil in the Abaiskiy region in the year during which our expedition was working was 25 to 60 times greater than, for example, that in England.

At that time we noted the following sad phenomenon. The content of radioactive strontium-90 in mutton was two times greater than its content in the intestines. This indicated that the radioactive material accumulates in animal organisms.

I will not burden the above information with more figures, which I do have; I will only say that the territory around the STS was contaminated at the time with high radiation doses which included such long-lived radionuclides as strontium-90, a source of beta radiation, as well as a group of alpha emitters which have a very long half-life. During the time since, a reduction has occurred in the radioactivity of the strontium-90 (due to its natural half-life), but the remaining radionuclides have obviously not disappeared and continue to go through the biological cycle. The strontium-90 content in sheep in this region is one million (!) times greater than the PDK for strontium in food products (750 to 1000 Becquerel).

From 1949 to 1963 (14 years), tests of various types of devices were conducted: thermonuclear, plutonium, and others. We prided ourselves on the military might of our nation, but it led to monstrous contamination of a huge territory in the republic. I already said that the residents of certain villages were sometimes evicted at critical moments. However, the military did not know the psychology of the peasantry: a peasant cannot rest when the cow has not been milked, and

the livestock have not been fed. And of course, despite the cordons, people would return at night to their villages, hide during the day, and begin farming at night. In addition, as was already said, the military left behind 20 to 30 (according to other accounts, 60) of the locals in Karaul and Kainar to protect property, livestock, etc. Without a doubt, all these people received not 55.7 rad (according to the test site personnel) but more than 200 rad. Let us remember that is enough to cause radiation sickness.

2.4 AND WHAT ABOUT TODAY?

There exist several probable sources of radiation to the populace today. And, during the time of open testing, close to two hundred types of radionuclides were dispersed around the test site. The radioactivity of the majority of these elements has fully disappeared, or has reduced to a safe level as a result of the natural half-life. However, long-lived isotopes still maintain their activity. They are in the soil and have been picked up into the feed during many years of growth. I mean such compounds as strontium-90, zirconium-95, cesium-137, carbon-14, plutonium-239, polonium-210, and lead-210. Plutonium and lead (sic) have not been studied as heavy metals which accumulate in the bones and several other tissues of an organism. And we also do not know how they accumulate in the human organism and in the biological chain: plants—animals—humans—plants—humans.

Meanwhile, the world literature contains a number of examples of the selected accumulation of radioisotopes and in addition examples of selected population contamination.

a. The residents of Western Australia who eat kangaroo and mutton (they eat the innards), much like all the population in village locations, are subjected to internal irradiation in doses which are 75 times greater than in the population in Europe. This means that the sheep and the kangaroo feed on plants which are filled with lead-210 and polonium-210. One must also consider that Australia is located at a distance away from the Pacific test site that is a thousand times greater than the distance of Sarzhel from the Semipalatinsk Test Site.

b. The population of Chukotka and the entire north of our country undergo internal radiation due to radioactive nuclides (strontium-90, cesium-137, zirconium-95, plutonium-239) which, in the fly—deer—man chain, accumulate greatly in organisms. A deputy group of the Supreme Soviet of the USSR studied the Chukotka peninsula and discovered a 200-fold increase in the radioactivity of the entire territory. As a result it was discovered that residents of Chukotka had an increase in bone content of lead-210 of 10 to 20 times and of cesium-137 of 100 times the average in the Soviet Union. This led to a growth in malignant tumors (up to 10 times for certain types of tumors), and to a sharp increase in the mortality rate, especially in children (70 to 100 per 1000 births). All of this led to a reduction in the average life expectancy of the root population to 45 years.

c. In Sweden, in accounts of the radioactive danger after the Chernobyl accident, practically all of the deer numbers were annihilated and the Laplanders were compensated for them. In addition, they have been supplied with free food for all these years. For two years, it was prohibited in Sweden to use the meat of roe deer, moose, and wild deer for food. It was even prohibited to feed it to the dogs!

Measuring radionuclides (alpha particle sources) in plants and in animals is a labor-intensive process which requires complicated equipment. The first materials which emitted alpha particles (plutonium, lead, polonium) on the Semipalatinsk Test Site were discovered by V. Stepanenko 5

June 1989 on the territory of the Tailan Brigade in the Sarzhal collective farm in the soil at a depth of 20 cm. The content was such that it exceeded by 700 times the background level and by two orders of magnitude the maximum allowable concentration. One should note that according to radiobiological data, alpha particles possess a relative biological activity which exceeds by 20 times the activity of roentgen and gamma rays. For the past decade, the radiobiology field has accumulated new experimental data which confirm that the biological equivalent of the effectiveness of alpha radiation exceeds by 180 times the effectiveness of roentgen and gamma rays. Thus, the PDK for radionuclides which emit alpha particles in food products, water, milk, and other liquids must be 100 times less than that for isotopes such as strontium.

In 1963 in the surface layer of the atmosphere, the content of dispersed plutonium exceeded the PDK 2 to 3 times, and, according to some data, 8 times. This speaks of the concentration of plutonium on the surface layer. But no one has yet studied how much this most harmful radionuclide will circulate in the air, water, and soil.

In the past few years, a linear dependence between alpha particle quantity and leukemia frequency has been established.

A second unconsidered source of contamination in the environment is the carbon isotope C-14 which is also one of the main products of a thermonuclear explosion. Its half-life is 1,000 years (sic) [actual half-life of carbon-14 is 5,730 years—Ed.] In underground explosions with a high background temperature where all the water vaporizes under high pressure, the radioactive steam literally shoots out into the adit. Radioactive carbon and tritium are formed in huge quantities, especially when testing a large charge of up to 150 kt. Such a phenomenon clearly occurred in 1955 when radioactive carbon dissipated toward the Egindybulakskiy, Karkaralinskii, and Kuvskiy regions. However, we had absolutely no information on the presence of this material at the time of the explosion and for the subsequent period, nor on the biological cycle. The test site ignores this idea, and makes it seem like alpha particles and radioactive carbon do not form during underground tests, nor during surface tests of nuclear devices. The test site also refuses to give information on the effect of plutonium warheads, tests of which were conducted repeatedly in the Degelen Mountains. The test site has kept quiet, even after V.F. Stepanenko, as was already mentioned, uncovered these same alpha particles in the ground in a section of Tailan.

One can give a multitude of examples indicative of contamination of the territory abutting the test site with long-lived radioactive materials (strontium, plutonium).

2.5 DIFFERENCES OF OPINION AND CONTROVERSY OVER RADIATION DOSE

Up until 1953, that is, until the first test of the thermonuclear bomb, military departments, including the STS, were barely interested in the level of contamination of populated points. A dose of 50 rad per year was accepted as the sanitary standard for those years which was considered safe for the population. Even so, after the first test in August 1949, the populations of Dolon', Besterek, and Mostik received a dose of external radiation of 160 rad. By accounts of the test site medical service, not one of the 10,000 irradiated (actually close to 200,000) suffered from severe radiation sickness, so such a high dosage was disregarded. The dosage measurements were taken at a height of 300 to 500 meters using a device mounted in a high-speed airplane, and no one took into account the contribution of radioactive contamination as a result of inhaling radioactive particles along with air, or radioactive matter occurring in food products and drinking water.

The situation changed with respect to testing a thermonuclear device. There emerged the danger that during a very high yield explosion, a radioactive cloud could cover a huge territory located far beyond the borders of the test site. The expected dose of external radiation could greatly exceed the PDD of 50 rad. This stressed the health and life of many thousands of people who had nothing to do with test site activities and knew nothing of the impending danger. First came the issue of methods to reduce the level of the radiation burden on the population living directly near the test site, as well as in Atom City itself. Let us offer the words of A.D. Sakharov: "We estimated the distance from the location of the explosion of our charge where we would expect a total radiation dose of 200 roentgens. This figure was selected as the maximum. People who lived in the downwind sector, closer to our defined 200 roentgen border, had to be evacuated. This was tens of thousands of people."

Marshall Vasilyevskiy mobilized military trucks for population evacuation.

