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MEDICAL EFFECTS OF ATOMIC BOMBS

The Report of the Joint Commission for the Investigation of the Effects of the Atomic Bomb in Japan; Volume I.

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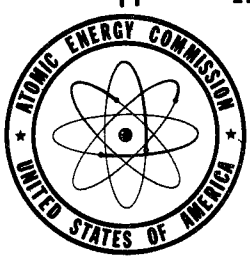

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1. These doctors were members of the Joint Commission, on leave of absence from the University.
2. In addition to these doctors, small groups of students and junior faculty members worked in the dispensary and the hospital for short periods.
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GLOSSARY

Center, Hypocenter or Ground Center	The point on the ground above which the bomb exploded.
Ground Zero, or GZ	Same as hypocenter.
GZ Distance	Distance from GZ.
Air Zero, or AZ	The actual point of the airburst of the explosion.
AZ Distance	Distance from the actual point of the airburst.
Distance	When this term is used without further qualification it refers to the distance from the center.
AMM Accession Number	158930 is the single accession number under which all of the blocks, tissues, and reports are stored at the Army Medical Museum.
Autopsy Key Number	Under this number subsidiary to 158930, are filed in serial order, the autopsy protocols and slides.
Photo File Number	Under this number at the Army Medical Museum are filed the photographic negatives or original prints. A copy of each print with its caption is also available in an album that is kept with the other materials of the study. (K) indicates that a Kodachrome transparency is also available.

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Summary Report of the Joint Commission for the Investigation of the Effects of the Atomic Bomb in Japan

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(This volume is classified SECRET and is bound separately.)

SUMMARY REPORT OF THE

JOINT COMMISSION FOR THE INVESTIGATION

OF THE EFFECTS OF THE ATOMIC BOMB IN JAPAN

It is desirable to present a summary of the studies that were made in Hiroshima and Nagasaki in such a way that a comparison of the effects of the atomic bombing of the two cities is possible. Since the structural condition of the cities and disposition of the population were widely diverse, this comparison does not necessarily reflect the relative efficiency of the bomb in each city.

The Cities.

Hiroshima was located on a broad delta which was perfectly flat except for a small hill some 2000 meters from the center of the explosion. Nagasaki was located in a series of valleys and on the banks of a harbor in such a way that the inhabited portions of the city formed the shape of a letter X. In Hiroshima the atomic bomb burst very nearly over the center of the city. In Nagasaki the atomic bomb burst over one limb of the X. The terrain of the latter city afforded protection from the radiant heat and the ionizing radiations to about one-fourth of the population, whereas the small hill in Hiroshima sheltered very few. The portion of Hiroshima below the bomb was a congested commercial and residential district, while in Nagasaki the comparable region was industrial and residential. In Hiroshima approximately 60 per cent of the population were within 2000 meters of the center of the explosion, and in Nagasaki only 30 per cent were so situated. These differences between the nature of the targets influenced the results, as might

be expected, and should be borne in mind. In each city the air raid defense measures failed to warn the people and many were exposed who could have found suitable cover.

The atomic bomb which was used against Hiroshima was composed of the uranium isotope U-235; and the one used against Nagasaki was composed of Plutonium 239.

The Nature of the Casualties.

Each bomb produced mechanical, thermal, and radiation injury. In their general features, the types of injury were similar in the two cities.

a. Mechanical injuries were inflicted either directly (by blast) or indirectly (by falling debris, etc.). Blast injury analogous to that inflicted by high explosive bursting within a few feet was almost unknown. Ruptured eardrums had a general incidence of less than 1% in each city, although in selected groups close to the center more were found. There were no lesions in the lungs, intestines, etc., ascribable to blast. Other mechanical injuries in survivors were found to have been produced largely by flying glass and the falling beams of wooden houses. The more severe injuries such as fractures were rare since those that had been severely injured were killed by fires that struck the city before rescue operations could be begun.

b. The burns were largely of the "flash" type and were the result of an exceedingly large quantity of radiant heat acting for an exceedingly short interval (probably between .01 and 1.0 second). They were of the "profile" type and involved only surfaces in the rectilinear path of the rays. Consequently they were sharply outlined. It is probable that specific portions of the spectrum accounted for the peculiarities of pigmentation and depigmentation that were observed. There was histological evidence that the latter could occur without destruction of the squamous epithelium of the surface. Depigmentation was prominent in patients close to the center, but there was a marginal zone of pigmentation even in these burns. Beyond 1600-2000 meters pigmentation was the prominent feature of the burns and

affected all portions of the exposed skin. It represented the minimal residual effects of the rays. Clothes, particularly when light in color and several layers in thickness and when loosely worn, offered some measure of protection, especially beyond 2300 meters. It was rare for burns to occur beneath a khaki coat and shirt beyond 1500 meters. In Hiroshima flash burns occurred to a distance of 4500 meters ($2\frac{1}{2}$ miles) but rarely was there blistering or necessity for treatment of patients beyond 3300 meters. In Nagasaki, the greatest proved distance at which flash burns occurred was 4000 meters.

c. The effects of the ionizing radiation resembled closely those produced by X-rays or gamma rays in animals and man. Quantitatively, the symptoms and findings were similar in the people exposed in Hiroshima and Nagasaki. In many persons nausea and vomiting occurred within a few hours of irradiation. The characteristic lesions were found in the skin, gastrointestinal tract, gonads, lymphatic system, and the bone marrow.

