First days of the Chernobyl accident. Private experience.

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26 April, 1986

From 21 April 1986 I was in Moscow on duty business. I had to discuss development of reserve consoles for controlling of first and second units of the Chernobyl NPP. I booked my ticket for traveling home, to city Pripiat, for Friday or for April 25. On Thursday morning I had very strong headache. Using of drugs did not help me. Therefore I tried to finish my duties in order to departure from Moscow already on Thursday. I was successful and could leave Moscow on Thursday. I went in the evening to the railway station. I changed there my ticket and went to my train. To my surprise my headache left me as only my train began its moving. I decided that this was a propitious omen and went to sleep. In the morning of 25 April my train reached Pripiat. It was Friday, the last working day. The weather in Pripiat was wonderful. It was warm like in spring and sunny. I called the Head of nuclear safety department Aleksandr Gobov. He told me that I might rest after the duty mission. He also informed me that 3 units were operated at full power and that the fourth unit had to be shut down for the planned maintenance at the end of day. I was not the whole week at home and was very happy to spend an additional day together with my children. My son was 3 years old and my daughter was 1 year old at this time. This day slipped away very soon despite that we went very late to our beds. Nobody could imagine that the next day will destroy our normal life for a long time.

I was informed about accident at 4 o'clock by my kinswoman that lived in Pripiat. She telephoned me in order to find out what happened at the Chernobyl NPP. She told me that people say terrible stories about some explosion at the NPP. According her two her housemate returned home before end of their shift and freighted all people in the house. They worked as builders at the construction pad of the Chernobyl NPP. They had this night their night shift. They told that they were spectators of some explosion at the NPP. I reassured her that no explosion could occur at the plant. I told her that I had on Friday a telephone conversation with one colleague that informed me about the planned shutdown of the fourth unit. Protection valves were examined usually before the shutdown. At this operation big amounts of vapor are released into the atmosphere. This release causes a strong noise effect like some explosion. I could calm my kinswoman but I became myself the feeling of some uneasiness. I began to call my colleagues at the fourth unit of plant. However nobody answered my calls. Then I telephoned some colleagues at the third unit of the plant. I was told that an explosion demolished roof of the central hall of the fours unit. I looked through window and could see the changed contours of the fourth unit.

I took my bicycle and went to the plant. However I could not reach the plant. Militiamen stopped everybody and demanded to get back to the city.

Returning home I began to call my supervisors. I was very surprised establishing that Aleksandr Gobov was at home. Nobody told him something about an accident at the plant despite that he was the Head of nuclear safety department of the NPP. Nothing was told also to the Head of Nuclear- and physical Laboratory Anatoliy Kryat. I went to Gobov. We called from his apartment Bryuchanov, Director of the plant. He asked us to come to the plant together with Aleksandrov, the Head of tryout production of the plant. Bryuchanov informed us that he sent a car for him. We went to the town exit where we met also Anatoliy Kryat. Some time later we came all to the plant. It was a little later than 7 o'clock in the morning. We went immediately to the bomb shelter of the plant that was constructed under the plant. There were members of the Civilian Defense Stuff (CDS) of the plant and the heads of the plant including Director, Chief Engineer, Secretary of the party committee of the plant, their vices as well as heads of some departments.

The first what I could understand after coming ton the bunker and was very strange for me, was the absence of exact information about the accident. We were no informed about what happened at the plant and about details of the accident. Nothing was told us, newcomers, about undertaken and foreseen countermeasures. It was told only that some accident happened at the fourth unit. But nothing was told about people and their actions performed after the accident despite the fact that some actions for mitigation of the accident were undertaken very soon after the explosion at the fourth unit. We were not informed by people gathered in the bomb shelter about situation in the central hall (controlling hall) of the fourth unit. Nothing was said how many people were there at the moment of explosion and how many people were sent to the hospital. Nobody knew what doses were received by members of operation stuff as the result of the accident.

It was to see that people gathered in the bomb shelter could be divided into two groups. Members of the first group including Director and Chief Engineer were in some braked state. Members of the second group tried to make some influence on the situation and actively act on it in order to change it in the positive direction. However such people formed the minor fraction of the people gathered in the bomb shelter.

The most important question for me was the question about what happened in the night at the fourth unit. Some time later I could gather important information about the accident from people that were eyewitness of the accident. At the moment of the accident some dozens of people were near to the Chernobyl NPP including security guard, construction workers and fishermen that tried to catch fish in the pond-cooler of the plant. I talked with all those that were very close to the fourth unit. There were about one dozen of people that were not far from the fourth unit and that could see the development of events from short distance. Their evidences were very important. I have been instructed by my supervisor to talk with such witnesses and to

record their evidences. Here is one of stories told me by two employs of the Chernobyl NPP. They knew the site of the plant were well. At the moment of the accident they were fishing in the pond- cooler of the plant. Hearing some first explosions they looked to the units of plant. And at that moment a very powerful explosion occurred at the fourth unit. It was like a noise of some airplane crossing the sonic barrier. The earth quaked under their foot. Then shock wave followed after the explosion. Sparks and different red-hot objects in the black cloud were carried high in the night sky. Later, after dissipating of the black dust they could see a glow that lighted from the below the high ventilating chimney placed on the roof between the third and fourth units. They did not consider this glow as a result of a fire. This was a cold glow of ionized atmosphere.

About fires after the explosion.

It was written much about fires on roofs of different buildings of the plant after explosion. It was told that these fires could fully destroy the Chernobyl NPP. According to such statements the plant was burning like some wooden storehouse. I studied this problem during some years. And I can tell that there were no such fires. There were only some inflammations including very dangerous inflammations that could cause serious fires. And all these inflammations arose inside of the plant and not on roofs of the plant buildings.