According to the stories of the residents, we know that this was the first evacuation. It was conducted one day before the test of the thermonuclear bomb. People were moved from an area from the Sarzhal collective farm (50 km from the test site) to the regional center of Karaul (200 to 250 km from the epicenter). Between these two population points, there are scattered many small farms and Chabaiskiy yurts, a portion of which were forgotten in the rush. People remained here as involuntary experiment subjects. The population of Kurchatov was also evacuated, even though the cloud moved in a south-southeast direction (Kurchatov is located to the northwest). All the population living beyond the defined borders was left in place. They witnessed the bright flash, then the bright expanding cloud approaching them, and covering the sun as if it were covered with a white powder. The people called it "unthawing snow", without knowing that it was mortally poisonous and able to cause untreatable harm to their health. The inhabitants in the populated points located five km south-southeast of Karaul were neither evacuated nor relocated. They were subjected to irradiation of doses several times less (sic; context implies "greater") than the 200 roentgens which were calculated. People living 40 to 60 km from Karaul on the downwind side were irradiated to doses close to 100 and more roentgens. As was noted above, before 1953 the population was never evacuated, and as much radioactive dust as the capricious wind and the radioactive cloud could carry fell upon their heads. At the end of November 1955 an even higher yield, improved thermonuclear bomb was detonated. Corresponding to the yield of the charge, millions of tons of radioactive matter mixed with earth or what was left of the earth moved toward the southeast, reaching Ust'-Kamenogorsk and further on to the territory of China. More than half the territory of the Semipalatinsk and East Kazakhstan oblasts was copiously contaminated with radioactive matter. The test site and the higher military command soothed themselves with the fact that the copious snow which fell a day after the test covered the radioactivity until spring.

Our arguments with the test site personnel began under rather dramatic circumstances. I remember how it happened.

It was well into the autumn of 1960. We conducted a joint expedition with the Institute of Biophysics of the Ministry of Health of the USSR. Professor R. Babayants, A.G. Gus'kova (now a Corresponding Member of the Academy of Medical Sciences of the USSR), and a number of other highly qualified specialists conscientiously and patiently worked under the severest conditions of the Semipalatinsk steppes and took part in a medical investigation of the population. Academician A.V. Lebedinsky, director of the Institute of Biophysics of the Ministry of Health of the USSR, saw to it that the expedition was supplied with the latest equipment for

biochemical investigations and he directed the highly qualified scientists (Doctor of Sciences L.N. Tutochnik and others). Thanks to the influx of new strength and the attention of the center, the conditions for the expedition were much more comfortable in comparison with the previous one. We were even able to use the auto route of the STS, which greatly facilitated transport of the population to the investigation site. So, finally, we, along with Professor B.A. Atchabarovyi, make our reports and write up our conclusions. The scientific portion of the test site, under the direction of Lieutenant S.L. Turapin, does not agree with the results of our radiological investigation, and simply pays no attention at all to the data concerning the health of the population. Most important was the radiation dose! At first the possibility of irradiation with high doses was completely repudiated. He argued for a long time about the level of radiation contamination in the village of Sarzhal. The test site representatives, led by Turapin, confirm that the population received less than 20 rad. When we showed the results of our radioactivity measurements and a correspondingly high level of illness, which was confirmed by the Muscovites, Turapin brings out another map of regional pollution where the dose is noted as 37 (?-illegible in original manuscript) rad. We argue as one does at a bazaar, and we note that our figures do not agree. So, we fight over each population point: Kainar, Karaul.

The test site itself made a report and wanted to gain our agreement and our signatures. We do not come to an agreement. After Lieutenant Turapin, STS Commander Guriy persuaded us (over a cup of tea). We were sure that we were right, and went out into the dining room, deeply disappointed. At midnight I was called to see the commander. On the government communications line was A.I. Burnazyan, the deputy Minister of Health of the USSR, responsible for not only radiation safety at the test site but across the entire country. Usually he is calm, but now he began to threaten, then persuade us. He promises to help the populace. Since I still don't agree to sign, he says he will think about it until the morning. We sit with Atchabarovyi in our room in the dark and cannot sleep. After some time two familiar folks from the place next door come to us. They begin discussions about this and that. They describe how life is in the Siberian labor camps. They imply that we are undermining the defense capability of our nation, and we are helping imperialism and that such people deserve no mercy in our country. After an hour, A.F. Kobzev appears; he is a former lieutenant in the KGB and the head of our united expedition. Again, warnings about our future. Again (it is already morning), we are called in to the commander. Again, Burnazyan is on the line. He asks us to sign a summary report, having told us his own opinion and his disagreement with the test site data. It seemed to us that this was an agreeable condition, and we took it. However, in the summer of 1989 when I looked over the data from 27 years ago, I did not find the page with our own opinions on it.

Recently the "State Herald" settled on the thesis that, in all, 10,000 people around the test site (I mean in the three neighboring regions: Abaiskiy, Beskaragaiskiy, and Zhanasemeiskiy) received irradiation above the PDU from 1949 to 1963. I casually mentioned this and now I would like to come down harder on this issue.

Somewhat different information comes from B.I. Gusev, head doctor of the specialized dispensary (created in 1963 in Semipalatinsk, and disguised under the name "anti-brucellosis"): he stated that only 25 to 30 percent of the population subjected to irradiation from 1949 to 1963 were taken into consideration. Consequently, according to Boris Ivanovich's data, no less than 40,000 people were subjected to irradiation.

Both sources talk only about three regions in the Semipalatinsk oblast and not one word is said about the inhabitants of the Karagandinskiy oblast (Kuvskiy and Karkaralinskiy regions), who

live as close to the test site as the population in the regions within the Semipalatinsk oblast. Our accounts are based on dosimetric measurements of the soil, plants, and other objects from 1958 to 1960 and allow us to say that close to 200,000 people received a dose which exceeded the PDD.

Our calculations will undoubtedly cause still greater opposition from our permanent opponents, whom we are justified in suspecting of prejudice. We have not once convinced them of it. It seems inhumane to us.

The military departments take pains in their attempts to lessen the level of the tragedy and the danger of its effects. The central bureaucratic departments and officials who are responsible for nuclear energy, the atomic lobbyists, cover up the crimes committed by the military. That is how it has been in relation to Chernobyl until now, when society has risen to defend its interests. But in Semipalatinsk, everything remains with no visible movement.

3.0 HEALTH EFFECTS FROM TESTING

3.1 THE TRUTH ABOUT HEALTH

It is not by hearsay that I know how we came, step by step, to an exact identification of the sinister threat to the nation's health from nuclear testing. It would be good to recount these steps.

In the beginning of the 1950s, our nation was seriously preparing the civilian population for a nuclear war. The position of Chief Radiologist was introduced into the staffs of many ministries, including the Ministry of Health. In medical schools and universities, students of higher levels began to study a new discipline, that of radiobiology and medical radiology, based on hurriedly and universally created new departments.

From 1952 to 1953, as Chief Radiologist of the Ministry of Health of the Kazakhstan SSR, I repeatedly had to travel to Semipalatinsk; it seemed that we were taking part in the nuclear tests. At the same time, we were not allowed beyond the borders of Semipalatinsk, and we, along with deputy minister Eh.A. Sarynovyi, spent our days in therapeutic establishments in the city.

During one of our visits, the chief doctor of the oblast hospital specifically spoke about the unusual illnesses which were observed in individual population points. At that time I made use of the rather detailed information on the tragedy in Hiroshima on radiation illness and then turned my attention to the symptoms described by the chief doctor, and found some similarity with radiation pathology. My assumptions were confirmed by my familiarity with the illness histories. My discoveries were reported to the Ministry of Health of Kazakhstan SSR and a decision was then made to organize an expedition to investigate the population.

During those years, we had field and so-called BP [Russian initials—Ed.] radiometers for measuring beta activity. Equipped with these, for one year we drove around nearly the entire territory of the Semipalatinsk oblast and we established defined zones of increased radioactive contamination. The STS refused any contact with us; it ignored our many calls from the oblast's executive committee. At a collegium of the Ministry of Health, it was decided to monitor the health of the population which lived on the territories with increased radioactivity.

Our first expedition included employees from the Alma-Ata medical institute, mainly enthusiasts who decided to donate their work leave and to work in remote villages whose residents had been subjected to irradiation. For two to three months for two summer seasons, the senior lecturer M.F. Pshenitsyna, a great therapist who later headed a department in the medical institute and who was a native of Semipalatinsk oblast, worked on the expedition. Her firm knowledge of the Kazakh language and day to day life created a favorable situation for her work. The population already knew about Maria Federovna's selfless deed, when in 1938 she went to a labor camp in Siberia with her husband K.U. Urazboev, a professor of the medical institute who was condemned as an enemy of the people.