1. Skin: There was some evidence that the skin was directly affected by the ionizing radiation. In a few cases there were epithelial changes at the margins of ulcerative lesions in patients dying during the 3rd week. In Nagasaki, vesicular lesions occurred which resembled those of roentgen dermatitis. In Hiroshima, epilation began approximately 2 weeks after the bombing, in most cases on exactly the 14th day. In Nagasaki, the peak of onset of epilation was later, occurring close to the 20th day. The hair came out in bunches by gentle plucking or by combing, or it was found in considerable quantities on the pillow in the morning. The distribution of the epilation usually resembled that of ordinary baldness in men, but in some instances the nape of the neck was also epilated. Even then a few

downy hairs remained in places where the epilation was almost total. Women were involved at the same time and to the same degree as men. Histologically the process was entirely analogous to that of the ordinary processes of loss and replacement of the hair in all of its details. Atrophy of the sebaceous glands went hand in hand with the changes in the hair follicles. Sweat glands in skin that had not been burned showed relatively little change, although occasionally the acini appeared shrunken and had thickened basement membranes and finely vacuolated epithelial cells with pyknotic nuclei. The epithelium of the surface of the scalp became thinner and the rete pegs were short and blunt and occasionally there was hyperpigmentation of the basal layers. Beginning approximately in the middle of October at a time when clinical regeneration of the hair was in progress, there was histological evidence of regeneration of the hair follicles. This was characterized by the appearance of a new zone of differentiation of the internal root sheath at the base of the old follicle. The new hair penetrated the external root sheath of the old follicle in exactly the same manner that the hair is replaced in the usual cycle.

2. Gastrointestinal Tract: In the most heavily exposed patients a severe dysentery-like diarrhea commenced soon after the bombing and persisted until death. In the others diarrhea was a frequent and troublesome symptom. As early as the 4th day remarkable histological changes were observed in the gastrointestinal tract. These consisted of the appearance of extremely bizarre cells, some with enormous nuclei possessing a coarse chromatin network and an abundance of cytoplasm. Atypical mitoses were found in other cells and tripolar figures were ocassionally observed. In one case dying in Nagasaki on the 10th day, such lesions were associated with an ulcerative

process. Large portions of the mucosa became necrotic and the submucosa was edematous. Masses of bacteria occurred in the superficial parts of the necrotic tissue but there was no leukocytic exudate. It is probable that both direct injury of the gastrointestinal tract and the leukopenia occurring at this time contributed to the pathogenesis of such lesions.

In the pharynx of a patient dying on the 10th day, there were remarkable changes resembling those following X-radiation of the skin, consisting of swelling of the squamous epithelial cells involving both the cytoplasm and the nuclei. Only scattered plasma cells were present in the tremendously edematous wall of the pharynx underlying this lesion. It is possible that changes of this type were responsible in part for the painful lesions in the oropharynx which were a characteristic feature of the syndrome of radiation injury.

3. Gonads: Even at the 4th day remarkable changes are found in the testes. There was sloughing of the germinal epithelium from the basement membrane of the tubules together with an increase in the Sertoli cells. Toward the end of the first month there was complete loss of germinal epithelium and its derivatives which ultimately were discharged from the lumen or became necrotic in situ. After the 5th week in some instances, the tubules began to display thickening of the basement membrane and there were hyaline deposits restricting the lumina of the interstitial blood vessels. There was slight hyperplasia of the interstitial tissue after the end of the 6th week. To correlate with the changes in the testes there was a remarkable decrease in the count of spermatozoa of patients who had been close to the bomb. How permanent this will be is at present unknown.

Much less striking changes were observed in the ovaries. Only in a few instances was it possible to demonstrate primary follicles in process of atresia and a decrease in the number of ova. The most constant finding was that of the absence of developing follicles despite the persistence of primary follicles. The endometrium showed an absence of corpus luteum effect and appeared in the resting phase. In one patient who had come to abortion in the 5th month just before death, there was found a corpus luteum of pregnancy in process of involution. Amenorrhea was very common in women who were close to the center of explosion and its incidence was inversely proportional to the distance. The incidence of amenorrhea in wartime Japan, however, was high throughout the country, particularly in bombed areas.

4. Lymphoid tissue: Even after 3 days there was a remarkable degree of atrophy of the lymphoid tissue. Mature lymphocytes had almost completely disappeared from the spleen and lymph nodes, so that nothing but the reticular skeleton remained. Clinically, this was manifested by a fall in the peripheral lymphocyte count, as observed in a few patients who had had blood counts within the first week. Beginning on the 5th day, atypical mononuclear cells began to appear both in the spleen and lymph nodes. The atypical cells in some instances resembled lymphoblasts; others were larger and had bizarre nuclei and an abundance of basophilic cytoplasm. Many of the latter suggested the Reed-Sternberg cells in their appearance. They became very numerous and in some cases persisted for at least 3 months. In a few instances, however, secondary follicles had reappeared by this time, both in the spleen and lymph nodes.

