Expert Witness Statement for Tribunal Case
Don Battersby and Anna Smith
vs.
Secretary of State for Defence

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1. Background

I have been asked by the representatives of the appellants in this ionizing radiation case to provide my expert evidence on the safety and accuracy of the current radiation risk model, that of the International Commission on Radiological Protection. The issue of the basis for radiation protection in the Life Span studies of those exposed at Hiroshima and Nagasaki is an area where I have carried out research in the last ten years. I will present my conclusions and the reasons for them in this report.
I am a physicist and my main area is particle physics. I have published more than 100 papers in the area of particle physics. My CV is attached to this report.

I was, however at Hiroshima when the bomb dropped and my house was destroyed. I had to abandon my mother in the ruins. I have lived with this all my life. I later became interested in the way in which the Hiroshima and Nagasaki bombings had become the basis for the legal framework of radiation protection all over the world, and have devoted some time and energy to examining the validity of the approach that developed and which now, 70 years later, is still accepted as the golden standard for epidemiological evaluation of harm from radiation. The results of my studies suggest that this model is highly unsafe.

2. The Hiroshima Life Span studies

The current radiation risk model, employed all over the world, and used in the present legal case to argue that doses were too low to account for any cancer or other ill health in veterans of the A-Bomb and H-Bomb tests is based on the relationship between what is termed radiation “dose” and the increased risk of cancer that is believed to be caused by that dose. The quantity “dose” or “absorbed dose” is a simple physics based unit and is the energy in Joules of ionizing radiation absorbed by 1 kilogram of tissue. This quantity has been modified by a factor of 20 in the case of internal alpha particle dose to obtain the allied quantity “equivalent dose”. However, for the purposes of establishing the amount of cancer caused by unit dose (the risk model) the results are based on the cancer increases seen in a selected group of individuals exposed at different distances from the ground zero of the 1945 Hiroshima and Nagasaki bombs and followed over their lifespan. There have been a number of criticisms of this study for informing on risk from radiation but the most important one has to do with internal and external radiation exposure.

The "doses" employed in the risk model are all external acute doses, and they are generally large. Internal radiation exposure from the "rainout" of the bombing, which was called the "black rain" affected groups that were close to and distant from the epicenter of the detonation, groups that were being compared to determine the effects of radiation. The US stated that there was scarce residual radiation from fallout and rainout from the Hiroshima and Nagasaki bombs because they were airbursts. But this is not true. During the chain reactions of Uranium-235 or Plutonium-239 fission finished within one-millionth second the radioactive fission products, bomb equipment with induced radioactivity by neutron absorption and remaining fissionable materials(U^{235} or Pl^{239}) remained inside of atomic bomb container before scattered into pieces which were surrounded by fireball. The rapid rising of these radioactive matter with fireball and absorbed moisture in the air and produced the mushroom cloud. Then raindrops of mushroom cloud contained radioactive materials. The mushroom cloud cooled as it rose though the atmosphere and fell as black rain. It is clarified recently that main effects of exposure by fallout came from intake of radioactive fine particles reappeared from small raindrops evaporated water and filled under mushroom cloud. If internal exposures by radioactive material in the fallout from mushroom cloud cause higher cancer effects than external exposures, then all of the conclusions of the ICRP risk model are false. It is this issue that I have spent much of my research studying. The results show clearly that internal exposures have radiological effects out of all proportion to their doses as calculated by the simple energy per unit mass approach. These effects found at Hiroshima and Nagasaki apply to all nuclear bomb tests. I will present my research here.

3. Distorted Research of Radiation Effects through Policy of Nuclear Weapon and Atomic Power Plant bias.

3.1 Research System of Radiation Effects Deformed by Concealment Policy of Atomic Bombing Damages

General Thomas Farrell, who was head of medical branch of the Manhattan Project made a press conference in Tokyo on the 6th September 1945 when many atomic bomb survivors in Hiroshima and Nagasaki were in agony by their acute diseases from atomic bomb radiation. While at that time several oversea reporters began to report who saw the tragic situations in Hiroshima and Nagasaki, Farrell afraid of increase of international criticism against atomic bombing by these reports. He said in the conference "Now in early September, none of survivors were in agony from radiation of the atomic bombing. People in Hiroshima and Nagasaki already died who should die." (1)

If one accepts the radiation effects the damages by atomic bombing will not only spread over wide regions but also cause pains for long time among survivors and will make internationally clarify inhumanity of the atomic bombings. Already Farrell must have considerable knowledge including internal exposure effects through accidents and human body experiments in the Manhattan Projects.

This press conference of Farrell became the beginning of the concealment policy of human effects from atomic bomb radiation. The occupation force imposed news censorship concerning to damage by atomic bombings. This censorship policy of the

United States connected with future delay of study of all aspects of radiation exposure effects, especially, internal exposure effects from the atomic bomb fallout.

In 1946 the U.S. set up the National Council on Radiation Protection and Measurements (NCRP) instead of the Advisory Committee on X-ray Radium Protection. The 2nd Committee of the NCRP covered deliberation on the risk of internal radiation exposure but did not allowed to release results of studies of the internal exposure and the deliberation was broken off in 1951. In order to present risk standard of radiation obstacles with internationally agreement the International Commission on Radiological Protection (ICRP) was inaugurated in 1950 by renaming the International X-ray and Radium Committee. Chairs of each committees of the ICRP served corresponding chairs of the NCRP then the ICRP also received many restrictions by nuclear policies of the U.S. Dr. Carl Morgan who was the director of health physics of Oak Ridge National Laboratory and served both chairs of internal exposure committees of ICRP and NCRP for 20 years, wrote a book "The Angry Genie: One Man's Walk Through the Nuclear Age" [(2)] where he reminisced about the NCRP which had continued to receiving political pressure.

3. 2 Defects of Epidemiological Studies by ABCC and Radiation Effects Research Foundation

Concealing policy of the atomic bomb radiation effects on the one hand the government of the U.S.A. had pressed to study the effects of radiation after usage of nuclear weapons among the cold war between the Soviet Union and founded the Atomic Bomb Casualty Commission (ABCC) in Hiroshima city and Nagasaki city in 1947 by direction of President Truman. Behind direction of the President there was a letter written by a naval surgeon. "For the study of casualties by the effects of atomic bombing the study of effects of two bombing in Japan is very important for our U. S. This unique opportunity might not gain before the next world war." The government Japan presented to the ABCC list of atomic bomb survivors obtained by supplementary investigation of 1950 national census. From this list the ABCC established the Life-Span-Study (LSS) group who were registered to Hiroshima city or Nagasaki city and began epidemiological studies of cause of survivor's death etc. and also began to study the health situations of survivors by setting up the Adult-Health-Study (AHS) group.

The ABCC had placed importance on investigation and research of the effects from the initial radiations which were emitted within 1 minute after bombing and made little concern or no attention on the effects of the residual radiations which were emitted after 1 minute. Among the residual radiations there are those emitted from induced radioactive matter by absorption of the initial neutrons and those from fallout matter from atomic bomb clouds. The former gave effects to the survivors who entered within 1 km from the hypocenter where much neutrons of initial radiation were irradiated and the latter did to the survivors who were bombed in the wide regions under the atomic clouds.