The expeditions of Lia Rykov (the niece of the former president Ryakov of the Sovnarkom, or Soviet People's Commissariat of the USSR) conducted blood studies in the hardest of conditions. Sophia Priyatkina, a senior lecturer of the neuropathology department, was ready to work as an ordinary neuropathologist. For two seasons, we had along with us a physician roentgenologist, Azadan Konovaluv, who was the grandson of a member of Narodnaya Volya (People's Freedom), who was sent from Petersburg to our province in the last century. Yes, the expedition

which we successfully knocked together consisted mainly of “unreliable” stratum of the intelligentsia.

The experience of our two summers of intense work showed that with the forces of a weak expedition it is difficult to prove the existence of radiation pathology. At our first meeting in the office of the First Secretary of the Semipalatinsk Party Regional Committee, M.S. Suzhikov, a test site representative, began reading aloud the earlier prepared statement that all the symptoms and syndromes that we discovered were nothing other than the emergence of vitamin deficiencies and the consequence of a high incidence of brucellosis, tuberculosis, and other diseases in the population. We lost at this meeting. We did not have any data on the incidence of illness in the population, or on the content of vitamins in food products and so forth.

When we returned to Alma-Ata, we informed our management of this, and upon the initiative of the President of the Academy of Sciences of the Kazakhstan SSR, academician K.I. Satpaev, it was decided to create a complex, multiple profile expedition outfitted with the latest equipment. A radiobiology section was created in the staff of the Institute of Provincial Pathology, and this institute was suggested to mobilize the entire collective in this work. Such a decision certainly facilitated manning the expedition with specialists and doctors of nearly all backgrounds, and to create a powerful radiodosimetric mobile laboratory. There was no need to persuade the Director of the Institute of Provincial Pathology, B.A. Atchbarov, and having nearly completed his final doctoral dissertation, he soon afterwards created a large collective with many sub-departments.

From 1954 to 1960, the population from five village areas were subjected to a complicated investigation.

3.2 JOINT EXPEDITIONS

And so, for two years, 1958 and 1959, the highly qualified specialists from the Institute of Biophysics of the Ministry of Health of the USSR and even a number of test site workers were enlisted into the service of the population.

The medical investigations included more than 8,000 residents, a portion of whom were checked twice. Inhabitants of three regions abutting the test site were checked (Abaiskiy, Zhansemeiskiy, and Beskaragaitskiy) as were two control regions (Chubatskiy and Bayanaul'skiy), which were totally comparable to the national make-up in socioeconomic status and other indicators. The expedition included radiologists from Kazakhstan and from the Institute of Biophysics of the Ministry of Health of the USSR, whose investigation results coincided a number of times with the test site data. Rather frequently their obtained results exceeded the doses recorded by the military department specialists.

3.3 “PELLAGRA” AND OTHER DISEASES

The results of the numerous investigations were reported in March 1963 at a scientific conference in the Institute of Biophysics of the Ministry of Health of the USSR with the participation of representatives from the STS, the Ministry of Defense, and the Academy of Sciences of the Kazakhstan SSR. An increase in damage to exposed parts of the body was noted in repeated observations, which, for lack of a suitable analogy in medical practice, were termed by Professor R. Babayants (from Moscow) as pellagrodermia, or pellagra-like syndrome. This syndrome included hyperpigmentation of the exposed body parts, hyperkeratosis (exaggerated cornification), xerosis, and cheilitis (inflammation of the lips). These signs were encountered 10 to 20 times more often in Kainar, and 5 to 10 times more in Sarzhal and Dolon', than in the

control village of Shchadra (Barnaulskiy region). Most amazing is that these unusual afflictions of the skin were observed in permanent residents of Dolon' 2 to 5 times more often than in Dolon' residents who lived in the village after 1951.

Expedition dermatologists noted with amazement the frequency of damage to the hair in the form of uneven fallout and thinning, increased brittleness, and frequent degenerative-dystrophic changes in the nails. These symptoms were observed in contaminated villages 2 to 3 times more often than in the control villages.

Professor Babayants, who was head of the dermatologists' group, could not explain the reason why the afflictions of the hair were encountered more often in the young, who look like strong shepherds and machinists, rather than in the elderly. Among the elderly there was not once incidence of loss of hair. When he discussed this riddle with me, it suddenly became clear to me: the older generation always wears hats, most often fur, while the young, who imitate the townspeople, walk around without headgear and therefore pay with epilation (loss of hair).

Neurologists, therapists, and other specialists discovered a complete range of symptoms such as asthenia and arterial hypotension, whose frequency in the studied regions was 5 to 6 times higher than in the control regions. Delayed permeability of vessels and their increased brittleness was encountered more often in the regions neighboring the STS than in the control areas. Every other resident of Kainar and Sarzhal suffered from low arterial pressure, weakness, and apathy. The pathology of the blood and the vessels was also very evident. For example, a reduction in blood coagulation was observed in 90% of those in the contaminated areas and only 10% of those in the control regions. The population of Sarzhal and Kainar clearly suffered from damage to the fine blood-carrying vessels, which was expressed in an increased permeability of the vessel walls, increased brittleness, and hemophilia.

Thus we established a positive deterioration in the health of the population in villages neighboring the test site. Of course, the above noted symptoms are not indicative only of radiation sickness, but can also, in certain specified conditions, be a consequence of vitamin deficiency, protein deficiencies, as well as tuberculosis and brucellosis, which are widespread among the Kazakhs. However, in the control regions with the same living conditions and diet, and with the same frequency of tuberculosis and brucellosis, the above mentioned syndromes were observed two to three times less frequently.

3.4 THE SECRET OF KAINAR

It was then that the term, "the secret of Kainar", emerged, a new phenomenon which had to be substantiated scientifically. The high rate of illness which was completely consistent with radiation pathology has remained unproven and a mystery without radiometrical confirmation.

At that time there was most likely no special desire to uncover this secret. Everything was under the cowl of the Committee for State Security and no one wanted to risk fighting for some Kainar somewhere. In a private meeting in his home, academician A.V. Lebedinskiy advised me to be careful, or else I could lose not only my career, but my life. There was a lot of truth in the words of Andrei Vladimirovich. One year before this, during my time in Moscow (I lived in a private apartment), a KGB employee came up to me and told me not to leave Moscow without someone's knowledge. He gave me a phone number. Of course I got scared and immediately ran to the Central Committee (CC) of the Communist Party of the Soviet Union (CPSU) on Staraya Ploshchad' (Old Square) to a reception at the deputy chief of the health section. By evening I

was in the CC building. They fed us exquisitely. Only by evening did my guardian tell me that everything was in order, and that I could continue to work. This was what was going on. Not long before that, the British Broadcasting Corporation (BBC) radio station reported some small news about some expedition which somehow discovered indications of radiation sickness among the local population. We did not hear the radio ourselves and did not know how this information ended up in London.

According to this report, radioactive clouds are supposed to bypass large population points along some corridor selected by the testers. However, the wind directions and rain play evil tricks on the people nearby. This is what happened the first time in 1949 when, despite expectations, radioactive fallout fell east of the test site, exceeding the maximum allowable dose by three times (160 rad). The same thing was repeated in 1951 and 1953, and each time the radioactive fallout products, instead of going according to the predictions in a particular direction, fell out unexpectedly over populated points creating a radioactive background which exceeded the allowable level. All of this was close to the truth. Again from 1952 to 1954, we repeatedly informed the CC CPSU through the first secretary of the Semipalatinsk oblast' committee of the Communist Party, M.S. Suzhikov, of the fact that a 50 roentgen dose exceeds the tolerance of the body in children and lactating women, especially when it acts on a large group of the population with unfavorable social, living, and nutritional conditions. However, it was only in 1956 that the Ministry of Health of the USSR established the maximum allowable dose at 5 roentgens, immediately reducing it tenfold.

Here is yet another example. In 1964 the state commission, which included Yurii Izrael, President of the Committee on Hydrometeorology (which, as it is assumed, gave the order), Avetik Burnazyan and others predicted the outcome and gave the okay for a "peaceful" explosion on the Chagan River in order to create dams and reservoirs which had no economic value. (See Figure 3.1 below.) This venture was completed with the formation of a crater 200 meters deep and 600 to 800 meters wide and ejected highly radioactive rock. For twenty years this lake has served as a source of radioactive emissions.