5. The bone marrow was seriously affected by the ionizing radiation of the atomic bomb. Definitive cells were reduced in number or entirely destroyed

and the time at which the maximum depletion occurred varied between the 1st and 5th week after the explosion. In nearly every patient who lived longer than 6 days after the bombing there was evidence of proliferation of the reticulo-endothelium. At the onset of this process, plasma cells, lymphocytes, and macrophages were formed, but after a period of time which varied from one to three weeks, differentiation into granulopoietic and erythropoietic tissue commenced. As regeneration progressed, there was a steady "shift to the right" of the marrow beginning from a very immature reticular tissue and ending in favorable cases with one that closely approximated normal. The recovery of the erythropoietic portions of the marrow appeared to proceed at a slower rate than granulopoiesis and thrombopoiesis, but each system appeared to reach a normal state at about the same time. When restitution to normal occurred it was observed by the 12th to the 16th week after the bombing.

In the majority of cases where the patient died at any time before the 6th week, the bone marrow was hypoplastic. In a few patients who died toward the end of the 1st month, the marrow showed focal myeloid differentiation with large numbers of myelocytes. There were other cases with a tremendous hyperplasia of the marrow which showed the evidence of a maturation defect since there was a leukopenia. In the patients who recovered, the bone marrow resumed a normal functional state.

It was possible to subdivide the fatal cases of radiation injury into three related groups on the basis of the time at which death occurred: Group 1: Patients who died in the 1st and 2nd weeks; Group 2: Patients who died from the 3 rd to the 6th week; Group 3: Patients who died after the 6th week.

The clinical syndrome of radiation injury was dependent to a remarkable degree on the pathologic lesions described above. It was practicable to classify the patients into 3 types: very severe, severe, and mild. The similarity between these clinical types and the grouping of the fatal cases examined at autopsy is good.

Very Severe Cases: (Pathologic Group 1). Clinically this type of patient received the maximum exposure to ionizing radiation. There was histologic evidence of injury to the skin, gastrointestinal tract, lymphoid tissue, gonads, and bone marrow; but the clinical manifestations of these injuries were not always apparent. Epilation was infrequent and purpura occurred terminally, in only a portion of the cases. The patients complained of nausea and vomiting on the day of the bombing and this was followed by progressive fever, anorexia, severe diarrhea, thirst, and malaise. Death ensued in delirium within the first two weeks. When blood counts were made, leukopenia was found in most patients by the 5th day, and possibly sooner, after the bombing. The mortality rate was probably 100 per cent.

Severe Cases: (Pathologic Groups 2 & 3). Clinically in this type of case the anatomical and clinical effects of the ionizing radiation attained their acme. During the 3d, 4th, 5th, and 6th weeks after the bombing the characteristic symptoms due to radiation occurred. Some patients succumbed during this phase of the disease; others who recovered from the acute symptoms died after the 6th week, usually of pneumonia or enteritis which may have been a new illness of sudden onset or an exacerbation of lesions that developed earlier. In other instances recovery occurred. In patients of this type a characteristic symptomatology occurred and some or all of the features were manifested by the individual patient. Nausea and vomiting on the day of the bombing were often

reported. This was followed by a latent period during which most patients felt reasonably well. The duration of this phase varied from a few days to as long as three to four weeks, at which time epilation, purpura, or inflammatory lesions of the mucous membrane of the mouth and throat developed. Fever and diarrhea occurred frequently and at about this same time. In the more severely affected patients, all of these symptoms appeared after a comparatively short latent period. In the less severely affected some combinations or all of the symptoms appeared in mild form after a longer period. Examination of the blood at the time when the symptoms were most marked revealed extreme leukopenia, thrombopenia and a progressive anemia. Hemorrhagic and necrotizing lesions developed concurrently which were sequelae of the hypoplasia of the bone marrow and which were entirely comparable to those seen in aplastic anemia and agranulocytosis. In the most severely affected patients, fever increased steadily and those who died usually succumbed within one to two weeks of its onset.

Approximately half of the patients exhibiting all or several of the symptoms noted above survived. In relation to defervescence the pharyngitis ceased before or during, and the gingivitis after, the end of the febrile period. Recovery was associated with an increase in the number of leukocytes and platelets in the circulating blood. The red blood cell count, however, usually continued to fall for some weeks after the onset of convalescence. Not all of the patients who survived the acute illness recovered. In some the bone marrow failed to differentiate properly and exhibited a maturation defect and these patients died after a chronic illness.

Mild Cases: Persons who were situated near the limit of the range of the

radiation or who, although close to the center were shielded by heavy buildings, manifested mild effects. Such patients had some or all of the symptoms mentioned above but usually to a less serious extent. The leukopenia and thrombocytopenia were less profound and if death occurred it was due to some complicating illness. In others who were apparently asymptomatic leukopenia was discovered during routine blood counts. Many of the patients of this type suffered from diarrhea and complained of anorexia and malaise. Most of those with the milder symptoms recovered completely. There were some, however, who had not regained their habitual feeling of well-being even three months after the bombing. A few of these had persistent leukopenia of approximately 3000; and a moderate anemia was more common. It is not known what role the dietary deficiencies played in the development of the anemia or in the protracted convalescence.