It is required the estimation of exposed radiations for epidemiological study of survivors. The U.S.A. studied shielding effects by the Japanese house constructed the Japanese houses in the test sites of the nuclear explosion tests and get the exposed doses for distance from the hypocenter and prepared the Tentative 1957 Dosimetry (T57D) and the Tentative 1965 Dosimetry (T65D). By using these dosimetry the ABCC had classified survivors by the exposed dose of the initial radiations and began to study the death rates and incident rates by cancers etc. In 1975 the ABCC had

closed and the Radiation Effects Research Foundation (RERF) was established with administration both of Japan and U.S.A. but the staffs and investigation plans with placing importance on the initial radiation effects were kept intact.

The T65D was prepared on the basis of the nuclear test only the Plutonium bomb of Nagasaki type there found a large discrepancy of the estimation of the radiation dose of the Hiroshima bombing. It became possible to calculate radiation transfer from the bomb to the ground then the 1986 Dosimetry System of the Atomic Bombs (DS86) was prepared and used to the dose estimation for the epidemiological study of the RERF.

Originally in the epidemiological study of radiation exposure effects of survivors comparison group of completely no exposed people must to be settled. However, in the epidemiological study of the ABCC and of the successor the RERF used as the comparison group the distant survivors for whom exposure by initial radiation can be neglected as well as entrance survivors who entered into the city after bombing. This is adapted to the purpose of the ABCC establishment to study the effects of the initial radiations. The problem of comparison among the survivors by ABCC-RERF was pointed out in the 1977 NGO Symposium on the Problems of Survivors held in Tokyo, Hiroshima and Nagasaki with collaboration of citizen and scientists. In this symposium scientists of natural science, medical science, cultural science, and social science mutually cooperated with each other and clarified comprehensively all aspects of the problems of survivors and inhumanity of nuclear weapon use. The results of this symposium were spread to the world.

In 1983, Inge Schmitz-Feuerhake, professor of Bremen University, at first clarified scientifically the problem of the comparison group of epidemiological study in the RERF. She heard a report of the NGO symposium and started to compare death rates and incidence rates by various obstacles among the distant-survivors (exposed less than 90 mGy of the initial radiation) and the entrance-survivors (entered into the city after bombing) who were made as the comparison group in RERF studies with Japanese average and obtained relative risks. Her obtained results of the relative risks are shown in Fig. 1. The relative risks of mortality are shown in the upper side of the broken line and those of incidence rates are the down side with black circles ● for the distance-survivors (0—9 rad T65D) and white circles ○ for entrance survivors (not in the city; NIC). The fact that relative risks for mortality by all causes and by all diseases less than 1 means both of distant and entrant survivors were healthy compared to the average of Japanese. However, the relative risks of mortality by the respiratory system cancer and of incidence of female breast cancer, thyroid cancer and leukemia are considerably large than 1. This fact shows both of distant and entrance survivors effected by considerable amount of radiations from the fallout and/or the induced radioactive matter. The relative risk of mortality of leukemia of entrant survivors in Fig. 1 is less than 1. In the entrant survivors group the people are included who moved to Hiroshima city or Nagasaki city before the 1st October of 1950. Schmitz-Feuerhake studied the relative risk of entrant survivors who entered within 30 days from the bombing day and shown in Fig. 1 attached by EE whose value is larger than 2. By this study Schmitz-Feuerhake show scientifically that both of the distant and entrant survivors exposed considerable radiation from the fallout and the induced radioactive matter. Unfortunately her article could not accept by inspection for publication to the specific journal and then submitted as a letter article of the "*Health Physics*".[3]

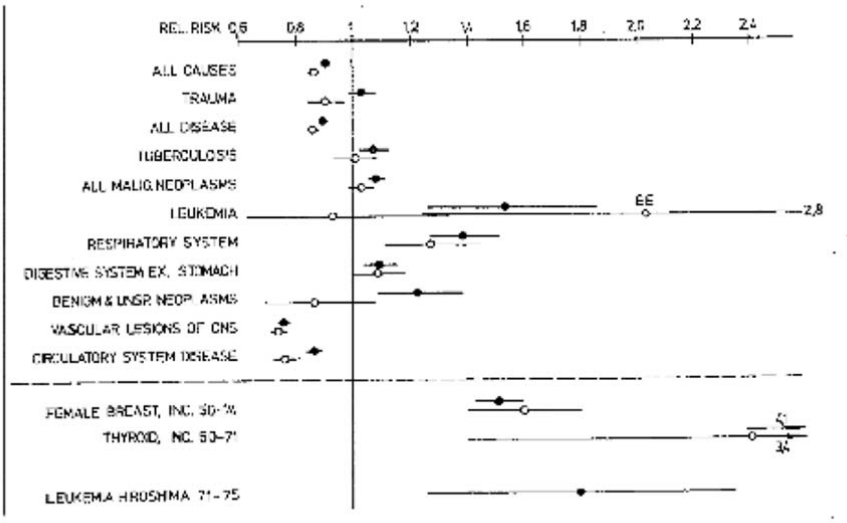

Fig.1 Standard mortality and incidence rates for cancer and other causes compared to national rates for "controls" in Hiroshima and Nagasaki

—o— group NIC —•— group "0-9 rd T 65 D"

above: mortality up to 1972 (and standard deviations) from ABCC (3), except EE

below: breast cancer incidence (4), thyroid cancer incidence (5,6), leukemia 71-75 (7)

EE: leukemia in early entrants (2,6)

3.3. Estimation of the Residual Radiation in DS86

The 1986 Dosimetry System of Atomic Bomb (DS86) give estimation doses of initial radiation, i.e. the gamma rays and neutrons, for each distance from the hypocenter of Hiroshima and Nagasaki and also discussed on the residual radiations in chapter 6. In this chapter introduced results of measurement of radiation emitted from radioactive matter which were brought by fallout rain and penetrated into soil and did not washed away by the fire-rains, typhoon rains or floods after bombing. In this chapter a possibility of wash away is stated, on the other hand, it described the calculated results of accumulated exposure by the measured retained radioactive matter from fallout from the bombed day to future life. The Japanese government and the RERF have used this description as the maximum exposure from fallout radiation, that is, the maximum exposure from fallout of Hiroshima bomb will be from 6 mGy to 20 mGy in Takasu region located 3～4 km west from the hypocenter of Hiroshima and 200 mGy in Nishiyama region located 3 km east from the hypocenter of Nagasaki and the exposures from fallout in the other regions could be neglected. The Ministry of Health, Labour and Welfare considered this DS86 description as the scientific and settled as the standard of fallout exposure for examination of application by survivors for minister authorization of atomic bomb diseases (if survivor's disease is authorized as the effects of atomic bomb radiation the survivor get special allowance for medical and living). Even now, the Minister and its hangers-on specialists, doctors and

scientists continued to believe this DS86 description of fallout exposure while from 2003 most of judgments of the collective lawsuit demanding the cancellation of rejection of atomic bomb disease application pointed out mistake of the standard. Furthermore the 6th chapter of DS86 describe measured results of gamma rays emitted from daughter nuclei of decayed cesium 137 absorbed human body of survivor bombed in Nishiyama region by whole-body counter in 1969 and 1981 and also shows calculated result of accumulated exposure as the fallout radiation. The half-life-time of cesium 137 is about 30 years but the biological half-life-time of cesium is less than 80 days by discharge of metabolic change then amount of the direct intake fallout cesium 137 reduced several decades decimals after 24 years and measured cesium 137 will be intake from crops in the Nishiyama region within one year and irrelevant to the direct exposure from fallout just after bombing. However, the RERF and the Ministry continued to use this measured results for concealment of fallout exposure.