Figure 3-1. Chagan nuclear explosion 15 Jan 1965

At a scientific conference in the Institute of Biophysics of the Ministry of Health of the USSR (February 1961), test site employees declared that radioactive contamination of Kainar occurred in 1951. This coincides with the residents' accounts that in June at haymaking time they observed a wide band of cloudiness for an entire day which moved very slowly over the village. Dust fell out from the cloud and landed on the surface of their bodies. This dust was similar to cement. According to test site data, a radioactive cloud moved at a rate of 10 km/h, which coincides with the observations of the village residents. The expedition of the Academy of Sciences of Kazakhstan SSR discovered radioactive particles in the form of fine grains with a diameter of 2 to 3 mm in the ground at a depth of 20 cm. In 1959, our measurements showed soil radioactivity at 0.2 curies/km^2 ($7,400 \text{ Bq/m}^2$) from strontium-90. It had been eight years, which is close to 1/3 of the natural half-life, since the initial fallout. In official test site documents, due to contamination that occurred in 1951, the population of Kainar received a dose of 7 rad due to

external irradiation. Later in 1989 Lieutenant S.L. Turapin, who in his time was the head of the test site service for radiation surveys, revised his initial data and noted the possibility of the population receiving 41.5 rad of external irradiation. According to our calculations, the population of Kainar, which numbers 1,800 to 1,900 people (45% of whom are children) was subjected to radiation effects from a dose of close to 180 to 200 rad. This explains the high illness rate of residents of this village. Thus, over 25 years, 214 people died from malignant neoplasms; this is a rate of 449 per 10,000 people, or 2.5 times the average in Kazakhstan. During those years 14 people suffered and died from leukemia; this is a rate of 28 per 10,000 people. At the same time, according to Burenin's data from the All-Union Oncological Scientific Center, the illness rate from leukemia is 4.7 per 10,000 people in the Semipalatinsk oblast, 5.2 per 10,000 in Kazakhstan, and 9.2 per 10,000 in the USSR.

Thus, in Kainar, the leukemia illness rate is 3 times higher than in the whole of Kazakhstan. During those years, Kainar recorded 20 cases of birth abnormalities, which greatly exceeds the indicators for other regions.

However, coworkers in the region stubbornly confirmed that the total radiation dose to which the Kainar population was subjected did not exceed 7 to 10 rad. According to ideas from years past, such a dose could not cause pathological abnormalities. The conference was in a deadlock. And then the wise academician Andrei Lebedinskiy said that science is encountering a new phenomenon, which he called "the secret of Kainar". But this phenomenon turned out to be not so much a secret as the consequence of unimproved dosimetry methods. In the beginning of the 1970's I again met with Lieutenant S.L. Turapin, the head of the department on the study of radioactive contamination. By this time he was demobilized and sadly told me about the strange history of mistakes permitted in the radiation level measurements in 1951. Sergei Lukich disclosed that to collect the radioactive dust during those years a Petryanov filter was used. It contained soot and other large particles according to which the radioactivity was to be determined. But later it turned out that this filter was not suitable for measuring radioactive dust and aerosols which differ from soot in their high surface electrical charge; therefore, microparticles, especially when found in an aerosol state, pass through the filter. This led to reductions in the amount of radioactive contamination. The second mistake was that the radioactive surveying was done at a height of 300 to 500 meters and greater, using filters located in planes flying at high speeds following the radioactive cloud. But in reality, irradiation occurs differently. Fine radioactive particles, especially in an aerosol state, are concentrated in the near surface layer of the atmosphere at a level of 0.5 to 2 meters from the ground; that is, at the level where man inhales air. The matter settled on the ground is also lofted on the wind to this height. Sergei Lukich made calculations and recalculations and came to the conclusion that after the test of the "device" in 1951, the population of Kainar could receive a dose of no less than 41 rad during the first week, and possibly greater. It seems to me that I was successful in convincing Sergei Lukich that this dose was reduced and that the population of Kainar, numbering close to 2,000 people by all accounts, received a dose of from 150 to 200 rad. This is indicative of the high illness rate in Kainar, corresponding in scale to the illness rate in the villages of Dolon' and Besterek, whose populations received a dose greater than 160 rad. In addition, even in 1958, the expedition of the Academy of Sciences of the Kazakhstan SSR uncovered microparticles in Kainar at a depth of 0.5 meters in the ground that measured up to 2mm in size with high radioactivity. It is possible that this is the contribution of the later tests on which we do not have much information.

4.0 LONG-TERM HEALTH CONSEQUENCES

4.1 DELAYED ACTION BOMB

It goes without saying that from the moment when testing was banned, the direct danger of radioactive contamination of the population, as compared to what had happened earlier, had lessened to some degree. However, the radioactive material accumulated over the preceding 14 years continued to show its temper. Now this emerges in the form of remote effects such as mutagenic, teratogenic, and carcinogenic effects as well as accelerated aging.

An example of the emergence of the mutagenic effect of radiation is the twofold increase in retinoblastoma (a congenital tumor in the eye) in the oblast for the past two decades, from 1960 to 1969 and from 1970 to 1979 (Professor Teterina's data). Important specialists-psychiatrists from Moscow, Alma-Ata, and Semipalatinsk note a 48% increase in psychiatric illnesses (from 1978 to 1988), which is two times greater than for the whole of the republic. In regions neighboring the test site, mental backwardness is noted 2 to 5 times more often than the average for the country.

One of the remote results of radiation is early aging, whose emergence can be traced through cataract frequency. As the investigations of a group of ophthalmologists have shown, in the control region of Kokpekti cataracts were observed 5 to 6 times less frequently than in the people who were subjected to irradiation. Cataracts in Sarzhal and Kainar are observed in every fourth individual. The Chief Doctor of the Anti-Brucellosis Dispensary, B.I. Gusev, informed a group of deputies from the Supreme Soviet of the USSR (in January 1990) that among those irradiated people who were taken into the study, early signs of aging clearly emerge. Thus, arteriosclerosis, cardiosclerosis, and other indicators corresponding to aging are observed in 25% of those who are of passport carrying age. Not only in the Zhanasemeiskiy region but in other regions which are located close to the test site we observe a high level of birth defects. Thus, according to the data of the Semipalatinsk Department of Health, the mortality rate of children up to 15 years of age from birth deformities in the Abaiskiy and Beskaragaiskiy regions for the past three years (from 1985 to 1988) increased threefold. These regions are for cattle-breeding and grains are not sown. Consequently they do not poison themselves with chemical fertilizers and pesticides. In this region there is no industry, so that the effects of chemical harmful factors are omitted and there remains only one cause.

The test site remains silent about the nearby regions of the Karagandinskiy oblast. None of the members of the numerous state commissions even remembers these regions, as if they don't exist, although it is known that the population of the Kuvskiy (Egindy-Bulak) and the Karkaralinskiy regions were subjected to massive irradiation during the nuclear "device" testing.

Now we reap the rich "harvest" of the consequences of this. Thus, Egindy-Bulak with a population of 19,500 people registers 30 children and 267 adults with mental weakness. Of these 72 are severe, and have been relieved of military duty. Goiter has been discovered in 75% of the permanent residents of Dolon' who were subjected to massive irradiation in 1949 and only in 22.6% of those who did not live in Dolon' until after 1951.

4.2 MALIGNANT TUMORS

It is widely known that in relation to malignant neoplasms radiation exposure does not have a threshold level; that is, radiation induces tumor growth at a very minimal dose. At the same time, there is a linear dependence between the frequency of occurrence of malignant neoplasms and the amount of the radiation dose. At high doses tumors appear within five years of irradiation, first in the tissues of the hemopoietic system (leukemia, leucosis). Let us remember again that the first explosion of a nuclear bomb with contamination to a wide territory to the southeast of the test site was conducted in 1949. Over the population points of Dolon', Mostik, Besterek, and others, as we remember, the dose of external irradiation was (according to test site data) 160 rad in one month. These villages, and the location of the polygon, may be seen in Figure 4-1.



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Figure 4-1. Map of area near Semipalatinsk Test Site

In 1951, 1952, and 1953 a similar situation, as we reported, was created southwest of the test site. Kainar, Sarzhal, Karaul, and other population points were contaminated by a radioactive cloud, where the radiation dose due to external irradiation was 60 rad, accounting for resettlement of the residents (see Figure 4-1). The remaining people obtained a dose close to 200 rad. As a result, within 12 years of the first nuclear explosion in the Semipalatinsk oblast (in 1961), a high illness rate due to malignant neoplasms was noted: 124.4 per 100,000 people, which was 35.5% higher than for the whole of Kazakhstan.