The prognosis of patients with radiation injury appeared to depend on several factors:

a. The closer the patient was to the center and the less his protection by heavy construction, the more severely was he affected.

b. The tempo at which symptoms appeared after irradiation appeared to be related to the severity of the effect. In those patients in whom the initial nausea and vomiting was followed by the progressive development of fever, diarrhea, and other signs, the prognosis was the worst. In other patients in whom there was a latent period after the initial nausea and vomiting and before the onset of characteristic symptoms, the severity of the disease was least in those with the longest latent period.

c. The patients with the severe type of radiation injury who had the poorest prognosis were those in whom all the symptoms of epilation,

purpura and oropharyngeal inflammation occurred in the most severe form.

d. The prognosis was the poorest for patients with the lowest white count and few instances were reported where recovery occurred in patients with white blood cell counts of less than 500.

Comparison of Population and Casualties in the Cities as a Whole.

1. The best estimate of the civilian population in Hiroshima at the time of the bombing on 6 August 1945 is 255,200; and that of Nagasaki on 9 August 1945 is 195,290. The deaths in Hiroshima were approximately 64,500 (25.5%) and in Nagasaki 39,214 (20.1%) by the middle of November 1945.

2. The Standardized Killed Rate (representing the number that would have died had the population density been 1 per 1000 sq. feet) was in the neighborhood of 79,500 for Hiroshima; and 75,300 for Nagasaki. The Standardized Casualty Rates (total of killed and wounded) were, respectively, 261,000 and 131,000. This indicates an unprecedented casualty producing effect.

3. Inspection of the Casualty-Distance Curves reveals that the point at which the chances of death were 50% was 1250 meters for Hiroshima; and 1300 meters for Nagasaki. The 50% point for injury or death was at 2100 meters for Hiroshima and at 2000 meters for Nagasaki.

4. Correlation of the general mortality curve in Hiroshima with specific groups whose conditions of exposure and fate are definitely known suggests that at 1000 meters only 11.5% more individuals died of other factors than would have died of radiation injury alone.

5. The mortality rate for individuals in concrete buildings was much lower than that of individuals in wooden buildings, and in both it was less than that of the general population at comparable distances.

6. The mortality rate, and the casualty rate of individuals in deep

air raid shelters, caves and tunnels was the lowest reported for any group. In Nagasaki persons survived uninjured who were in caves directly beneath the exploding bomb.

Comparison of the incidence of injuries in the sample of survivors studied by the Joint Commission.

No satisfactory records of the incidence of each of the three types of injury for the population as a whole in each city could be obtained. The Joint Commission studied a sample of the surviving population. In comparing the information obtained in the two cities, the following factors should be borne in mind:

a). The bomb at Hiroshima exploded some 100 meters higher above the ground than at Nagasaki.

b). In Nagasaki the irregular features of the terrain, and the larger number of concrete and heavy buildings afforded some shielding to a higher proportion of the population than was the case in Hiroshima.

c). There was a difference in the distribution of the populations at various distances from the center.

d). There may be a sampling error in that a higher proportion of the uninjured may have reported to the investigators in one of the two cities.

To make the comparison as fair as possible, it is necessary to select groups of the population whose exposure was comparable before an estimate of the relative effectiveness of the bombs can be attempted. Nevertheless, it is of interest to compare the crude casualty estimates based on the survivors in the two cities.

1. Mechanical injuries: The most satisfactory groups for purposes of

comparison were the occupants of Japanese-type wooden houses. For the part of the city within a distance of 5000 meters of the center, the total incidence* of mechanical injuries in Hiroshima was 82.8%, and in Nagasaki 71.6%.

2. Burns: The most satisfactory groups for purposes of comparison were the people who were outdoors, unshielded, within a distance of 4000 meters of the center. The incidence* of burns in Hiroshima was 89.9%; and in Nagasaki, 78.3%.

3. Radiation Injury: The most satisfactory groups for purposes of comparison were the people who were inside Japanese-type wooden buildings. The criteria for the diagnosis of radiation injury in this sample group consisted of the occurrence of epilation or purpura or both. The incidence* of radiation injury under these circumstances was 37.4% in Hiroshima, and 33.7% in Nagasaki. This group may be subdivided into 3 parts: those between 0-1000 meters, 1100-1500 meters, and 1600-2000 meters from the center. The incidence* of radiation injury in the smaller groups in Hiroshima was 85.9%, 38.6%, and 10.1% respectively; and in Nagasaki was 53.5%, 38.0%, and 18.2% respectively.

FACTORS OF EXPOSURE AND PROTECTION

1. Mechanical Injuries.

Analysis of the data in both cities reveals that mechanical injuries were minimal in individuals who were out of doors and unshielded. Among survivors they were greatest among those who were indoors in buildings of

*In the Summary the incidence of each of the three types of injury is stated in per cent of the total number of injured persons, and not in per cent of the total number of persons in the sample studied.

heavy type, either concrete or brick. When, however, total mortality in the two types of buildings is considered it was found to be much greater in the buildings of Japanese type, since these tended to collapse whereas the concrete structures maintained their external structural integrity.