From hearing surveys it is clarified that in Hiroshima, regions of strong fallout rain from central part of atomic cloud are located in the north-west of the hypocenter. In Fig. 2 regions referred "Masuda fallout rain region" are shown which are also certified by recent investigations. The main region of the fallout rain are overlapped with strong fire rain regions which was caused by strong and large fire almost whole Hiroshima city with 2 km radius from the hypocenter. Then most of radioactive matter was washed out. The witness of survivors talked that between the initial fallout rain and the fire rain many frogs and fishes came floating to the surfaces of ponds and streams. Furthermore, in September and October of 1945 Hiroshima city was directly received by big typhoons and suffered great damages by deluges which washed away many bridges as well as most radioactive matter. Koi and Takasu region corresponding to the weak fallout rain region and no fire rain region and little effects by the floods.

On the 9th August taking order by the Japanese government the group of Dr. Yoshio Nishina collected soil samples of 28 points of Hiroshima city to confirm that the dropped bomb was the atomic bomb. These soil samples had been reserved in bottles and radiations from these soil samples were measured by Dr. Kiyoshi Shizuma, et. al. and their measured results are shown in Fig. 2 by sizes of circles surrounding sample points with running numbers[(4)]. The Japanese government and the RERF have insisted that the maximum fallout radiation point is Takasu (the number 12 point in Fig. 2). But the number 7 point in Fig. 2 (the east end point of West Big Bridge located about 2 km the west-south-west direction from the hypocenter and radius of circle showing radiation dose is reduced by 1/20) whose radiation is 19 times stronger than the number 7 point. The fact that strong radiation at this point has been never measured after fluids accompanied the typhoons show that the estimation of fallout radiation cannot be done after fluid.

Because the Nagasaki atomic bomb was the plutonium bomb the fallout rain region can be recognized by measurement of plutonium retained in soil. As shown in Fig. 3 large amount of fallout rains fell in Nishiyama region located 3 km east of hypocenter and from this region the fallout rain region are extended toward east direction with width of 3 ～5 km. Differently from Hiroshima in Nagasaki the fire area is less than 1/4 then the washout of radioactive matter in Nishiyama region was avoided, then it is recognized the measured value is ten times or more than those of Hiroshima.

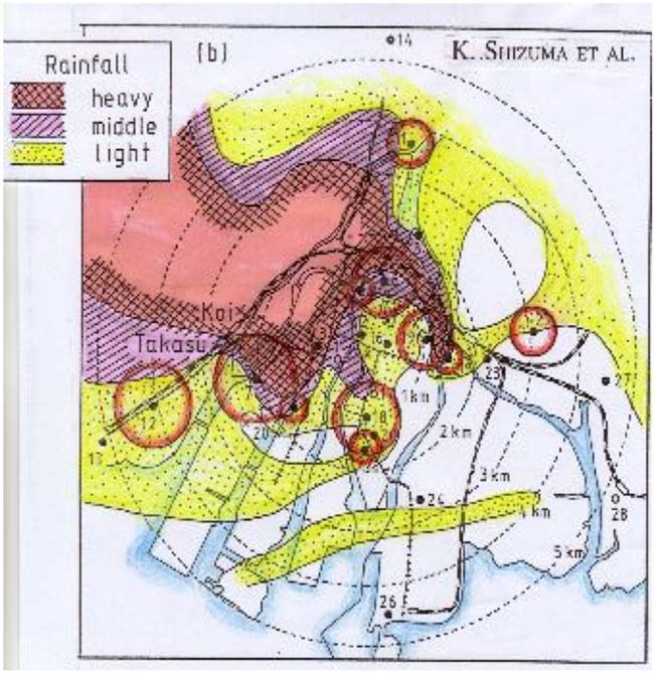

Fig. 2 Fallout rain region(Masuda region) and radiation from Nishina soil samples.

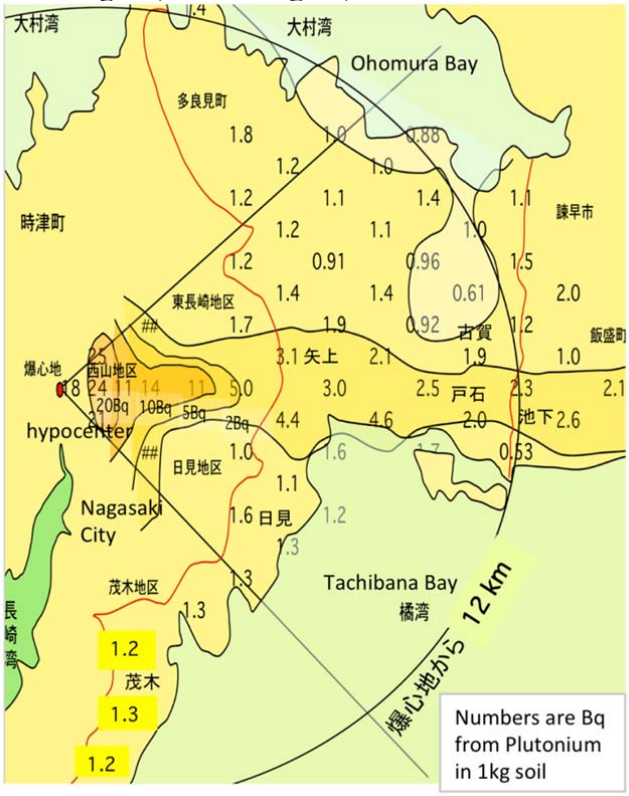

Fig. 3 Radiation from Plutonium retained in 1 kg soil around Nagasaki hypocenter.

4. Exposure Effects by Fallout

By statistical analysis of measured results of induced radiations in rocks and buildings produced by the initial radiation exposure it is clarified that the calculated estimation of the initial radiation doses (the gamma rays and neutron flux emitted within 1 minute after bomb explosion) of the DS86 are under estimation systematically in the regions beyond about 1.5 km from the hypocenters of both Hiroshima and Nagasaki. I reported this result in the Japan-U.S. joint workshop held in the RERF and in the conference of the Japanese Radiation Research Society and also presented as a opinion paper and testified in the court of the certification of sufferers of atomic bomb-related diseases against the Japanese government by survivors. The plaintiff of Nagasaki won the suit the Supreme Court was bombed at 2.45 km south of Nagasaki hypocenter and she fell epilation as well as several witness women bombed further distance fell epilation. I found that even if the underestimation of the initial radiation given by the DS86 were corrected the incidence of epilation of women bombed in these distant region cannot be explained. It is known that in Nagasaki the strong fallout rains regions were located in the east direction from the hypocenter and not in the south direction. Then we have to consider the other effects than fallout rain.