Here one fragment of the report of the fireman Ivan Shavrei: “I was near to the dispatcher office of the fire service at the time of explosion. I was on-duty. I heard powerful flap like some explosion. I did not consider it as some indication of some accident because releases of vapor were followed every time with such flap (It is believed here examining of main protection valves before the shut down of reactor). I was going to rest but in the following moment I heard another explosion. I ran to the window and heard new explosions. I could see through window a black fireball over the roof of the turbo generator building of the fourth unit of the plant…”.

The fireman Vladimir Prishchepa has written in his report: ”After coming to the NPP the second division of firemen has connected a car pump with hydrant and water hoses with dry pipes of sprinkler system. Lieutenant Pravik ran through the transport corridor to the turbo generator hall. We moved to the line “A” and placed the car at the hydrant. Then we established a main line to dry pipe sprinkler system of the roof of the turbo generator building. I mounted myself on its roof using a fire escape. When I was on the roof I could see that slab floor was damaged. Close to the fourth unit I discovered a source of inflammation. It was small. I wanted to come to it in order to douse this inflammation source. However it was dangerous because of damaged elements of slab floor. I went back to the fire escape and then went along the wall stepping on the fire water pipeline. I came to the heat source and doused it with sand. I had to use sand because I had no possibility to lay there a water pipe. Then I went back to the fire escape and met Major Telyatnikov on it. I reported him about the situation on the roof. He ordered to place an operational post on the roof. I was at this post together with the fireman Shavrei I.M. up

to morning (up to 5 o'clock in the morning- N.Karpan). In the morning we had nausea and vomiting. We were given 2 drugs for everybody and sent to the sanitary inspection room. We washed ourselves but vomiting kept on. I went to the medical department of the plant. I was given there one drug. Then I was sent to the town polyclinic. On other day, on 27.04.1986 I was brought to Moscow, to the clinic № 6".

As can be seen from these fragments there were no heat sources on the roof of the turbo generator building. This indicates that there was no necessity to place an operational post on this roof. According to our study there was such necessity only in case of the roof of the reactor building of third unit of the plant. There were serious heat sources there and they were doused by division of firemen of Lieutenant Pravik. The Chernobyl NPP was constructed in form of two assemblies. Each of these assemblies included two practical identical units and turbogenerator building placed between reactor units. The third and the fourth rector units formed such assembly.

One can read in the report of Major Telyatnikov: "A glow can be seen in the central reactor hall (benchmark plus 35.6 – floor of the central reactor hall, the central reactor hall and its roof did not exist). Nothing could burn at such damage except the reactor. And we decided altogether that this glow was from the reactor".

This report indicates that firemen coming to the plant did not find some fire on the roof of the fourth reactor unit. The glow that was seen from some distance proceeds from destroyed reactor. There was not fire on the roof of reactor that is described even today because there was not roof on the reactor of the fourth unit. It came fully down as a result of the explosion.

This conclusion agrees with the report of Serafim Vorobyev, the Head of Civilian Defense Staff of the Chernobyl NPP: "In the night of 26 April at 2 minutes before 5 o'clock I received the call from telephone operator. I was told to come immediately to the plant. I tried to find out the reason of this order. The telephone operator answered in short: "Serious accident!" and hanged up the receiver. I am the military man outside of service. I needed only one minute for dressing. Soon I was in my garage that was near to my apartment. I took my car "Zhiguli" and went to the plant. By going to the plant I picked the Head of the 1 Department Igor Nikiforovich Rakitin and the Secretary of the party committee of the plant Sergei Konstantinovich Parashin. By coming nearer to the plant Rakitin cried loud: "Look! Look!". I took a quick glance on the plant. I came in view **the disintegration of the fourth unit and smoke coming from it. However I did not see the fire.** I felt an anxiety. I new that different accident occurred sometimes at nuclear power plants but not such accident with such damage…"

Actions of the Chernobyl NPP stuff after the explosion.

Explosion demolished fully the roof and the west wall of the reactor hall. It also destroyed the wall of the turbo generator building that was constructed between third and fourth units of the plant. The debris of reinforced concrete elements formed by explosion damaged also the roof of the turbo generator building. The explosion caused small inflammations on roofs of buildings near to the fourth unit. They were doused by firemen simply by swatting with their gauntlets. They were not dangerous und did not require water for dousing. By the way it was impossible to use water for dousing heat sources on roofs because of two reasons. At first, the pressure produced by pumps was to low for bringing water on roofs. At second, the dry pipes of sprinkler systems on roofs were damaged by debris caused by explosion.

Serious heat sources were only in the turbo generator building. They originate from shorting of electrical cables damaged by fallen construction plates of the roof. According to existed regulation such heat sources must be doused only by personnel of the plant but not by firemen. The first action of the stuff of demolished fourth unit was to close the door to the central hall or to the space to the open atmosphere that formed from the reactor hall as a result of the explosion. All stuff members that were at the fourth unit at the time of the accident excluding lost Valeri Chodemchuk were gathered together and withdrawn to secure place. The wounded Vladimir Shashenok was evacuated also to secure place. At the same time the fifth shift of the fourths unit under supervision of Aleksandr Akimoм began replacing of explosive hydrogen in generators for nitrogen. It also began to switch out burning electrical equipment and pump out many dozens tons of oil from turbines in order to prevent the propagation of fire to equipment of the 3^{ed}, 2nd and 1st units of the Chernobyl NPP.