2. Burns.

In Hiroshima, study of certain large groups under known conditions of exposure in the open gave an estimate of mortality to be expected under certain conditions. At 750 meters in completely unprotected individuals the mortality is approximately 100 per cent. At 1000 meters the mortality is 95 per cent approximately, but at 2400 meters, the mortality is less than 1.5 per cent. Study of groups of school children shows that there is a very sudden fall in mortality beyond 2000 meters, probably associated with a sharp decrement both in the lethal effects of the thermal injury, as well as a decrement in the radiation injury which would complicate the results of infection of the burns.

3. Radiation Injury.

At 1000 meters individuals in Hiroshima protected only by Japanese buildings and suffering no other injuries showed a mortality of 58.5 per cent. Under similar circumstances a smaller group in Nagasaki showed a mortality of 45 per cent.

In concrete buildings at Hiroshima and Nagasaki the mortality from radiation effect beyond 1000 meters is nil.

Correlation of the shielding effects of concrete buildings and shelters with survival data of patients shows that, for Hiroshima:

1. At 250 meters (650 meters from airburst) more than 150 inches

of water (5 ft 4 in. of concrete) are necessary to protect against death from radiation effect, and more than 250 inches of water (9 ft of concrete) are necessary to protect against radiation injury.

2. At 450 meters (750 meters from airburst) at least 150 inches of water (5 ft 4 in. of concrete) are necessary to protect against death. At least 240 inches of water (9 ft of concrete) are necessary to protect against radiation effect.

3. At 550 meters (875 meters from airburst) at least 100 inches of water (3 ft 6 in. of concrete) are necessary to protect against death from radiation effect, and 250 inches of water (9 ft of concrete) are necessary to protect against radiation injury.

4. At 750 meters (960 meters from airburst) at least 50 inches of water (1 ft 9 in. of concrete) are necessary to protect against death and more than 250 inches of water (9 ft of concrete) are necessary to protect against radiation injury. If the structure has no windows facing center, then 200 inches of water (7 ft 3 in. of concrete) suffice to protect against radiation injury.

5. At 1000 meters (1165 meters from airburst) more than 4 inches of water (1.7 inches of concrete, are necessary to protect against radiation injury.

For Nagasaki:

1. At a distance of approximately 500 meters (700 meters from airburst), the intensity of the ionizing radiation was such that at least 85 inches of water (3 ft of concrete) was necessary to prevent fatal radiation injury. At the same distance, from 140 to 230 inches of water (5 ft to

7½ ft of concrete) was required to protect against radiation injury.

2. At a distance of approximately 800 meters (900 meters from air-burst), the intensity of the ionizing radiation was such that approximately 75 inches of water (32 inches of concrete) was more than sufficient to prevent fatal radiation injury. At this same distance approximately 97 inches of water (3½ ft of concrete) was adequate shielding to prevent radiation injury.

Section 1

INTRODUCTION

Prepared by Ashley W. Oughterson, Col., MC

1. Organization:

The organization of a study of atomic bomb casualties was directed by Brigadier General Guy B. Denit, M.C., Chief Surgeon of GHQ, United States Army Forces Pacific, in approval of a plan submitted on 28 August 1945 by the surgical consultant of that headquarters, Colonel Ashley W. Oughterson, MC, Appendix 1 (1).

After landing in Japan, it was learned that the Japanese Government had sent several scientists from various universities in Japan to Hiroshima and Nagasaki to study the effects of the bombs. Contact was established with the representatives of the Imperial Government on 3 September 1945, at which time they submitted reports on the effects of the atomic bomb. Thereafter close liaison was maintained between the Japanese scientists and the Surgeon's Office of GHQ in Tokyo. A group from Manhattan District under Brigadier General Thomas Farrell arrived in Japan early in September. On 4 September 1945, a conference was held with General Farrell and it was agreed that it was desirable to have a unified control of the various groups interested in the study of the medical effects of the atomic bomb. The mission of the Manhattan group was primarily to determine what residual radioactivity was still present in the bombed cities in order to safeguard our troops, and to conduct a brief preliminary study of the effects of the bomb for an early report to Washington.

The Japanese Government groups had made all of the early observations and their cooperation was essential. Therefore, before the departure of the group from Manhattan District from Japan and with their concurrence, the Supreme Commander directed the formation of a "Joint Commission for the

Investigation of the Effects of the Atomic Bomb in Japan" (Appendix 2 (1)).

2. Mission:

The objectives of the study were:

A. To determine the nature of the casualties.

B. To determine the number of each type of casualty in relation to distance from the bomb.

C. To establish factors of protection.

3. Personnel:

A. GHQ, AFPAC: The personnel provided by the Chief Surgeon's office consisted of 11 medical officers and 11 enlisted men, and later of a medical photographic team.

B. Manhattan District: The personnel of the preliminary survey group consisted of approximately 30 officers and men, among whose number were radiologists and physicists as well as medical officers. They were under the immediate direction of Colonel Stafford L. Warren, MC.

C. United States Navy: The Surgeon General of the Navy had sent out a group under Captain (then Commander) Shields Warren, (MC) USNR, of NavTechJap, composed of 15 officers and enlisted men. This group worked in Nagasaki in complete cooperation with members of the Joint Commission.