The chain reaction of nuclear fission finished within one-millionth second and during in this short time the radioactive matter produced by the chain reaction were confined inside of atomic bomb container before scattered into pieces. The gamma rays penetrated through the container absorbed by nuclei of atmosphere produced a fireball (a small shining star) which was a plasma state with super high temperature and super high pressure surrounding the atomic bomb container. The fireball emitted visible and heat rays from its surface during its expansion and cooling down towards sun surface temperature. Accompanying to rapid rising of the fireball the radioactive matter inside of the fireball also rose and cool down rapidly and became radioactive ultrafine particles. These ultrafine particles absorbed moisture from atmosphere and became nuclei of water-drops and produced atomic clouds.

The central part of atomic cloud had very strong rising power and broke through the tropopause which is a boundary surface between the troposphere and the stratosphere and about 10 km altitude and the top reached about 16 km altitude in the stratosphere. The size and density of raindrops of the central part of atomic cloud were very large and the raindrops became very heavy and fell as the fallout rain. On the other hand the size of raindrop of the surrounding parts of atomic cloud were small and lost their rising power when reached to the tropopause and expanded toward horizontal direction pushed by the ascending current. During descended these small raindrops evaporated their water and became original radioactive fine particles and filled under the atomic cloud. These radioactive fine particles caused internal exposure effects to the survivors under wide region of the atomic cloud.

On the 8th December 2012 the RERF reported their results of study of the effects by fallout rain. They compared the mortality of solid cancer and leukemia among 86,671 respond survivors in the Life-Span-Study (LSS) group who answered “Yes” to the question “Are you met the black rain” to those answered “No”. The results are summarized in Table 1. Because of no difference of solid cancer and leukemia between mortality “Yes” group to the “No” group, the RERF reported that the black rain caused no exposure effects. But this is comparison within survivors and their

results merely show that there are no difference between fallout rain region and fallout fine particle regions.

Table 1 Number of Death and Mortality and Excess of Relative Risk of Solid Cancer between 1963 and 2003 (RERF)

Hiroshima	No. replied	No. death	Mortality	ERR	Confidence Interval
No	29,270	3,369	11.51	0.00	−
Yes	11,667	1,409	12.08	0.00	−0.06, 0.07
Unk	17,598	1,778	10.10	0.00	−0.06, 0.07
Nagasaki	No. replied	No. death	Mortality	ERR	Confidence Interval
No	23,678	2,450	10.35	0.00	−
Yes	734	160	13.62	0.30	0.04, 0.59
Unk	3,724	324	8.70	−0.03	−0.14、0.10

No:did not met the black rain, Yes: met the black rain, Unk: Unknown.

In the RERF report it is shown that in Nagasaki the excess of mortality relative risk (ERR) of solid cancer in the region answered "Yes" is 0.30 (30%) and this result is significant with 5% level. In Nagasaki LSS group survivors who answered "Yes" were lived in the old Nagasaki city region where a large amount of radioactive soils were retained for long time as clarified by measurement of the Plutonium. However the RERF denied themselves their result because of no evidence among other items although the result is 5% significant level.

In 2011 Dr. Y. Hirai et. al. published an article "Electron Spin Resonance Analysis of Tooth Enamel Does not Indicate Exposures to Large Radiation Doses in a Large Proportion of Distally-exposed A-bomb Survivors".[5] They measured gamma ray exposure on molars of 49 survivors exposed less than 0.005 Gy of initial radiation (the so called distant survivors). They found that the molars of 4 survivors who were bombed from 2.826 km to 3.491 km in the fallout rain region of west-south to north direction from the hypocenter were exposed with the most high exposure of 295 mGy and average is 127 mGy. Contrary to the fallout rain region, the in the regions where the fallout rains did not fell and located from east to south direction with distance more than 2.75 km from the hypocenter 5 survivors were exposed gamma rays from 300 mGy to 550 mGy to their molars. This result shows that the survivors in the fallout region without rain were received more exposure than those in the fallout rain region. This fact suggest the situation that survivors were surrounding by dense radioactive fine particles in the air and they inhaled these fine particles by breathing and/or took by eating and drinking and caused by internal exposure due to the weak penetration power such as the beta rays which were main origin of the fallout nuclear decays and cause dense ionization in their body. In the article by Hirai et al it is shown medium of gamma ray dose to the buccal side molars is 17 mGy and to the lingual side is 13 mGy. They obtained these media by averaged including about 40 % negative doses therefore large underestimation may be possible. If the effects by beta ray exposure with several times larger than the gamma ray exposure are taken into consideration distant survivors were received several times more exposure than those of Koi-Takasu region 5 mGy to 20 mGy to which the governments insist. This

situation supports the results obtained from the incidence rates of acute radiation diseases that the distant survivors were suffered severe internal exposure from the fallout radioactive fine particles.

Around 1950 the Atomic Bomb Casualty Commission (ABCC) investigated the incidence of acute radiation diseases among the LSS group. Similarly to other many investigations epilation incidences were observed among survivors bombed at distance beyond 2 km from the hypocenter where the initial radiation scarcely reached. By the way, the Japanese Ministry of Health, Labor and Welfare and the REFR insisted that the acute diseases occurred distant place where the initial radiation did not reach were caused by other origin and the epilation was by mental shocks and the diarrhea was by bad health situations at that time. At that time many Japanese cities became burned fields by air raids of U.S. and many people shocked mentally, however, 100 or 1000 scale epilation or diarrhea did not seen other than Hiroshima and Nagasaki. Furthermore, epilation caused by mental shock could be discriminated clearly from caused by radiation and its incidence rates are systematically change with distance from the hypocenter as well as other acute diseases.

By many experiments using animals it is clarified that the incidence rates of acute radiation diseases are given by the normal distributions of exposed radiation doses[(6)]. D. O. Stram and S. Mizuno[(7)] studied among the atomic bombed survivors relation between incidence rate of severe epilation (more than 67 % hair loss) and the initial radiation exposure dose given by the DS86. The results of incidence of severe epilation are plotted by black circles in Fig. 4. The incidence rates of severe epilation show almost normal distribution below 3 Gy, however above 3 Gy does not increase about 70 % rate and even decrease in the region above 5 Gy. This behavior different from the normal distribution can be explain by a bias that the LSS was constructed mainly from survivors who entered in resisters of Hiroshima and Nagasaki city on the 1st October 1950 and survivors were not contained who died during 5 years after atomic bombing as pointed out by Dr. Alice Stewart[(8)].