As can be seen from this information firemen worked on roofs and stuff members in different rooms of the fourth unit or under much more dangerous conditions. Such conclusion can be drawn by comparison of fatal cases among firemen and stuff members. It is known that six firemen died as a result of their 4 hours duty on roof. However, 23 members of stuff plus one man from the city Charkov that was on his duty visit died as a result of their work in the destroyed fours unit after explosion preventing of fire and explosions in the turbo generator building.

It is clear that not a number of died people can be measure of their risk and their heroism. I do not want to underplay the role of firemen. Their heroic actions are well known. I only want to make clear that stuff members of the fourth unit deserve also our recognition. It is clear that actions of stuff members undertaken in first minutes and hours after explosions prevented worsening the accident. People need to know what was done by members of the NPP stuff. I am convinced in the very high professional competence of operators of the fifth shift that worked at the time of the accident. The supervisor of this shift, Aleksandr Akimov, was the first who understood what happened at the fourth unit. He told at 3-40 in the morning to the Supervisor of the plant shift Vladimir Babichev, that a “general radiological accident” (the highest level of

accident) occurred. Vladimir Babichev came to the plant after the telephone request of the director of plant Bryuchanov.

Aleksandr Akimov assessed correctly the level of the accident. He understood the seriousness of the accident and reported his conclusions to the director of the Chernobyl NPP. He did not leave the dangerous zone and did everything possible in order to make safer the demolished unit. He was a very good man. Even at such extraordinary conditions he demonstrated his concern about other people. 4 specialists work at the normal conditions in the control room of the reactor unit: 3 operators and the head of the shift. The senior engineer Kirshenbaum worked this night as the operator responsible for the regulation of turbine. He was the youngest in the shift. He did not know well rooms of the reactor building and Aleksandr Akimov ordered him to leave the operator's room after explosion: "You are here unnecessary. You can not help us. Go away".

My work

It was very disappointing that all information gathered in the accidental zone by senior specialists such as Dyatlov, Sitnikov, Chugunov and Akimov was accessible only for Director and Chief Engineer of the plant. Possibly it went to the Ministry but it was inaccessible for middle level specialists of the plant. This was the reason that I had to gather the necessary information about consequences of the accident. Already before 10 in the morning I could visit together with the head of nuclear- and physical laboratory Anatolyi Kriat the central hall and control room of the third unit, the control room of the demolished fourth unit, the seventh and eights turbo generators that were connected with the reactor of the fourth unit and some other places. I could also examine being outside in the site of the plant the status of the destroyed fourth unit.

I do not want to describe all my tasks that I was given in the morning April 26,1986 by my supervisors. I want to name only 2 my tasks. They were:

- To assess if the air cooling could be enough for preventing of melting of fuel assemblies that could be caused as a result of residual heat release. This task arose because specialists were not assured that water pumped into active core for cooling of it could reach the active core at whole.
- To estimate if there was some possibility for initiation of criticality of the reactor (how sure was shut down of the reactor).

My assessment carried out on the basis of a method developed by specialists of the Principal Designer of the Chernobyl reactor had shown that there was no sense to pump water in the destroyed reactor. They have shown that the air cooling 6 hours after explosion in case of open reactor was enough for preventing the further damage of fuel that could be caused as a result of residual heat release.

Assessment of the poisoning effect indicated that approximately at 19 in the evening concentrations of iodine and xenon in fuel of the fourth unit will reach such level that initiation of chain reaction in the active zone and new explosions could be possible. The probability of the chain reaction initiation was assessed as 100%. It was estimated on the basis of an assumption that absorbers entered in the active core for 50% percents of their length and the amount of fuel in the active core was approximately about 50 critical masses.

We did not know ~~by assessment of the probability of repeated chain reaction~~ that all absorbers together with fuel were thrown out the reactor. We did not know too that a half of fuel assemblies together with graphite blocs were thrown out to the reactor hall. They formed there gorges of fuel and graphite. These gorges had about 20 critical masses. There were all conditions for initiation of chain reaction (presence of nuclear fuel and moderators – graphite and water). One needed only to wait the decay of poisoned substances that absorb neutrons (iodine and xenon). The occurrence of self-sustaining chain reaction approached implacably.

My report for the Head Engineer Nikolay Fomin and his deputy in the field of science Michail Lyutov was short:

- The pumping of water into reactor had to be stopped because the air cooling 6 hours after accident was enough by the open active core.
- The poisoning effect will be not important at approximately at 19 in the evening. Therefore one needed to introduce absorbers into active core for suppression of the chain reaction. Boron could be used for this purpose. Thus one needed to find one ton of boron acid and dissolve it in the water. This solution could be brought into reactor by using fire hydrants. It could be brought into reactor by using hydraulic monitors of fire engine delivering solution of boron acid from the ground.
- It was necessary to order the plant photographer to make photos of destroyed unit and reactor from helicopter. This was necessary to do in order to receive the picture of damage.
- It had to give me an armored carrier for organizing of mobile dosimetry unit for measurement of exposure dose rates of gamma irradiation as well as beta and neutrons fluxes at fixed points of the NPP sites and near to the fourth unit. Such measurements could allow seeing dynamic of development of an accidental process after termination of the poisoning effect. They had to give the possibility to register timely velocity and direction of radioactive substances distribution. Such information was necessary for adopting of decision about evacuation of the city Pripyat.

After preparing my report I borrowed by *S*eraphim Vorobyev (Head of Civilian Defense Staff of the Chernobyl NPP) the military dosimetry instrument DP-5 and began my detailed study of the unit 4. I went round the unit. It was seen from the north side damaged rooms of drum-separators, rugged tubes and running water from them. It was to see also that pumped water could not reach the active core.