D. Japanese Government: A total of approximately 90 Japanese physicians and senior students were furnished by the Japanese Government. These were mostly from the Tokyo Imperial University. Cooperation was extended also by members of the various medical schools, laboratories and hospitals (Appendix 3 (1)). Very

valuable assistance was also extended by members of the Japanese Army Medical School and the First Tokyo Army Hospital

E. Other Cooperating Groups: Valuable assistance was received from members of the United States Strategic Bombing Survey during the work in Japan and from the British Mission to Japan. To both of these, full cooperation was extended by the Joint Commission, and the records and observations of the Commission were made available to them.

4. Procedure:

When the Commission was formed, a month had already elapsed since the bombs were dropped on these cities. In order to obtain adequate clinical data while patients were still available, there was great urgency to enter these cities at the earliest possible date. Permission to enter these cities could not be obtained from the Commanding General of the Sixth Army since troops of the Sixth Army had not occupied the region. However, permission to enter the area was eventually obtained and through the liaison with the Imperial Government this was first accomplished with the cooperation of the Japanese Police. On 8 September 1945, the group landed on Iwakuni Airfield near Hiroshima with six plane loads of supplies. A preliminary survey of the damage was made and the physicists determined the amount of residual radioactivity present, which was found to be within the limits of safety. The group returned to Tokyo and on 19 September 1945 proceeded to Omura Airfield adjacent to Nagasaki. Here also, preliminary observations were made and the residual radiation was found to be within the limits of safety. Colonel Warren and a part of the Manhattan District group remained in Nagasaki to make further investigations. On 29 September 1945, the remainder of the Nagasaki investigation team was landed at Omura

Airfield. The start of the investigation at Hiroshima was delayed by a severe typhoon which isolated the city, making air or rail travel impossible until 12 October 1945, when the Hiroshima team was landed in that city by air.

5. Scope of the Investigation:

A. After preliminary investigation conducted by the radiologists and physicists of the Manhattan District team, the teams assigned to Hiroshima and Nagasaki began their work. The procedure and methods of each team are outlined in Sections 4H and 4N. A total of 13,503 case records were obtained. These were, in part, copies of Japanese records of the earlier cases, and in part represented the case histories of patients actually studied by members of the Commission.

The collection of data concerning factors of protection was emphasized. When the records were brought back to the United States they were subjected to statistical analysis, as presented in Section 9 of this report.

B. The records and materials of 217 autopsies were collected and brought back to the United States, where they were prepared for study at the Army Institute of Pathology. The results of this study are presented in Section 8.

C. A special casualty study on an adequate statistical sampling basis, was conducted under the direction of Captain (then 1st Lieutenant) Marvin E. Habel, FA. This was carried out in December, 1945, and early January, 1946, with the help of Japanese Government authorities and clerical assistance from the high schools in the two cities. Lieut. Harold Nisselson, USNR, of the United States Strategic Bombing Survey, gave valuable advice regarding procedure.

Bombing Survey, gave valuable advice regarding procedure.

D. Studies of Special Groups: An attempt was made to establish contact with survivors of groups of individuals whose conditions of exposure could be definitely determined at various points throughout the city. This was made possible by contacting surviving principals or teachers of schools. In this manner, data were collected concerning approximately 17,000 school children. The foreman of "patriotic work groups" were also sought out and valuable information was obtained with their aid. These studies are summarized in Section 10H and 10N.

E. Building and Shielding Data: A special effort was made to determine the location and fate of individuals in buildings of various type and to correlate the medical facts with the data concerning shielding. Building plans were obtained in Japan and actual measurements of the structures were made by members of the Commission. Upon return to the United States, the shielding factors were calculated by engineers of the United States Strategic Bombing Survey (Sections 11H and 11N).

F. Photography: Approximately 1500 photographs were obtained by the Commission on the scene and from the files of the Japanese photographic and investigating agencies. Many of the Commission's photographs are in color as well as in black and white. An attempt was made to collect views of the cities before the bombing and photographs were made from the same situation for correlation with the casualty data. Approximately one-half of the photographs are used to illustrate the present report.

6. Disposition of the Materials:

The clinical records and autopsy protocols, autopsy specimens and slides,

blood smears and bone marrow smears obtained by the Commission or from Japanese investigators, specimens of clothing and other materials of interest from the point of view of protection, photographic negatives, Kodachrome transparencies and prints, building plans and engineers' drawings, are all stored at the Army Institute of Pathology. A guide to this material has been prepared.

Thus there is provided in one central location a complete record of the facts and materials that have been gathered to date, which now exists for purposes of reference, as well as a nucleus for a registry.

7. This investigation could not have been accomplished without the guidance and aid of Brigadier General Guy B. Denit, Chief Surgeon, GHQ, AFPAC, Col. Albert W. Schwichtenberg, M.C., Chief Surgeon, GHQ, AFPAC, Adv., and Capt. J. J. Galloway. (M.C.), USN, Chief Surgeon 2nd Marine Division in Kyushu.