By neglecting shielding effects of the initial radiation the incidence rates of severe epilation are shown by diamond-shaped marks in Fig. 5 by the distance from the hypocenter of Hiroshima. If shielding effects were considered the marks will be shifted towards hypocenter. The incidence rates of severe epilation approach zero at about 2 km from the hypocenter and the hypothesis by Stram and Mizuno that severe epilation were caused by the initial radiation might be almost consistent. In Fig. 5 the incidence rates of total epilation examined by the ABCC are also shown by red squares[(9)]. The opening between red squares marks and black diamond-shaped mark is roughly corresponded to moderate and slight epilation caused mainly by fallout radiations. From this observation beyond 1.5 km from the hypocenter the exposure effects by fallout were stronger than those by the initial radiation. Taking into account of this observation the results by Stram and Mizuno shown the black circles in Fig. 4 in the low dose region less than 1 Gy is too rapid increase than the normal distribution and will contradict to the threshold assumption of the acute radiation diseases. If the effects of the fallout radiation exposure the black circles will be shifted towards higher exposed dose. Furthermore if the incidence of total epilation including severe, moderate and slight epilation as shown by square marks in Fig. 5, the black circles will move upwards then incidence rates of total epilation concerning to the total exposure with both initial radiation and fallout radiation will be moved as shown by arrows and to the position shown by red square in Fig. 4.

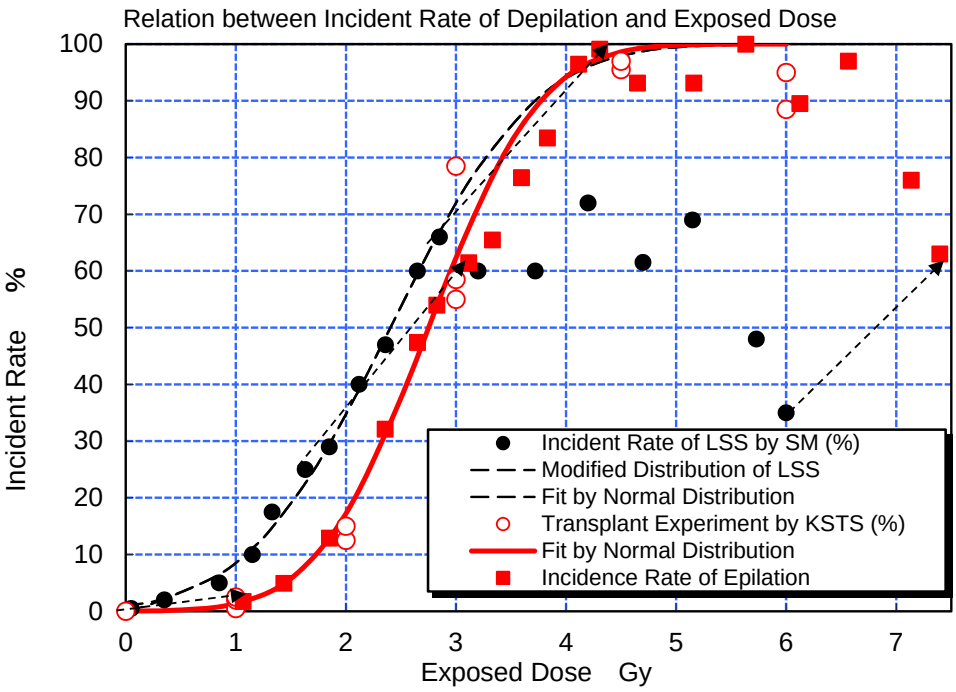

Fig. 4 Incident Rates of Epilation among Hiroshima Survivors in LSS and Hair Lost Ratio and Exposed Dose.

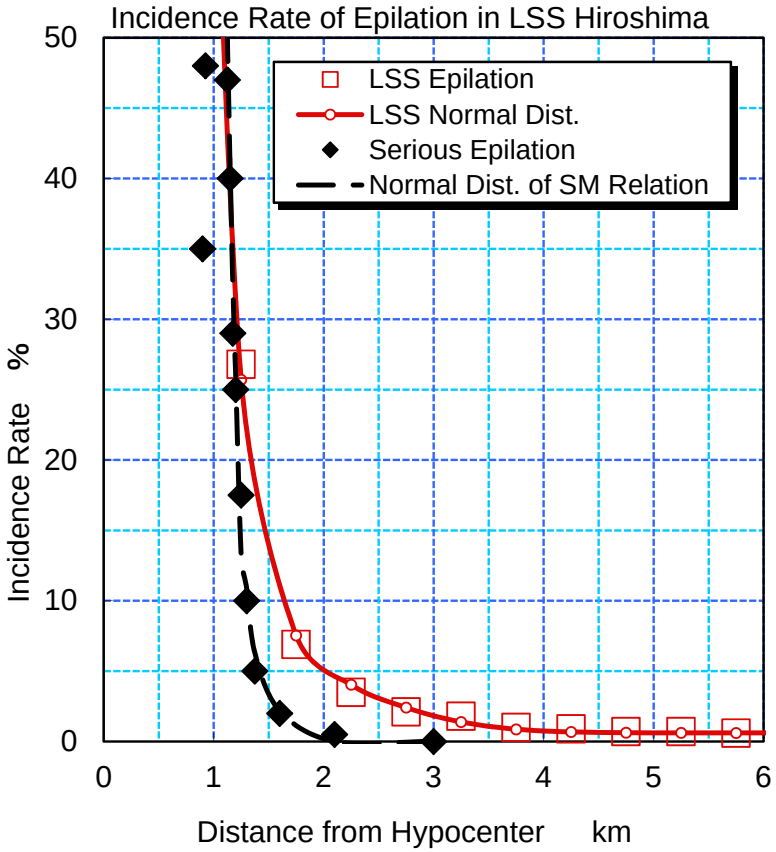

Fig. 5 incidence rates of severe and total epilation among the LSS Hiroshima group

Dr. S. Kyoizumi et al[10] of the RERF studied rates of fallen hair by the X-ray irradiation on head skin of 5 dead fetus transplanted to 22 mice removed immunity. Their results of rates of fallen hair by the X-ray irradiation dose shown by red open circles in Fig. 4 completely coincide to the expected total epilation rate shown by red square marks in the region less than 3 Gy. If rate of fallen hair is zero the incidence rate of epilation obtained from many people is also zero, and if the fallen rate is 100 % then the incidence rate is also 100% and both rates are distributed as the normal distribution then the incidence rate and fallen hair rate will be described by the same normal distribution function. In Fig. 4 the normal distribution N (2.751 Gy, 0.794 Gy) is represented by a red curve fitted all dose region. By use of this normal distribution the incidence rate of epilation among the LSS Hiroshima group was analyzed by taking the initial and fallout radiation exposure[11]. The initial radiation exposure by the Hiroshima bomb is used which is given by the 2004 Dosimetry System of Atomic Bomb Radiation (DS02) and denoted as $P(r)$ where r is distance from the hypocenter and a constant parameter c represents averaged shielding effects of the initial radiation. The formula representing the exposure by fallout radiation was obtained after repeated trial and error as $F(r) = ar \exp(-r^2/b^2) + d$ where a, b and d are parameters and $\exp(x)$ is the exponential function. The total exposure from the atomic bombing $D(r)$ is given by $D(r) = cP(r) + F(r)$. The four parameters a, b, c and d are determined by the chi-square fitting method applying $D(r)$ to the exposure dose of the normal distribution function N(2.751 Gy, 0.794 Gy) to calculate the red curve of incidence rates of total epilation examined by the ABCC shown in Fig. 5. The obtained radiation total doses $D(r)$, initial radiation exposure $cP(r)$ and fallout exposure $F(r)$ are shown in Fig. 6.