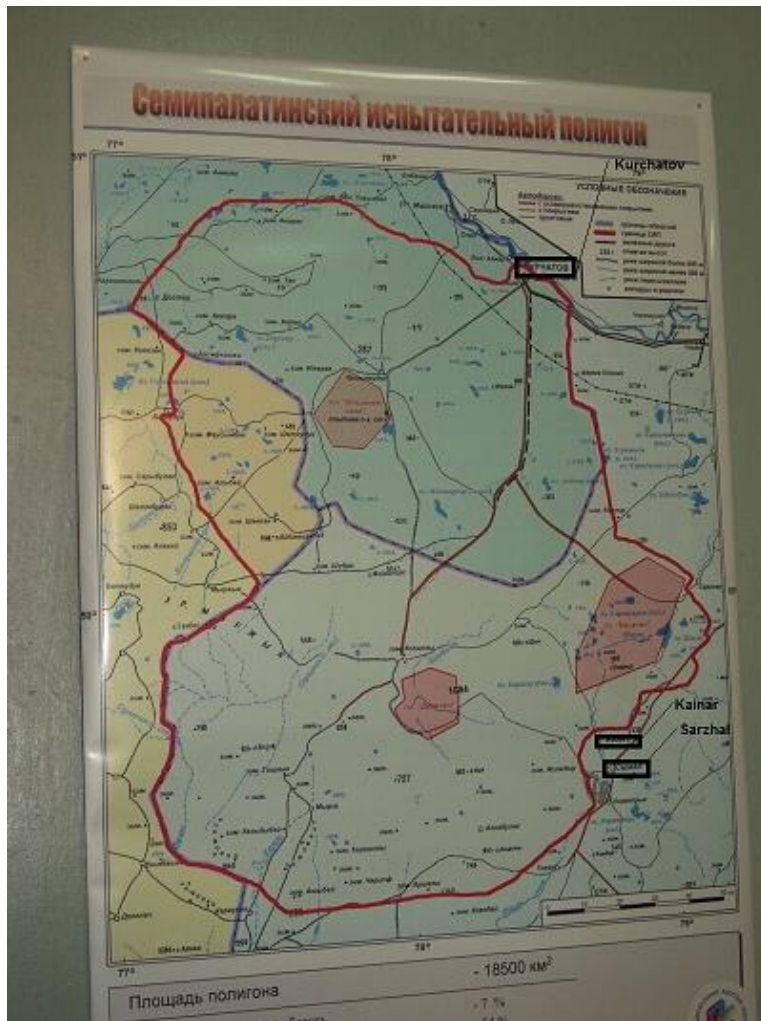


Figure 4-2. Semipalatinsk Test Polygon. Six-sided figure in upper center was the original test site. Irregular figure in lower center is Degelen Mountain, where underground tests were done.

In the 1950s in Semipalatinsk oblast, chemists were barely used at all in agriculture, industry was not sufficiently developed, and the environment was clean. The Irtysh River was wide and full of water. Therefore, the main reason for the increase in malignant neoplasms in the region is the radioactive fallout as a result of the surface and atmospheric tests of nuclear weapons. This is confirmed by the data of Professor P.I. Busrenin from the All-Union Oncology Center and of B.I. Gusev, the Chief Doctor of the so-called Anti-Brucellosis Dispensary. The authors, on the order of an interdepartmental commission, studied the level of excess mortality from malignant tumors among the residents of populated points contaminated by radioactive nuclides. The conclusion was made: a significant increase in the risk of suffering from malignant tumors as the villages came closer to the test site.

During the next decade, the Semipalatinsk oblast' saw a continual rise in tumor illnesses and in 1970 it reached 171.7 per 100,000 people, which is 11.2% higher than for the whole republic.

In the 1960s in the Semipalatinsk oblast, 1,700 people were ill with malignant tumors and these 1,700 died; in the 1970s that number was 1,100. These 2,800 people who had died over two decades can be included in the category of so-called excess mortality caused by the effect of

radiation. The Committee on Radiation Protection of the USSR (the president is academician L.A. Ilyin) predicted the consequences of the accident at the Chernobyl' nuclear power station proceeding from a calculation of 100% realization (induction) of malignant tumors over 30 years after irradiation. The last open test of a nuclear weapon which clearly caused irradiation of the population was conducted in 1963 and thus, for the past 26 years (according to the committee's calculation) there must occur a nearly total realization of carcinogenic radiation effect, and now, at the end of this dangerous time period, the illness rate for malignant tumors around the test site should be decreasing (assuming no other carcinogenic factors, such as chemicals, toxins, or other materials are present). However, an analysis of the illness rate for malignant tumors in the Semipalatinsk oblast indicates a lack of this tendency. Conversely, the illness rate is growing, although somewhat slower than in the 1970s, and in 1988 was 188.9 for the oblast, 172.2 for the Beskaragaiskiy region, and 218.0 per 100,000 population in the Zhanasemeiskiy region.

A concentrated appearance of radiation effects can be shown using Kainar as an example. Kainar's population in 1960 was close to 1,500, and in 1988, 2,540, more than a third of whom were children. For those 28 years, in this small state collective 214 people died from malignant tumors, which is 440 per 100,000 population. This is a gigantic percentage. During those 28 years in the state collective, 14 people died of leukemia, or 28 per 100,000.

A leading employee of the All-Union Oncological Scientific Center of the Academy of Sciences of the USSR, Doctor of Medical Sciences M.A. Bul'bulyan, with a group of scientists, conducted independent investigations of the illness and mortality rates from malignant tumors in the Semipalatinsk oblast.

This is what Deputy of the Supreme Soviet of the USSR Zhumatova writes after having visited the test site region with other deputies in January 1990:

What I saw in the Znamenik village located 30 km from the test site shocked me! At night I could not sleep. Before my eyes there stood children whose minds were so weak to the point of dementia, not one, but two, and close to 10 kids of differing ages, and there were only 1,500 people living in the village. In the next wards we saw children with physical birth defects and developmental defects. I was even suspicious at first: may be the local management gathered up all the psychically and physically incomplete children from the nearby villages. However, official documents and statistics confirm that mental weakness and psychic illness in the oblast is 2 to 2.5 times greater than the indicators for the entire republic. This was reported by Shcherbakon, the chief doctor of the oblast's psychiatric hospital.

The oblast has very high indicators of suicide. Thus, in Kainar village (60 km from the test site) over the past 8 years (from 1981 to 1988) 22 people killed themselves (by hanging), half of whom were born between 1952 and 1965. The older generations of Kazakhs did not even know what suicide is. The residents of this village suffer from malignant tumors 2.5 times more often than the average for Kazakhstan.

Today, the children of those people who were subjected to radiation effects suffer from immunodeficient disease. For them all infectious illnesses occur very severely, transforming into a chronic, drawn-out form. The immunodeficient effect of radiation is manifested in the following: for ten years (from 1978 to 1988) thyroid gland illnesses (enlargement) increased by 40% in Vladimirovka, compared to 17.8% in the control region of Kokpekti.

5.0 OTHER EFFECTS OF TESTING

5.1 IRRADIATED DESCENDANTS

Ionizing radiation has a pernicious effect on genetic material, that is, on deoxyribonucleic acid (DNA) where thousands of chromosomes are concentrated, each of which governs the synthesis of a specific protein which supports the metabolism, pureness, and equilibrium of an organism.

Leading radiologists of the world believe that one of the objects most vulnerable to the action of radiation in small doses are male germ cells which are highly sensitive to the action of radiation. During the life of one who has suffered irradiation, this appears in the form of a temporary or permanent sterility (barrenness), some emergence of impotence as well as abnormalities in the DNA chromosomal apparatus. We have long known that ionizing radiation is one of the most powerful carcinogenic factors. In the first quarter of the 20th century, 338 pioneer doctors and physicists who worked with radioactive materials became ill with cancerous tumors and paid for this knowledge of the essence of X-rays and their effects with their health and life. Included among the victims is Nobel Prize Laureate Maria Sklodovskaya-Curie, who gave a priceless contribution in the study of radioactivity. Therefore, the more frequent illness occurrence from malignant tumors in the Semipalatinsk oblast cannot be unexpected. The possibility of coming down with cancerous tumors and other illnesses caused by genetic abnormalities was greatly disputed. Indeed, can abnormalities in the male germ cells or in the maternal egg cells which have occurred as a result of radiation effects, cause cancer, mental weakness (oligophrenia), blood illnesses and psychic illness in subsequent generations? We will try to answer this.