Exposure dose rates of gamma radiation in the morning of 26 April 1986 in distance 35-40 meters from the destroyed reactor were not higher than 50 R/h. I went in the turbine hall up to turbine 8. The maximal exposure dose rate in the area between turbines 7 and 8 was at the level 50 – 70 R/h and close to turbine 8 up to 200 R/h. I could not find there fuel assemblies of fragments of fuel elements as well as blocks of graphite. I could see in the turbine hall only different junk, soot and fragments of floor slabs..

Then I visited the control room of the unit 4 in order to control the deepness of penetration of absorbers in the active core. I did not do some registrations of synchro-transmitters because I did not want to be very long time in this room. I ran simply through the control room of the unit 4. A little later all information of synchro-transmitters was noticed by the supervising foreman of the control and protection system Eduard Petrenko. Using these data we demonstrated with Anatoly Kryat to our supervisors the possible scenario of catastrophically development of events in the fourth unit if the additional absorbing substances will be not added to the active core. I based my conclusions on a number of following assumptions. I knew that critical dimension of fuel layer in case of the RBMK reactor was approximately 1 meter. I knew also that absorbers could not reach the lower part of the active core. Using this information I assessed that about 10 critical masses of fuel were in the active core of damaged fourth unit in its lower area. Absorber could not reach the this part of the active core.

I as well as Kryat and Gobov told many times about the possibility of initiation of the chain reaction to our supervisors Lyutov and Fomins and to Bryuchanov (through party secretary Sergei Parashin). Serhei Parashin informed me that Director of the Chernobyl NPP asked authorities to bring boron acid to the plant. However, the boron acid was not received on 26 April 1986.

I was very upset because of impossibility to find the necessary amount of boron acid in order to exclude the possibility of initiation of self-sustaining chain reaction. Not far from the NPP was the city Pripyat with unprotected inhabitants. There was my family too. Director of the Chernobyl NPP told me that he had no right to take the decision about evacuation of all these people.

First results of the situation assessment

The head of spectrometry laboratory of our department of nuclear safety Vitaliyi Perminov was ordered to come to the plant together with the morning shift. He performed analysis of samples of water and substances deposited on the ground. He told me at approximately 12 o'clock concrete facts that shown the scale of accident. His spectrometric studies demonstrated that deposited substances contained products of fuel fission. He also said that 17% of activity was linked with neptunium. This was an indication of the active core destroying and the release of radioactive substances to the atmosphere. It was established that all samples of deposited substances contained particles of nuclear fuel. The activity of water running to the control room of the unit 4 was 10^{-3} Ci/l. Established data made clear that the reactor of the

fourth unit was seriously demolished. This information was reported to supervisors of the Chernobyl NPP: at first to Lyutov and later to Bryuchanov and Parashin.

Radioactive contamination of water caused significant problems for people that tried to mitigate consequences of the accident. They had no dosimetry devices and did know about the danger of contaminated water. These people had no possibility to take a shower and change their dressing for clean one. And this was the reason of radiation burns and acute radiation diseases among them. One needs to notice here that contaminated dressing produced irradiation doses about 100-200 R/h even then when personnel left dangerous places for normal one.

Immediately after receiving information about existence of fuel particles in air I called my wife. I asked her to close windows and remain in the apartment. I asked her also to be ready for leaving Pripyat for safer place. She had to prepare some small bag with children's things and wait for me. The problem how could I bring my family to safe place before "awaking" of reactor did not give me the rest. After executing the most important tasks I asked the Director of the NPP for permission to use the plant's bus for bringing our shift to Pripyat for our lunch. I received such permission. However I did not want to spend this possibility for my lunch. I wanted to use my time for bringing my family to the country town Chernobyl to relatives of my wife. This town is about 18 kilometers from the city Pripyat. I asked Anatoly Kryat to help me during the lunch time to bring my family to the Chernobyl town. He had a personal car and agreed to help me. I called relatives of my wife and asked them to wait for our arrival. Then I called my wife and told her that we will go to her relatives in the town Chernobyl. At approximately 14 we came with Anatoly Kryat to our apartment block and took my wife and children. However we were stopped at the exit from the city (bridge over the railway line) by an armed militiaman. He ordered us to go back to the city. I understood from him that all exits from the city Pripyat were blocked by militia. This was an order of authorities. Such order was adopted in order to prohibit a self-willed exit out the city. I understood that all inhabitants of the city Pripyat became hostages of the situation and I became very upset. The militiaman advised me to visit the city department of militia and asked there for permission for leaving the city. I had to follow his advise. In the city department of militia I saw a lot of militiamen. They all were in a big hurry. Occasionally I met there captain Vyacheslav Vashek. He was my landsman from Ural and a very god man. I explained him my situation and asked him to accompany me to the Chernobyl town. He agreed to help me if I could explain him what happened at the plant. The militia post at the bridge over the railway line stopped us again. However, captain Vashek ordered militiamen not to hinder us and we continue our travel.

I left my family in Chernobyl and went immediately with Anatolyi Kryat to the city Pripatyt, Coming back I ran immediately to the plant. Underway I met groups of children. They wanted to see the destroyed reactor. I explained them that it was very dangerous and ordered to run home.

I appeared in the bomb shelter approximately at 15 – 30 and began prepare a mobile dosimetric group. I was happy that I could bring my family to the Chernobyl town. And I could concentrate me fully for my tasks. I tell about this episode of my life at first time in my life.

What was done from my recommendations?

When I came back to the plant I was given the following information:

- Water was pumped into the active core. This was decision of the Department of the Ministry of Power of the USSR.

- No absorbing substances were added to the active core because no boron acid was brought to the plant.