As shown in Fig.6 the exposure from the fallout radiation and that of the initial radiation cross at about 1.2 km from hypocenter and the initial radiation rapidly

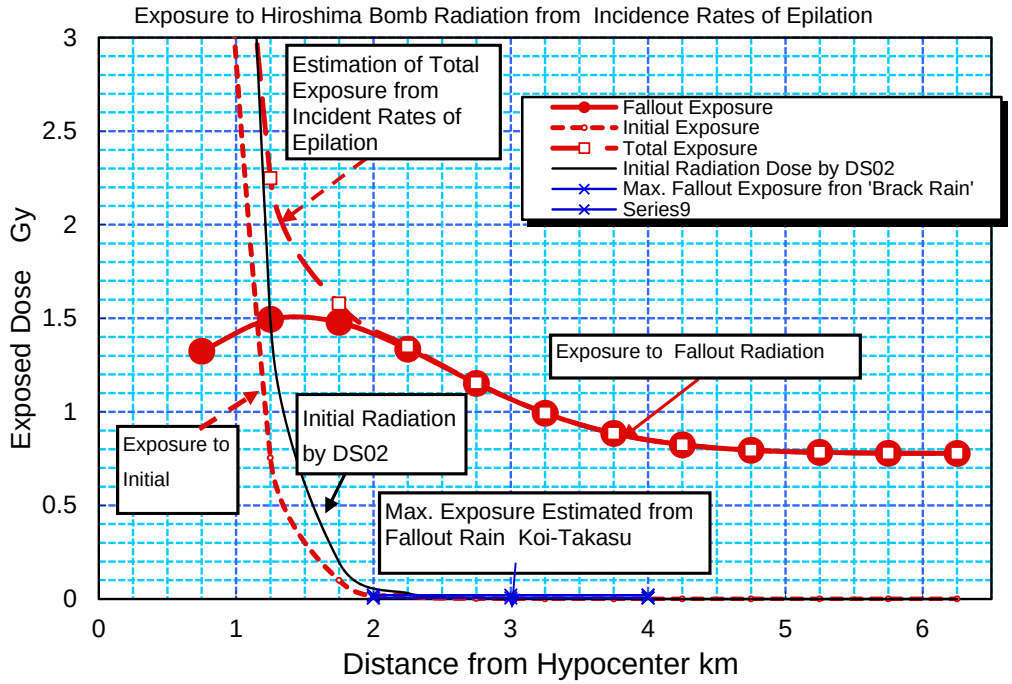

Fig. 6 Exposure to the Hiroshima atomic bomb radiation estimated from incidence rates of epilation among the LSS Hiroshima group by the ABCC.

decrease then beyond 1.2 km the exposure to bomb radiation is mainly by fallout radiation. The fallout radiation exposure in the region 5 km to 6 km from the hypocenter is almost constant value 0.8 Gy and may continued more father distance. Estimated maximum exposure from radioactive soil produced by penetration of fallout rain are shown by × marks in Koi-Takasu region which are the maximum of fallout exposure insisted by Japanese government and the RERF. The estimated exposure are almost 55 times of the Koi-Takasu region. The large separation of estimated fallout exposure from radioactive soil of Takasu region is recognized by that (1) the maximum fallout rain region is not Koi-Takasu region but the north-west direction region from the hypocenter and (2) main exposure by fallout is not from fallout rains but from intake of fallout fine radioactive particles.

Dr. M. Ohtaki et al reported their studied result concerning to the excess of relative risk (ERR) of mortality of solid cancer among survivors compared to the non-survivors in Hiroshima prefecture. The result show that the ERR is almost constant between 1.2 km and 2.0 km which can not be understood by exposure of the initial radiation which decreases about 1/20 between this region and they concluded that probability to be explain other than the initial radiation is more than 70 %. This results by a chronical radiation exposure effects are consistent with the results obtained from the acute diseases that fallout radiation exposure effects become major effects beyond 1.2 km.

By comparison of distance dependence of incidence rates of diarrhea with those of other acute diseases such as epilation and purpura (due to subcutaneous). Fig. 7 shows the incidence rates of diarrhea, epilation and purpura at the distance from the hypocenter examined among survivors who were bombed indoors and did not enter into 1 km area within 3 months by a medical doctor Gensaku Oho[(12)]. Oho has studied various cases of incidence of various acute diseases among survivors who were bombed indoors or outdoors, entered or did not entered within 3 months. Selection of survivors of indoors as well as not entered is to avoid the effects by burn and residual exposure of induced radiations. Inside 1 km where the initial radiation gave major exposure effects the incidence rate of diarrhea is very small compared with those of epilation and purpura which are almost 100%. On the other hand beyond 1.5 km where the fallout exposure became major the incidence rates of diarrhea become 3 or 4 times of those of epilation and purpura. This behaviors of incidence rates can be explained by the penetration mechanism of radiation and origin of diarrhea.

Diarrhea is caused by exfoliation of dead cells of intestinal wall. In the case of external exposure the radiation only with strong penetrability such as the gamma ray and neutrons can reach to the intestinal wall. The strong penetrability of radiation is attained by its skipped ionization effects among human tissue then its energy hardly lost. Therefore the radiation with strong penetrability can reach to the intestinal wall but it penetrate without any damage to the cell. Then the incidence rate of diarrhea in this region becomes small. On the other hand in the distant region where the fallout fine particles were filled the survivors intake these by inhalation, drinking or eating and the radioactive fine particles can reach to the wall cell and emit radiations from nearby position. The weak penetration power radiation give dense ionization in the wall cell and can cause diarrhea easily. Then by use of the normal distributions for diarrhea which are sifted toward higher and lower exposure dose directions for external exposure and internal exposure respectively the incidence rate of diarrhea is

analyzed as well as those of epilation and purpura given in Fig. 7 where the obtained fitting curves are shown[11]. The obtained exposure doses from the incidence rates of 3 different acute diseases are shown in Fig. 8. As is shown in Fig. 8 almost the same exposure doses both initial and fallout radiation from three different acute diseases and also obtained from epilation by the ABCC shown in Fig. 6. From this result the epilation and purpura were also caused by internal exposure in the region filled by fallout fine particles as diarrhea.