While examining generations of Japanese who survived in Hiroshima after the nuclear bombardment of 1945, more frequent malignant tumor illness was not noticed. Scientists explain the lack of greater frequency in leukemia and other tumors in the Japanese descendants in the following manner. The radiation occurred one time during one lifetime for a short period of time. Radiobiologists know that germ cells are more sensitive to repeated action at the same dose. Tests on mice conducted by scientists from Hiroshima showed that after chronic irradiation in doses of 360 to 5,040 milliSieverts (3.6 to 50.4 rem), descendants had widespread tumors of the lungs and other organs and were severely hit by leukemia.

The most amazing data on the effect of chronic irradiation in small doses were obtained in Great Britain during an examination of people who worked at nuclear electric power stations. In the vicinity of Sellafield, since 1947 a huge atomic plant has been enriching spent nuclear fuel. Professor Martin Gardner analyzed 107 cases of illness in the hemopoietic organs of people under 25 years of age (from 1950 to 1985) whose fathers were irradiated in doses of from 10 to 100 milliSieverts (1 to 10 rem) for the period of their employment. The author showed a direct dependence between the irradiation dose of the fathers and the frequency of hemopoietic organ illness in the children. Thus, if the fathers received no less than 100 milliSieverts (10 rem) before the study, then the risk of illness in the children increased 6 to 8 times. If the fathers are subjected to irradiation during the sixth months before the study, then even insignificant doses of 10 milliSieverts (1 rem) increased the risk 4 to 5 times. The National Council on Radiation Protection of Great Britain is examining the issue of toughening the requirements and lowering the allowable dose to 1.5 rem/y. Now let us compare these data with the results of the investigation of the population around the STS. Here, as we remember, close to 200,000 people

received a dose of greater than 10 rem. The descendants of all of these people run the risk of coming down with leucosis and other illnesses caused by abnormalities in the genetic apparatus not only 6 to 8 times more, but much more frequently.

5.2 CONTEMPORARY “MANKURTY”²

According to the rate of illness from psychological disorders, the Semipalatinsk oblast outpaces all the remaining localities two times over. In regions neighboring the test site, the psychological illness rate and oligophrenia (mental weakness) are even higher; they occur 2 to 2.5 times more frequently than in the country as a whole. The frequency of psychological illnesses increases as one nears the test site. Professor Z. Alimkhanov analyzed the illness rate in 1987 with respect to the distance between the population points and the test site. It turned out that in villages less than 120 km away from the test site (Sarzhai, Kainar, Abrola, Sargalda, Medleu, Akbulak), there were 144 psychologically ill people out of 10,962 residents (1.33%), while in the population points at a distance of 120 to 160 km away from the test site, only 124 cases in 15,777 were found (0.78%), slightly over half as many. The largest portions of psychological illnesses is oligophrenia (mental weakness), according to the data from Professor Alimkhanov. Oligophrenia is observed especially frequently in people under the age of 40 (born after 1950). There were 34 cases of oligophrenia per 100,000 population in 1987 in the entire republic, whereas Semipalatinsk oblast saw 52.3 cases per 100,000. In only 10 years (1970-1980) debilitation and other forms of oligophrenia in Semipalatinsk oblast grew from 51% to 66.8% of all psychological illnesses, and in Beskaragainskiy region, 81%. In a study of the frequency of psychological illnesses in Semipalatinsk oblast, Professor Alimkhanov discovered a sharp, “explosive” increase in frequency in those people who were born after 1949. Thus, oligophrenia increased tenfold and epilepsy fivefold. Three quarters of the psychologically ill under study in the Semipalatinsk oblast were people born after the beginning of testing of nuclear weapons on the test site. Oligophrenia indicates a weak mind and it varies from a complete state of debilitation to a high level of dementia. Statistics include only those who are lagging behind in their studies at psychiatric establishments or have been excused from fulfilling their military duty. We do not have information on the number of children who are under study because of mental weakness as a result of a mild appearance of oligophrenia. Many of these young people who are suffering from various forms of oligophrenia can have, and will have, descendants who, more likely than not, will inherit this congenital defect. One does not want to use the word “genocide”, but it is difficult to define and characterize the complicated living conditions for the population of the region neighboring the test site in any other way. Psychiatrists in the Semipalatinsk oblast have for many years been convinced of the direct effects of the nuclear test site and of testing on the psyche and on the frequency of psychological illnesses. They know that the closer the population point is located to the test site, the more psychological illnesses they will have. These observations were confirmed and presented by Professor Alimkhanov at the latest congress of the “World Constituency against Nuclear Weapons” (May 1990, Alma-Ata). The promulgation of the following figures caused quite an impression on the attendees: in population points located 50 to 60 km away from the test site, the coefficient of psychological illnesses is 161; at a distance of 120 to 160 km, it is only 78.0 per 100,000 population.

² A story in Central Asian folklore refers to a slave who was tortured and eventually turned against his own people by his captors. In the later years of the USSR the term “mankurty” (plural form of “mankurt”) was used in the Central Asian republics to describe the alienation of their people by a society that repressed them, distorted their history, and tried to cut them off from their ethnic roots.

A group of psychiatrists from Semipalatinsk (V.K. Kadykov, V.P. Shchukin) established that close to 15.0% of the examined children and 41.0% of the adults who lived in direct proximity to the test site suffer from various forms of neuropathological disorders, while at the same time in the Kokpektinskiy (control) region this indicator is 3.3% among children and 5% among adults. Mental weakness in the Abaiskiy and Beskaragaiskiy regions is 2.5 to 3.0 times greater than the republic indicator.

Psychological illnesses in the village of Znamenok increased from 63 cases per 100,000 population in 1975 to 230 cases in 1988, that is, a nearly fourfold increase in some 12 years. The situation with psychological illnesses is even worse in the village of Chagan, which is 10 to 15 km from the test site. In only the past three years, the number of persons ill with mental weakness increased threefold and reached 450 cases per 100,000 population.

5.3 IS IT EASY TO PART WITH LIFE?

Continuous stresses related to the testing of “devices”, asthenia, and deterioration of health due to a reduction in the overall resistance of the organism, genetic flaws inherited from intensely irradiated parents—all of this places a heavy burden on the psyche of the younger generation. Not having the stability and the experiences of life, young boys and girls often become indifferent not only to their own futures, but to the very dearest thing, their own life, and they easily part with it.

The older generation of Kazakhs, as I have already said, due to their religious traditions and their sense of responsibility for the family and for their ancestors, would never think to end their lives by suicide, under any conditions. The Kazakh language doesn't even have a word for “suicide”. For the past decade, this type of death has become a usual occurrence in the region.

As it was established among people who have lived in direct proximity to the test site, suicide occurs five times more often than among residents of areas far away from the test site. In addition, the living and eating conditions and other social adversities can hardly be that different in villages which are located less than 100 km from one another.

5.4 THE COST OF DAMAGE

I affirm that today each resident of Semipalatinsk oblast is paying with three years of his life for the damage inflicted to their health as a consequence of the “deterioration of the environment” in which they live. Considering that close to 800,000 people live in this region, the losses in life expectancy come to 2,400,000 years. In most civilized countries, a sharp increase in the life expectancy of the population has occurred over the past 15 years (1970 to 1985). In Japan this indicator is 79.5 years, in Sweden 76.7, and in the US 74 to 75 years. An analysis of the statistical material showed that the average life expectancy of the population in the Kazakhstan SSR on the whole increased during this period only 3 years, from 66.6 to 69.4 years. In the Semipalatinsk oblast, on the contrary, life has become shorter by 2.17 years in comparison with 1970 to 1971.

For the past decade, the Semipalatinsk oblast has seen a deceleration in the natural growth of the population: the population increased by only 8.4% between 1979 and 1989, which is 1.5 times less than in Kazakhstan, and 2 times less than in the Aktiubinsk and Chimkentsk oblasts.