- The helicopter was given for photographing of the destroyed reactor. Because I was absent by evacuation of my family photos were made without my participation. They were made by Polushkin (coworker of the N.A.Dollezhal Scientific- and Construction Institute of Power Techniques, Moscow) and the Chernobyl plant's photographer Anatoly Rasskazov. We were not shown photos made by them.

- We were given an armored carry. We began to ride every 2 hours from 16 with Yuri Abramov (shift supervisor of the Department of Labor Protection and Safety Techniques) and crew of armored carry on the same route performing measurement at the established places (5 points). We had instruments for measure of gamma, beta and neutron irradiation.

We have seen by such measurements how water pumped into the active core for its cooling was running on the northern wall from broken tubes. It accumulated fissions products and particles of fuel and moved to the low levels of building to blocks 3,2,1 contaminating different rooms of the plant. The day shift pumped out this water. 10 thousands cubic meters of water was pumped into reactor on 26 April 1986. The Deputy Chief of the Shop of Centralized Repair Yuri Yudin, Vladimir Babichev, Viktor Smagin, Anatoly Kryat and other stuff members that were involved in assessment of the accident consequences informed supervisors of the Chernobyl plant that pumped water did not came into the active core.

The poisoning effect ended at the time assessed by me and approximately at 20 in the evening of 26 April 1986 we could fix the fire in the reactor and hear explosion's noise. At the beginning the upper part of units was lightened with ruby light. Later reflexes of light and fire (colors up to a glaring white color) began to appear in some unequal intervals. They reached the upper part of ventilation tube and it seemed that they were fed by some sources like water geysers. We could see that fire heights in different zones of the central hall of reactor unit were unequal. This meant that there were a number of fire foci with different intensity in the active core. The sound of fire was also unequal after its power and tone. It changed from blare up to explosions like volcano

explosions. The fire was so powerful that human capabilities were not enough for its suppression. It was impossible to come near to the fire and nobody tried to suppress it. Firemen have left already the plant. And there was no sense to send people for suppressing of the fire.

The release of radioactivity out the reactor increased very significantly at this time. We could notice this fact by measuring exposure dose rates at our established points. Our last measurements of exposure dose rate on 26 April was performed at 24 in the night. At this time (4 hours of fire) the exposition dose rate of gamma radiation increased by 10 times. Yuri Abramov had registered also at the last point of our route (area opposite the north wall of reactor unit 4) appearance of neutrons (20 neutrons per second per squire centimeter). The exposition dose rate of gamma radiation was about 20 R/h at this point in the morning and in the middle of day. But it reached 200 R/h at approximately 24 o'clock on 26 April. **All these facts indicated that the new self-sustaining chain reaction was initiated in fuel after the finish of the poisoning effect. It was established later that all fuel was withdrawn out the active core. However some fraction of fuel was deposited in the destroyed reactor hall. This resulted in formation of an impulse reactor that produced outbursts by achieving of critical status. Necessary conditions for achieving this status were created by constant pumping of water into the broken circuit of forced circulation and absence of neutron absorbers in zones of deposited nuclear fuel**.

The self-sustained chain reaction stopped itself at approximately 4 o'clock in the night of 27 April because the local critical mass consumed its potential. However, the release of huge amount of thermal energy and radioactive gases lasted after the finish of the chain reaction during 2 following weeks despite of filling the active core with sand, clay, lead and boron.

After every visit of established measurement points we reported results of our measurements to Bryuchanov and Fomin. They called the members of the Governmental commission that resided in Pripyat and informed them about radiation situation.

We have ended our work at approximately 1 o'clock in the night of 27 April and went to Pripyat. Here worked in the city hotel the Governmental commission from Moscow. No information about danger of radiation was given to population and the life in the city was as usual despite the fact that the city was filled with radioactive substances. Iodine prophylaxis was not undertaken and this was the second fault of the Governmental commission that did not undertaken protective countermeasures for the city population protection. I consider as the first fault of the Comission the absence of efforts for bringing neutrons absorber (boron) to gorges of fuel and to the shaft of reactor. And this caused initiation of the self-sustained chain reaction in the evening of 26 April aggravating catastrophic consequences of the accident for the whole world.

The question appears, why authorities did not undertake protection measures? The Head of Civilian Defense Staff of the Chernobyl NPP gives the following answer on this question: "Already

some hours after the accident come to Pripyat the Second secretary of the regional party committee. He has taken management of situation in his hands. He was according my opinion a clever party manager. He was seriously upset because of the accident. However problems of the civil defense were not an aria where he could find reasonable solutions. This field of activity has its own specific. It seems anything very easy before one did not understood existing tasks and the necessity to solve concrete problems… In case of the Chernobyl accident the following situation arose. It was necessary to undertake concrete measures but there was no confidence that proposed solutions were correct. As a result one began to wait for decisions of higher authorities. This means that responsibility was moved to them. Later a lot of higher authorities came to Pripyat! The Head of the Civil Defense Staff of Ukraine General Bondarchuk and the Deputy Head of the Civil Defense Staff of the USSR General Ivanov appeared soon in Pripyat. I hoped after their coming that they will organize necessary countermeasures for protection of the city population. This did not happen. No warning of radiation danger was announced. Why it was not announced is for me even today a question".

- Later many authorities said that they had no necessary information about radiation situation ….