8. When the work of the Commission was transferred to the United States under the Research and Development Board of the Surgeon General's Office, the fullest possible cooperation, advice, and assistance were given by the Director of the Army Institute of Pathology, Col. J. E. Ash and the staff of the Institute, and by Col. Robert E. Lyons, Chief of the Division of Biometrics, Air Surgeon's Office, and his staff.

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APPENDIX 1 (1)

ON BOARD
SS GENERAL STURGIS

28 August 1945

MEMORANDUM:

TO: Brigadier General Guy Denit

SUBJECT: Study of Casualty Producing Effects of Atomic Bombs.

1. A study of the effects of the two atomic bombs used in Japan is of vital importance to our country. This unique opportunity may not again be offered until another world war. Plans for recording all of the available data therefore should receive first priority. A study of the casualty producing effects of these bombs is a function of the Medical Department and this memorandum is prepared as a brief outline for such a study.

2. The need for study at the earliest date possible.

The casualty producing effects of these bombs should be studied at the earliest possible moment for the following reasons:

a. Much of the data must be obtained from the interrogation of the survivors and the sooner this is accomplished the more accurate will be the results.

b. Post-mortem examination of the dead may provide valuable information as to the cause of death. Three weeks or more will have elapsed and opportunity for post-mortem examination will be limited to late deaths among the survivors. It is hoped that some post-mortem examinations may have been done by the Japanese and that these records may be amplified by early interrogation of the Japanese pathologists.

c. Accurate case histories by interrogations of the injured may provide the most reliable data. These should also be correlated with the physical findings and the necessary laboratory examinations.

d Residual radiation effects have been suggested as a possible source of danger and while this appears to be remote, such a possibility should be investigated at the earliest possible date.

3. The scope of the study.

The total number of casualties reported at Hiroshima is approximately 160,000 of whom 8,000 are dead. Even though due allowance is made for inaccuracies in these estimates the scope of the problem is such as to require the organization of teams with interpreters in order to complete an adequate study within a reasonable time limit. These teams should include pathologists and clinicians working under the direction of trained investigators.

4. The data which should be obtained.

It is recognized that any plan for the collection of data should be modified according to the circumstances. The following suggestions are intended to indicate the minimum rather than the maximum data required to properly evaluate the casualty producing effects of these bombs.

a. The location of all casualties living and dead should be determined in relation to the bomb and plotted on a contour map.

b. All living casualties should be identified by number for location on the map and an exact description of the case kept in a cross index file. Standard diagnostic nomenclature should be used. Such a procedure is necessary in order to determine the different casualty producing zones.

c. The position or protection of all casualties should be determined since this may be a determining factor in blast effects and burns. (Standing, sitting, prone, indoors, outdoors, in shelters, trenches or behind walls etc.)

d. Consideration should also be given to such factors as contour, temperature wind and humidity in relation to casualties. It is unlikely that the latter factors will be of much influence but contour may be of considerable importance.

e. Evidence of blast effect should be searched for in both the pathology and in the clinical history. X-ray evidence of lung pathology may be helpful.

f. Burns should be carefully observed as to degree and character, part of the body involved, rate of healing, cause of death, etc.

g. All casualties should be recorded as to whether they were due to primary effects of the bomb or were secondary to burning buildings, flying debris or falling walls etc.

h. Evidence of residual radiation effects. While there is little indication that such injury will be found it should nevertheless receive serious consideration.

i. Complete post-mortem examination should be performed on all injured in whom the cause of death is not clearly established.

j. It is hoped that the Japanese may have already organized an investigation of the casualties but this is unlikely under the circumstances. However much valuable data may be obtained from interrogation of Japanese doctors and pathologists. Also data valuable from a negative standpoint may be obtained from uninjured survivors who were within the danger zone.

5. It should be emphasized that since the effects of atomic bombs are unknown, the data should be collected by investigators who are alert to the possibility of death and injury due to as yet unknown causes.

6. It is recommended:

a. That in view of the importance of the data to be obtained and in view of the magnitude of the problem that a committee be appointed by the Chief Surgeon to survey the possibilities of obtaining data and to direct the collection of the data needed to properly evaluate the casualty producing effect of the atomic bombs.

b. That the various aspects of the investigation of the casualty producing effects of the atomic bomb be correlated through the Office of the Chief Surgeon.

A. W. SUCHERSON
Colonel, Medical Corps

Copy

Appendix 2 (1)

OFFICE OF THE SUPREME COMMANDER
FOR THE ALLIED POWERS

APO 500
12 October 1945

SUBJECT: Atomic Bomb Investigation.

TO : Commanding General, Eighth Army, APO 343.

1. This headquarters has directed that a "Joint Commission for the Investigation of the Effects of the Atomic Bomb in Japan" conduct such investigations as are necessary. The commission is composed of the following three major groups:

a. The Manhattan Project Group under Brigadier General Farrell.

b. The GHQ Group under the Chief Surgeon's Office, represented by Colonel A. W. Oughterson, MC.

c. The Japanese Government Group under the direction of Dr. Tsuzuki of the Imperial University, Tokyo.

2. It is desired that this commission be furnished whatever assistance is necessary and practicable in order to accomplish their mission. Colonel A. W. Oughterson is the plenary representative of the Joint Commission in Japan. Appropriate passes should be issued at his request to enable the parties to enter restricted areas at your command.