According to our deep conviction, this is caused by the chronic effects of several years of radiation (large doses from 1949 to 1963, smaller doses later). Moreover, we do not deny the effects of other unfavorable factors in the living environment. Conversely, we also feel that the

latter rendered an aggravating effect in the appearance of adverse radiation effects on the health of the oblast's population.

The mortality rate for the Semipalatinsk oblast from 1981 to 1988 is 8.1 to 8.6 per 1,000; in 1989 it was 8.9 per 1,000. For the Republic for these same years, the rates are 7.2 and 7.6, respectively. The mortality rate in the Semipalatinsk oblast was noted in 1959. People died from various illnesses. The mortality rate for cardiovascular disease was 241 per 100,000; for illnesses of the digestive organs 126 per 100,000; from infectious disease 67.6 per 100,000; and for respiratory tract diseases 57.7 per 100,000. By 1987, the mortality rate from these illnesses decreased an average of two times, but still continues to remain higher than the average for Kazakhstan. Despite this, for the past decade the oblast has seen a deceleration in the natural population growth. The population increased from 1979 to 1989 by only 8.4%, which is 1.5 times lower than the rate for the Republic.

The decelerated natural population growth is caused by the high infantile and child mortality rate. Stillborns increased from 1960 to 1983 from 6.1 to 12.5 per 1,000 births. In the Abaiskiy region, stillborns equal 15.2 per 1,000 births. Infant mortality in the oblast equals 34 per 1,000; for the Republic it is 27 per 1,000.

6.0 CRISIS OF CONFIDENCE

The newspaper “State Herald” (27 July 1990) calmed the population with some theoretical calculations on the expected levels of malignant tumor illnesses in the Semipalatinsk oblast. Considering the computations of theoreticians, sometimes one wants to yell out: “Stop soaring about in the clouds! Stop creating an illusion for yourselves and for the population! Why do you close your eyes to factual data?” Surely authors are aware of the fate of those unfortunate 10,000 Soviet “Hibakusha”, who have been observed by the Anti-Brucellosis Dispensary for a quarter century? You see, there remain only 3,000 of them, as was reported by the Chief Doctor of the Anti-Brucellosis Dispensary B.I. Gusev. The Deputy Commission of the Supreme Soviet of the USSR, headed by Iu. Shcherbakov in January of 1990 noted that illness from malignant tumors among the selected study contingent was 35% higher than in the control group who are found in this account. One should note that the control group is undoubtedly smaller than the base group.

In the archives of the Institute of Biophysics of the Ministry of Health of the USSR and of the aforementioned Anti-Brucellosis Dispensary, there is one copy of the expedition calculations from the Ministry of Health of the Kazakhstan SSR together with the Institute of Biophysics from 1958 to 1960. According to this account, in 1961 the population suffering from malignant tumors in the oblast was 30% higher than in the entire republic. These numbers are real, they concern living people, and the paper “State Herald” still continues to concern itself with theoretical calculations, according to which it is concluded that in the test site region, the “excessive” illness due to cancer is equal to “only” 7%.

For whom are these debates calculated, these debates which are similar to the anecdotal dispute of the monks in the Middle Ages concerning the number of devils one can fit on the head of a needle? The paper confirms it: if we extrapolate this addition for all three regions, where close to 70,000 (at the same time, more than 90,000) people lived during that time period, then the growth in tumors due to radiation effect are at a level of 1% relative to the spontaneous level). We suggest listing by name 214 of those who died during these years in the single village of Kainar, with a population of between 1,500 to 2,500. This is 449 per 100,000, which is 2.5 times more than for the whole of Kazakhstan.

The Scientific Committee on the Influence of Nuclear Radiation (NKDAR; UNSCEAR in English abbreviation) of the United Nations formulated the moral side of using radiation. One of the points of the statement reads: “The freedom to risk one’s life and health is an inalienable element of personal freedom. To subject other people to such a risk is to encroach on their personal freedom.”

You see, the military command never once asked the opinion of the population, nor let them know of the possibility of expected dangers. Moreover, they kept secret and still keep secret the actual situation. Undoubtedly, the population in the region is worried, disturbed, and demanding; but people can only be calmed by the truth, and not half-truths and unfounded confirmations as the “State Herald” gives out. And it is far from being the only source of criminal disinformation.

There are several other examples. For instance V.A. Bukatov, President of the Interdepartmental Commission, on 25 May 1989 in one of the newspapers publishing his article “Nuclear Test Site: Rumors and Facts”, in which he writes: “There is no link between the level of illness in the population and the existing radiation situation”.

Except Bukatov does not know that even according to the data from the test site specialists, 10,000 people were subjected to irradiation which exceeded the maximum allowable dose: close to 3,500 people received up to 40 rem and another 1,000 more than 160 rem. In 1953 I don't remember a single time before a thermonuclear test when the population was evacuated from inside a zone where radiation was [not] expected to equal 200 rad. Those who lived outside that border and who were judged to receive not 200 total rad, but, let's say 170 to 180 rad, were left in place.

Defenders of the test site confirm: "The specialists began to account for all factors which allowed them to conduct explosions with the least consequences". Yes, this is exactly so: tests were conducted with the "least consequences" for the residents of the city of Kurchatov. In 1961, when the STS leadership gave us access to secret material, we were most surprised by the fact that all the tests were conducted in the presence of westerly, southwesterly, and rarely southerly winds. If the winds were directed to the east, northeast, and southeast, then the tests were postponed day by day; that is, nuclear weapons tests at the STS were conducted under climatic conditions which inhibited the movement of the radioactive cloud toward the city of Kurchatov. The population of the eight village regions of the Karagandinskiy and Semipalatinsk oblasts during the 14 years systematically received varying doses of radiation as a result of the tests of hundreds of nuclear devices.

Here are other examples of ignorance and untruth: the "State Herald" printed some facts on the frequency of hematological illnesses (that is, blood illnesses) among the population of the Semipalatinsk region. In 1985 tumors in the hemopoietic-lymphatic organs occurred (when counting per 100,000) at a rate of 9.1 for women and 11.6 for men, while for the whole of Kazakhstan it was 5.2 for women and 6.0 for men. These data are confirmed also by B.I. Gusev, Chief Doctor of the Anti-Brucellosis Dispensary, who established that in 1985 the standardized indicators for illness due to malignant tumors in the hemopoietic organs in the Semipalatinsk region was 1.4 times greater than for the entire USSR for men and 1.2 times greater than for the entire USSR for women.

And here is the unexpected conclusion from the "State Herald" newspaper: "More than a quarter century has passed since the end of surface and atmospheric testing. Thus, to link the leucosis illness rate in the Semipalatinsk oblast to radiation is unfounded." Such an assertion is not supported by any scientific data and has been made for the ignorant.

The impression is made that some interested group is standing guard over the test site and over what concerns radiation industry and the military and civil technocracy. So in February 1989 the newspaper "Moscow News" published an article on the emerging cases of deformities among piglets and calves at one of the collectives in the Norodnicheskiy region of the Ukrainian SSR located in direct proximity to the Chernobyl nuclear power station. There was an immediate reaction. A month later, N. Shilov from the All-Union Institute of Agricultural Industry comes forth in the press and confirms that these deformities are not linked to radiation, since the dose was less than the allowable but it did not give the results of measurements. In May, K. Gordeyev (Institute of Biophysics of the Ministry of Health of the USSR, Moscow) reports that not one of the 64 cases of deformities in the calves and piglets was documented according to radiation level.

In rejecting the ideas of the dependence of birth deformities in young cattle on radiation, the authors give no reasons for this. As a result, the readers not only don't believe them, they also disbelieve all atomic energy specialists. Thus, there emerges a crisis of confidence. The crisis

snowballs because the same people are responsible for monitoring and for guaranteeing safety; that is, they are responsible both for measuring and observing the safety rules at both the Chernobyl nuclear power station and at the STS.

The lack of reliable information on the mechanisms for independent monitoring led to the population long ago stopping to believe the test site, who are only protecting their own interests. From the experience at Chernobyl, the people saw changes in the “objective” information on the levels of radiation contamination. Even now, after three years, the government must resettle hundreds of population points from this region. I remind you that during the dosimetry and the determination of the level of contamination as well as during the recalculations of the cumulative radiation dose around Chernobyl, it seemed that the best forces in our nation took part—representative from the Ministry of Health of the USSR, Ministry of Agricultural Industry, Ministry of Defense, and the State Committee for Hydrology and Meteorology. This did not help to avoid the distortion of reality. In our case, in Semipalatinsk, the test site itself (and only the test site) monitored the level and dispersion of radiation in the neighboring territory, and if something was disadvantageous, then the STS would shroud it in secrecy. The documents either disappear or are destroyed (for example, the doctoral dissertation of S.O. Turapin). But they are carelessly quiet about the data on the dosimetry of civil establishments.