- Those information that was known in the morning of 26 April (10 hours in thy morning) gave basis for decision to announce the warning. One did not need to know data about dozens and hundreds of roentgens. One had only to base the necessary decision using the written reports of Bryuchanov. They were published and it is possible to read them. Reports of Bryuchanov demonstrated clearly the necessity of population warning. Here is one example. In the report about radiation situation in Pripyat signed by Bryuchanov and Korobeinikov (Head of Laboratory of External Dosimetry of the Chernobyl NPP) was stated that exposure dose rates in the city were from 4 to 15 microroentgens per second. This was equivalent to 14 – 54 milliroentgens. In accordance with existed requirements of regulating documents it was necessary to inform population in case if exposure doses exceed the level 0.05 milliroentgens per hour. It had to explain people how they had to behave in this situation. At the level of irradiation 200 roentgens per hour existed documents required using of horn signaling the existence of radiation danger.

milli-roentgens

Radiation situation in the city Pripyat

Weather conditions in Pripyat during 26 April could be characterized as calm. Because constant release of radioactive substances from the damaged reactor the radiation situation in the city aggravated steadily. This demonstrates the scanned page of the workbook that contains results of measurements carried out in Pripyat by specialists of the Laboratory of External Dosimetry on 26, 27 and 28 April 1986 sown in Fig.1.

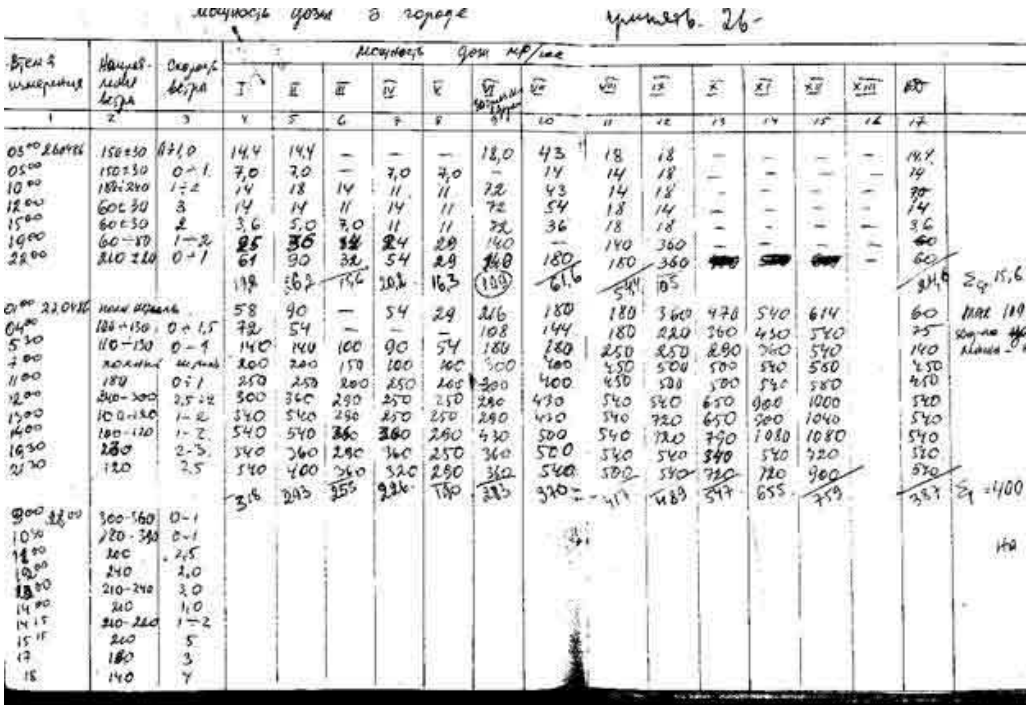

Fig.1. Scanned page of the workbook with measurement data of exposure dose rates in chosen spots in the city Pripyat.

Exposition dose rates demonstrated in Fig.1 are given in milliroentgens per hour. One needs to notice here that this table does not include data with exposure dose rates up to 2 roentgens per hour found in some spots of the city. The same data are presented in Table 1. Table 2 gives exposure dose rates in different places of Pripyat registered on 26 and 27 April 1986 (plan of Pripyat is shown as an annex to this report).

It is to see from Tables 1 and 2 that a sharp increase of exposure dose rates in the city began after the finishing of the poisoning effect (on April 26 after 19 hours). The exposure dose rates of gamma radiation at the beginning of evacuation of Pripyat (at 14 hours on 27 April) were in the entire city in the range from 0.5 to 1 roentgens per hour. Children that played outside of their apartments could receive during 5 hours the same doses as stuff members of the nuclear power plants. Real doses of people outside their apartments were even much higher because additional contribution gave also inhalation of radioactive gases and dust.

Table 1. Exposure dose rates measured on 26 – 28 April and on 28 May 1986 at points chosen around the fourth unit of the Chernobyl NPP (milliroentgens per hour).

Time of measurem.		Chosen points													
Day	Time, hours	1	2	3	4	5	6	7	8	9	10	11	12	13	14
26.04.86	03	14.4	14.4	-	-	-	18	43	18	18	-	-	-	-	14.4
	05	7	7	-	7	7	-	14	14	18	-	-	-	-	14
	10	14	18	14	11.4	11	72	43	14	18	-	-	-	-	7
	12	14	14	11	14	11	72	54	18	14	-	-	-	-	14
	15	3.6	5	7	11	11	72	36	18	18	-	-	-	-	36
	19^{20}	25	36	14	24	29	140		140	360	-	-	-	-	60
	22	61	90	32	54	29	140	180	180	360	-	-	-	-	60
27.04.86	01	58	90	-	54	24	216	180	180	360	410	540	614	-	60
	04	72	54	-	-	-	108	144	180	220	360	430	540	-	75
	05^{20}	140	140	100	90	54	180	180	250	250	200	360	540	-	140
	07	200	200	150	100	100	300	400	450	500	500	540	550	-	450
	11	250	250	200	250	200	300	400	450	500	500	540	550	-	450
	12	300	380	290	250	250	200	430	540	540	650	900	1000	-	540
	13	540	540	290	250	250	290	430	540	720	650	900	1040	-	540
	14	540	540	380	360	290	430	500	540	720	700	1080	1080	-	540
	19^{20}	540	360	290	366	250	360	500	540	540	540	540	720	-	540
	21^{20}	540	400	360	320	290	360	540	500	540	720	720	900	-	540
28.04.86	19^{20}	400	360	290	360	250	350	500	540	1010	1200	1100	900	590	230
	19^{40}	440	400	360	290	290	360	540	500	940	1000	900	860	450	180
	22^{20}	290	180	180	180	-	460	430	430	1080	1300	1370	1000	510	290
	23^{00}	320	250	250	250	-	360	380	350	800	1080	880	860	500	180
28.05.86	-	-	120	84	130	67	-	-	250	270	610	1100	-	400	-