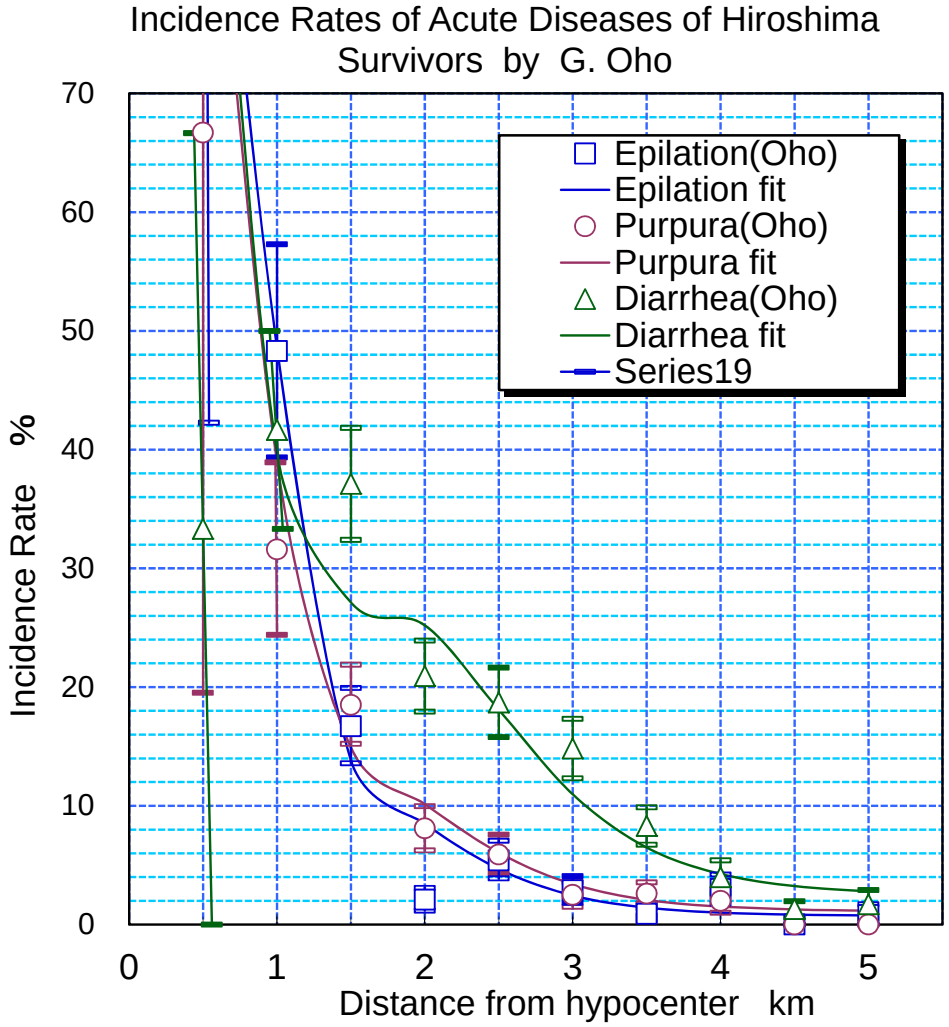

Fig. 7 Incidence Rates of Acute Diseases in Hiroshima Survivors by G. Oho

Concerning to the Nagasaki bomb exposure the same analysis as Hiroshima was made on the basis of the incidence rates of epilation, purpura and diarrhea which were investigated by the Nagasaki Medical College[13] in the region within 5 km from the hypocenter in 1945 and by the Nagasaki city and the Nagasaki prefecture[14] in the region between 5 km and 12 km from the hypocenter in 1999. Obtained results are shown in Fig. 9.

As is shown in Fig. 9 within 1.2 km from hypocenter the exposure by initial radiation dominated but beyond 1.2 km the fallout radiation exceeded as was in Hiroshima. The exposure effects reached the peek value at about 2 km and decreased

slowly and became almost constant between 5 km and 12 km with values 1.2 ∽1.3 Gy which is about 1.5 times of 0.8 Gy of Hiroshima fallout exposure at 6 km from the hypocenter. This is recognized if we take into account the facts that the yield of Nagasaki bomb is about 1.4 times of those Hiroshima bomb, that larger amount of the bomb equipment were induced radioactivity than Hiroshima bomb and that the radioactivity of plutonium239 retained without the chain reaction is stronger than that of uranium235.