Only now do we know the real truth about Chernobyl, thanks to the work and persistence of the USSR Supreme Soviet Commission, and, as we can see, that genuine openness became possible for Chernobyl only four years after the accident. Semipalatinsk to this day is still in a secret gloom: the residents of only a few population points (Dolon', Sarzhal, Karaul, and Kainar) were able to find out the approximate radiation doses which they received in the various years only recently. The test site was forced to declassify the information when they had already been unsuccessful in keeping quiet about the recently uncovered high illness rate established by the commission of the Academy of Sciences of Kazakhstan SSR already in 1953 to 1960, which had been confirmed by the commission under the leadership of Member-Correspondent of the Academy of Medical Sciences of the USSR, A.F. Tsyb.

Very little is known about the tragedy around the Semipalatinsk Test Site, both abroad and in our own country. And the military departments take pains to try to reduce the scale of the tragedy and of the consequences of continuous nuclear weapons testing over 40 years. In this they get the complete support of the Soviet bureaucratic departments, the officials who are responsible for nuclear energy. The impression is created that we have an organized “nuclear lobby”. The newspaper “Pravda” on 27 May 1989 gave figures that 62% of the irradiated population of the Ukraine, Byelorussia, and Russia received a dose of from 1 to 5 rem; 33.6% received 5 to 10 rem; 3% received from 10 to 15 rem; and only 1.2% received from 15 to 17 rem. Let's compare these figures with test site published levels of radiation loading which was received by the residents of the Semipalatinsk oblast. According to STS data (per 10,000) who were subjected to radiation, 37% received a dose of from 0.5 to 2 rem, 19% received from 2 to 20 rem, 35% received from 20 to 27 rem, and 9% received 160 rem. These two columns of numbers are astounding when compared. Not one of those who suffered from Chernobyl received a dose greater than 20 rem, and only 1.2% of them received a dose of 15 to 17 rem, while at the STS 44% of those irradiated received a dose of more than 20 rem. Indeed they confirmed themselves that the population of the city of Semipalatinsk received a dose of 0.56 rem, while the number of residents in this city during those years was more than 150,000 people. Thus, the number of people who received a dose greater than 0.5 rem must not be less than 150,000. Of course, those

who suffered from the Chernobyl accident number more, but the dose loading was many times higher for the population around the STS. However, both the government and the press who are constantly worrying about the population around Chernobyl pay very little attention to those who suffer from the Semipalatinsk Test Site, our bloodiest and most extensive tragedy.

7.0 CONCLUSION

In closing, I would like once more to turn the reader's attention to the following points.

In the past few years, the attention given to the Semipalatinsk Test Site by the general public in Kazakhstan and the whole nation has grown noticeably due to the active work of the anti-nuclear movement "Nevada-Semipalatinsk". The Congress of the "World Constituency for the Ban of Production and Testing of Nuclear Weapons", which met in May 1990 in Alma-Ata, gathered close to 2,000 delegates from 26 countries and served as a sort of launching mechanism for the further mobilization of society against the never-ending testing of nuclear weapons in our country and the entire world. In the central and republic presses, there appeared articles, mainly of a publicity nature, on this theme. We scientific workers preferred a wait and see approach. At first it was decided in a small circle to agree with those issues on which a strong difference of opinion had emerged between the scientific workers of Alma-Ata and Moscow. As I already noted, there was a difference of opinion regarding the high illness rate in the population from the regions neighboring the test site. The main dispute concerned the dose of radiation received by the residents of these population points. Workers from the test site and from the Institute of Biophysics of the Ministry of Health of the USSR stubbornly affirm that, with the exception of Dolon' village whose population (close to 1,000 people) received 160 rad, the remaining population points were subjected to irradiation in a dose of less than 50 rad. We still continue to defend the opinion that the population points of Sarzhal, Kainar, and others received no less than 200 rad of external radiation. The dosimetry results obtained from 1953 to 1959 by the expeditions of the Kazakhstan SSR Academy of Sciences and Ministry of Health, with the help of the Institute of Radiation Hygiene from Leningrad, are paid no attention to by the test site employees, who also continue to keep secret all information which deals with testing during those years. We included many factors as evidence of high radiation doses. The most important of these were as follows: a 1.3 times increase in illness rate from malignant tumors in residents living 100 km away from the test site; a 1.5 to 2 times increase in the frequency of cases of mental weakness (in the second generation) among the population living at the same distance; a many times increase in frequency of genetic abnormalities (chromosomal aberrations in the bone marrow cells) in animals (amphibians and rodents, in particular) who lived in regions neighboring the test site as compared to those from remote areas. The motivation for the emergence and growth in genetic abnormalities due to non-radiation factors, which the test site employees claim is the cause, is completely unconvincing; on the contrary, according to the data of the State Agricultural Industry Ministry of the Republic, for the past few years (1984 to 1989), the amount of hexachlorine-cyclohexane used in the economy calculated per person in the Semipalatinsk oblast is 1.5 to 2 times less than in the Chimkentskiy and Kzyl-Ordinskiy oblasts. We firmly believe that the growing number of cases of mental weakness, suicide, and other psychological illnesses, which earlier were atypical for the region, are a direct result of the harmful effects of radiation. The world renowned scientist Anthony Rotblatt, President of the Paguoshskiy Movement, feels that the global levels of genetic damage as a result of the irradiation of large groups of the population are unpredictable. The abnormalities in the chromosomal apparatus have already been studied, and will continue to be observed for a long time, and yet we still won't know the extent of the genetic damage.

In this article we wanted to emphasize this fact: continuing tests of nuclear weapons are unnatural. The quantities of nuclear weapons we now possess on the earth are already sufficient

to annihilate all life on the planet many times over, with interest. The purposeful persistence of the Ministry of Defense and the Ministry of Atomic Energy of the USSR to continue to improve the production and testing of nuclear weapons can be explained by the group interest of the military departments, the nuclear technocrats, and their apologists. Added to this is the so-called principle of delay, the insufficiency of information, and the passivity and political immaturity of the population.

A few words on the position of the government in relation to the Semipalatinsk Test Site. Recently, the USSR Council of Ministers issued the order, signed by N.I. Ryzhkov, calling for the construction of a multidisciplinary hospital in Semipalatinsk, and the organization of the Alma-Ata Institute of Radiation Medicine and Ecology with an affiliate in Semipalatinsk. This is understood to be very good, even more so since this action indirectly acknowledges the existence of the pernicious effect on life and health of continuous testing at the test site. According to this order, this year in the Semipalatinsk oblast, several food products are being additionally distributed: sugar, tea, coffee, mineral water, canned fruits and vegetables, and children's food. This again is good. BUT!!! All these measures are not serious aid to the suffering population and are far from appropriate to the colossal damage inflicted on the population as a result of the many years of nuclear tests, and finally, they cannot improve the health of the population. Most important is that the aforementioned order lacks even an allusion to compensating the people for these 18,000 square kilometers of land which are now alienated, where tens and hundreds of rivers, reservoirs, and springs have disappeared and where wells have dried up. The water supply systems have been destroyed as well as homes and so forth, not to mention the terrible harm that has been inflicted upon man's health.

APPENDIX A. SYMBOLS, ABBREVIATIONS, AND ACRONYMS

CC CPSU	Central Committee of the Communist Party of the Soviet Union
BBC	British Broadcasting Corporation
DNA	Defense Nuclear Agency
DTRA	Defense Threat Reduction Agency
KGB	Committee for State Security
NKDAR	Scientific Committee on the Influence of Nuclear Radiation (UNSCEAR)
NKRZ	National Committee on Radiation Protection of the USSR
NKVD	People's Commissariat for Internal Affairs
PDD	Maximum permissible dose
PDK	Maximum permissible concentration
PDP	Maximum annual permissible dose (internal dose equivalent)
STS	Semipalatinsk Test Site
U.S.	United States
USSR	Union of Soviet Socialist Republics
VDU	Temporarily permissible level (emergency dose)

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