Table 2. Exposure dose rates in streets of the city Pripyat (milliroentgens per hour).

Name of street	Day of measurements	
	26.04.1986	27.04.1986
Kurchatova Str.	22	320
Sportivnaya Str.	16	250
Hydroproektorskaya Str.	20	230
Stroitelei Str.	16	250
Squire at city park	86	280
Druzhba narodov Str.	62	380
Entusiastov Str.	53	520
Ohneva Str.	115	490
Labaratory of External Dosimetry	25	340

The radiation situation on 26.04.1986 on the territory of the Chernobyl nuclear plant is shown on Fig. 2 given below.

Plan of the Chernobyl NPP site

(Satellite's photo of the Chernobyl NPP is given in Annex)

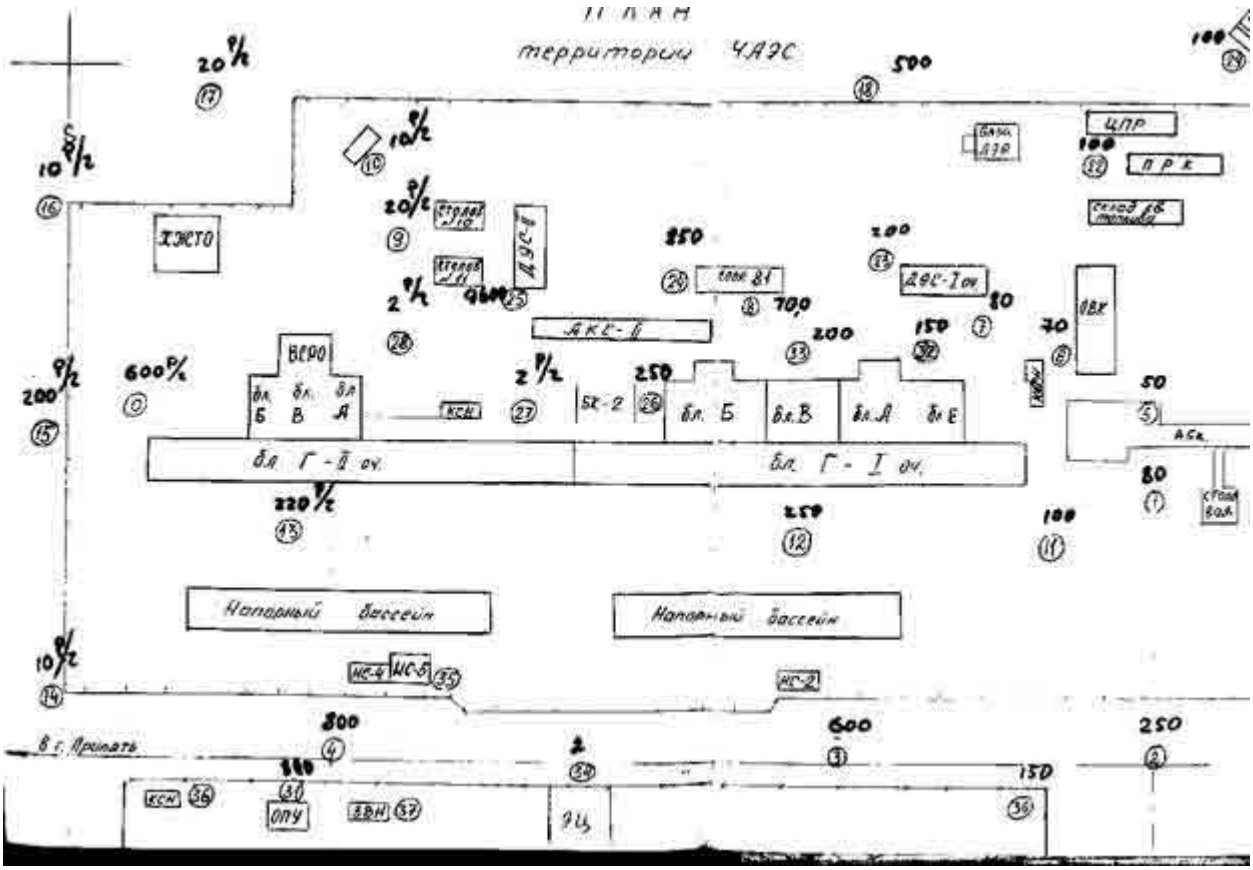

Figure 2 . Exposure dose rates on the territory of the Chernobyl NPP.

Notice: Exposure dose rates are given in milliroentgens per hour in those cases if only some figures are shown. However in case of the most contaminated spots figures and letters are given. In this case one needs to understand that exposure dose rates are expressed in roentgens per hour.