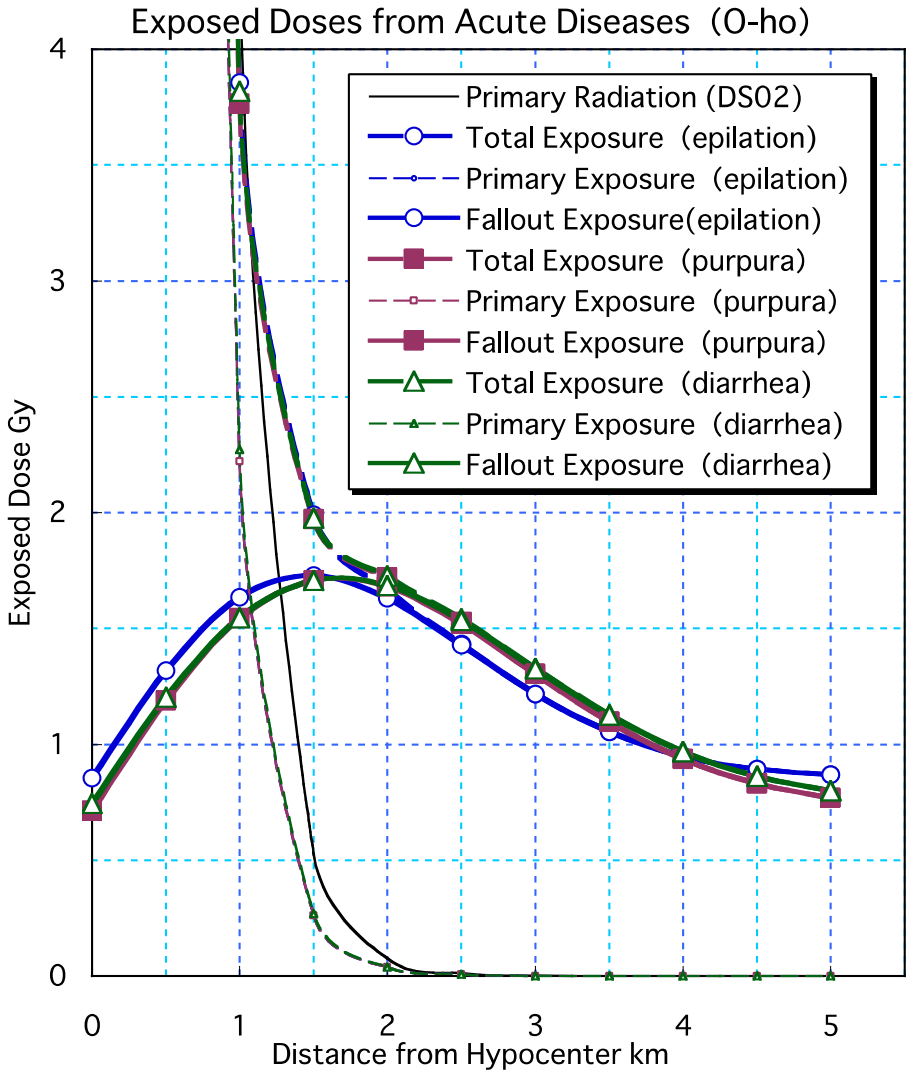

Fig. 8 Exposed Doses of Hiroshima Atomic Bomb from 3 Different Acute Diseases

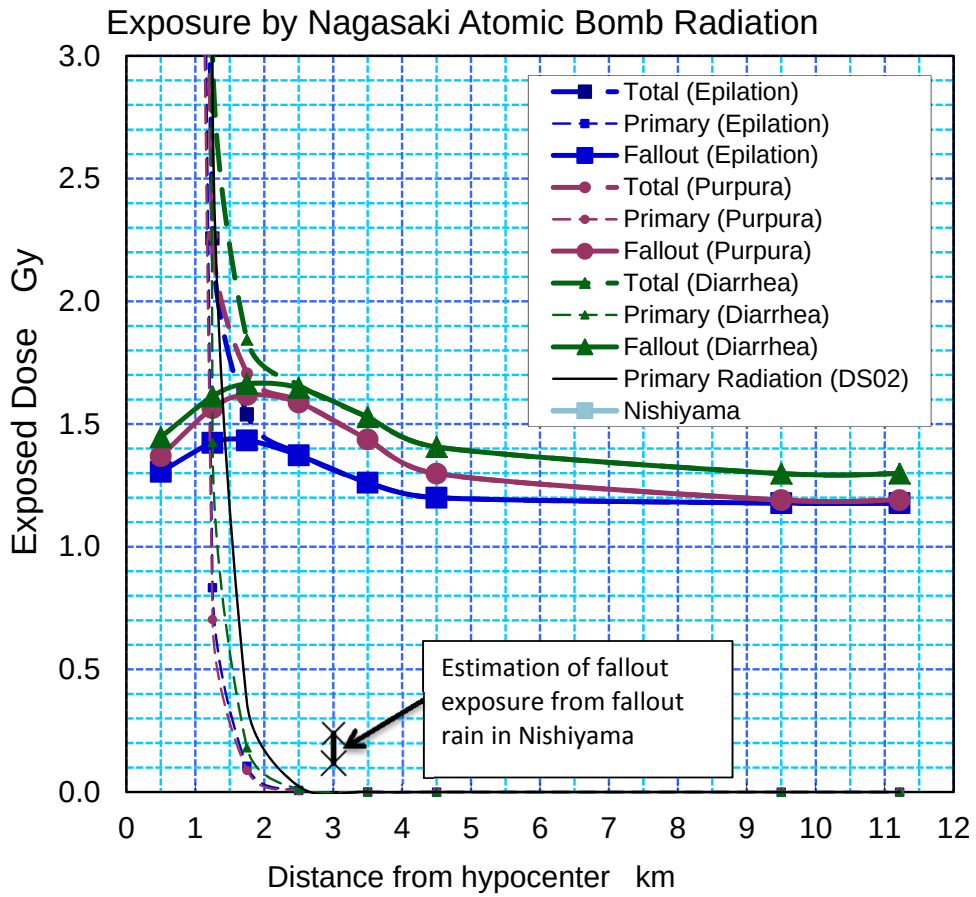

Fig.9 Radiation Exposure by Nagasaki Atomic Bombing Estimated from Acute Radiation Diseases

Ignoring these severe fallout exposure effects the distant survivors have been made essentially as the comparison group in the epidemiological studies of the RERF and the study of internal exposure has been much delayed. It stands to reason that when the standard of radiation protections by the ICRP settled on the basis of the RERF applied to the radiation protection from the Fukushima nuclear power plant accident there arose many big doubts. There are many similarities between exposure by nuclear plant accidents and fallout by nuclear weapon explosion but survivors under atomic cloud bombed at even 10 km from the hypocenter exposed from the radioactive fallout particles carried by the rain drop of atomic cloud before decrease there radioactivity and caused acute radiation diseases among them. Contrary to atomic bomb the power plant accidents released more than 500 times radioactive matter compared to those of atomic bomb explosions but the accident of No. 2 reactor which released most large amount radioactive matter occurred 4 days later after the chain reaction stopped and radio-activities largely reduced and spread region of radioactive matter is very wide compared with spread region of the atomic clouds then among victims of Fukushima power plant accident may be very rare exposed radiation to cause the acute diseases. Therefore the important problem to be care concerning to the exposure of radioactive matter from the Fukushima power plant accidents might be the chronic diseases such as cancers. Although the study of internal exposure was greatly delayed due to the ignoring the effects of the residual radiation it is required to prepare the systems to avoid the radiation protection from the accident radiation on

the basis of human right as pointed out by the UN Human Right Committee and Fukui court judgment of nuclear power plant stop. However, after the Fukushima, scientists who have concerned to radiation prevention joining with Japanese government said repeatedly that the increase of cancer incidence is not confirmed under 100 mGy then no worry is necessary. This shows their inattentive to learn special knowledge. Recently several scientific papers increase which show cancer increase even below 10 mGy exposure.

3.3 Conclusion of this research

There exist many investigated materials concerning to the situation of survivors after exposure of the atomic bomb radiation. Then the scientists are required to study these materials on the basis of developed medical and biological study even molecular level in order to clarify including the mechanism of internal exposure. As seen above the internal exposure is very important to understand the fallout radiation effects from mushroom cloud. Estimation of internal exposure from physically measured method is very difficult. The method shown here[11] which is based on the normal distribution function describing incidence rates of epilation among 68,500 Hiroshima atomic bomb survivors examined by the ABCC[7, 9] and the X ray experiment[10] will offer a base of estimation method of exposure including internal exposure. But now many scientists and medical doctors do not recognized the defects of the radiation protection standards proposed by the ICRP and the UNSCEAR.

Because of my research, in 2009 I signed the Lesvos Declaration of the European Committee on Radiation Risk which calls for national governments to abandon the ICRP risk model and begin to employ that of the European Committee on Radiation Risk which gives a more correct picture of the health effects of chronic internal radiation exposures.

The main conclusion is that the current ICRP risk model cannot apply to internal exposures to fallout and rainout material produced by Atomic bombs and because of this the whole radiation risk model currently the basis for legal decisions about exposures is unsafe to a large degree.

Therefore in the case of the test veterans, the argument that their “dose” was low is not a valid argument because their internal contamination from fallout and rainout will have caused the health effects just as it did at Hiroshima and Nagasaki.

Witness Statement

I understand that my duty is to the Tribunal and the information in this report is to the best of my knowledge truthful and accurate. I do not know any of the clients in this case. I have received no fee for writing this report but was asked to do so by Dr Busby. I reserve the right to alter my opinion following further evidence that may become available.

Shoji Sawada
15th September 2015

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On 6 August 1945 experienced the atomic bombing in my house 1.4 km from the hypocenter of Hiroshima and could not help my mother under crushed house.

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