It is interesting that the Deputy Chairman of the Council of Ministers of the USSR Boris Shcherbina, the Chairman of the USSR State Committee of Hydrometeorology Yuri Izrael and his deputy Yuri Sedunof told on 6 Mai 1986 at the press-conference in Moscow that the exposure dose rate in area of the unit 4 was only approximately 15 milliroentgens per hour. In reality the exposure dose rateeven in the city Pripyat was from 1 to 3 roentgens per hour reaching in some spots 50 roentgens per hour**.** At the same time the exposure dose rate in area of the plant was in

the range of 5 – 300 roentgens per hour reaching in some spots 1000 roentgens per hour and higher.

27 April 1986.

I do not know what happened in the city on morning because I left my appartment very early that day. I went to the plant. Conservation of other units of the Chernobyl plant that were shut down after the accident was the most important task for physicists on 27 April 1986. It was necessary to withdraw fuel from active cores of reactors and to add additional absorbers of neutrons to them. These tasks have taken the whole day. On 27 April the list of stuff members needed at the plant was formed. Other people were allowed to go on evacuation together with their families.

Operators of control boards of other units were all this time on duty. There were also specialists in turbine halls despite the fact that radiation situation in areas of turbine 7 and turbine 8 was bad. .

We were working from early morning up to 24. After finish of our work we were brought by bus to the city. It was empty. It was to see militiamen that patrolled the city. They had no any individual protection equipment. Seeing us they began to control our documents. They were interesting how dangerous was for them to be in the city. We recommended them to minimize their time outside of buildings and to protect their respiratory apparatuses.

It was very strange to see dark blocks of apartment having no light windows. Practically all inhabitants of Pripyat were evacuated. Only approximately 200 people were left for working at the plant.

28 April 1986.

Physists of our department of nuclear safety were busy with transforming reactors of units 1,2 and 3 in safe status all following days. We slept in our apartments in Pripyat. We finished our work only on 4 May 1986. From this time we had our apartments in the pioneer campus “Tale”.

Contamination of unit 4, ventilation tube’s floor roof of unit 3.

No measurements of radioactive contamination of roofs of the Chernobyl were performed in the first days of the accident (26, 27 and 28 April 1986). Such measurements were organized later when preparedness of roofs cleaning began. Recorder chart of measurements is given below.

Measurements of radioactive contamination of roof of the unit 3 were performed by the group under supervision of Yuri Samoilenko. Data established by them were used later by planning of necessary activity for roof cleaning from different radioactive debris and fragments of fuel assemblies. The exposure dose rate on the shown recorder chart is given in roentgens per hour.

Notces:

Flag *denotes radioactive sources with exposure dose rates higher than 200 roentgens per hour.*

Asterisk *denotes radioactive sources with exposure dose rates higher than 1000 roentgens per hour.*

Boxes presents areas of roofs of the unit 3 given in squire meters.

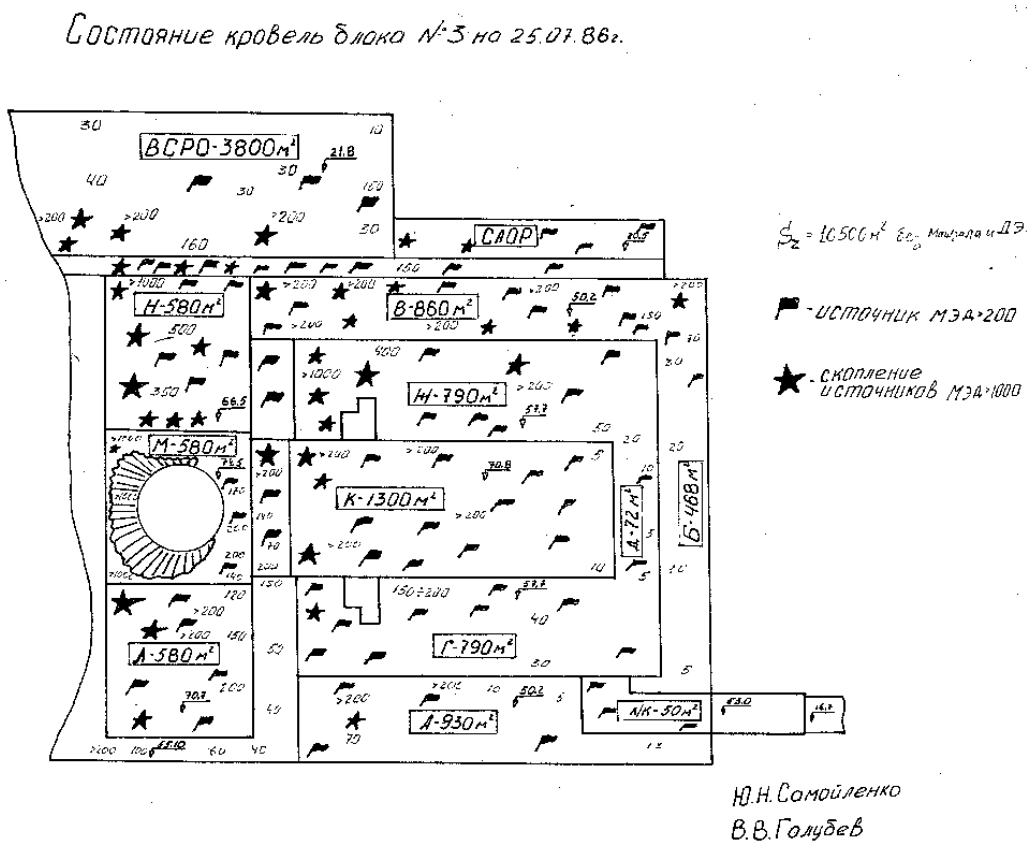

Fig.3. Status of roofs of the unit 3 of the Chernobyl NPP (measurements of exposure dose rates performed by Yu.N.Samoilenko and V.V.Golubev)