FOR THE SUPREME COMMANDER:

H. W. ALLEN
Colonel, A.G.D.
Asst Adjutant General

A similar letter was addressed to the Commanding General, Sixth Army, in Kyoto.

Appendix 3 (1)

Japanese Institutions Which Have Assisted the Joint Atomic Bomb Commission

Imperial University Medical School, Tokyo.

Keio Medical School, Tokyo.

Imperial University Medical School, Kyoto.

Prefectural Medical School, Kyoto.

Imperial University Medical School, Osaka.

Imperial University Medical School, Kyushu.

Yamaguchi Medical School, Ube.

Okayama Medical School, Okayama.

Japanese Army Hospital, Okayama.

Omura Naval Hospital, Omura.

Iwakuni Naval Hospital.

Nagasaki Medical College, Nagasaki.

Nishina Laboratory, Tokyo.

Kumamoto Medical School, Kumamoto.

Japanese Army Medical School and First Tokyo Army Hospital.

Ube Medical School, Ube.

Section 2

PHYSICS

Prepared by R. E. Marschak, Ph.D., Henry L. Barnett, Capt., MC, George V. LeRoy, Lt. Col., MC, and R. Nakajima, MD

It is appropriate to preface a Report on the Medical Effects of the Atomic Bombs with some notes on Physics. It is beyond the scope of the Report to attempt to present either the physical theory or the applied physics which has made the atomic bomb a reality. In this section, three subjects will be discussed:

(A) Definitions of certain physical terms which are used in the Report.

(B) Elementary summary of the physical reactions responsible for the atomic "explosion".

(C) Residual radioactivity.

(1) Summary of the findings.

(2) Naval Medical Research Institute, Report No. 150 A (Secret)

(A) Certain working definitions may prove useful to the reader who is not a professional radiologist, or a physicist.

(1) Ionization: is the process by which electrically neutral atoms or molecules gain or lose an electron. The positively or negatively charged radicle which results is termed an ion. Ions may be formed by chemical means, or by the action of certain types of radiation.

(2) Ionizing radiations: are electro-magnetic radiations, or elementary particles travelling at high speed, which dissipate their energy through the production of ions in whatever medium they traverse. The types of ionizing radiations with which this Report is concerned are X-rays, gamma rays, and neutrons.

(3) The energy, or the power, of electro-magnetic radiations is expressed

In three conventional ways which are ralated by a formula.

(a) In wave length, given in microns, or in Angstrom units.

(b) In kilovolts, required to produce the radiation by an X-ray tube.

(c) In electron volts, (ev) or in appropriate multiples: electron kilovolts (ekv); or million electon volts (mev). The electron volt is a true measurement of energy, used by physicists. One mev X-rays are equal to 1,000,000 volt X-rays.

(4) The energy of elementary particles (neutrons, beta rays) is expressed in electron volts.

(5) X-rays, or roentgen rays are electro-magnetic radiation emitted in quanta from the elements of a target which is bombarded by cathode rays. (Cathode rays are artificially accelerated electrons.) The energy of X-rays may be as little as 30 ekv, or as great as 5 mev.

(6) Gamma-rays are naturally occurring X-rays which are emitted by certain radioactive elements. The energy of gamma rays ranges from 0.2 mev to as much as 5 mev.

(7) Alpha rays are nuclei of helium atoms which are emitted spontaneously by radio-active elements and are obtainable artificially with a cyclotron.

(8) Beta rays are fast electrons emitted from radioactive elements; or they are cathode rays which are artifically accelerated electrons. The energy of beta rays ranges from 0.1 mev to 22 mev or more.

(9) Neutrons are similar to the nuclei of hydrogen atoms, minus the electrical charge. They are emitted by radioactive elements during nuclear fission, and may be produced from various materials in a cyclotron. Neutrons are of two classes: fast and slow. The energy of fast neutrons is

of the order of 3.4 mev. That of slow, or thermal, neutrons is of the order of 200 ev.

(10) The intensity, or dosage of ionizing radiations is measured in "roentgens" in the case of X-rays and gamma rays.

(11) The roentgen is defined as the quantity of X-ray or gamma rays which will produce ions carrying 1 electrostatic unit of quantity of electricity of either sign, in 1 cubic centimeter of air (0.001293 G) at 0°C and 760 mm Hg.

(12) The dosage of neutrons is measured in "n" units, which are arbitrary readings of a commercial dosimeter, the Victoreen. These readings can be converted into "roentgens".

(B) Elementary Summary of the Physical Reactions Responsible for the Atomic Explosion (1)

An atom is known to consist of a small central nucleus around which electrons revolve at relatively large distances. The average distance of an electron from the nucleus is about one hundred thousand tires as large as the diameter of the nucleus, so that most of an atom consists of empty space. In spite of the small size of the nucleus it contains most of the weight of an atom. In addition to size and weight the electrons and the nucleus of an atom have an electric charge. An electron carries the smallest unit of negative charge which has been observed. The nucleus is positively charged, and the number of charge units it carries varies from one element to another. This number determines the number of electrons attracted to the nucleus to produce an electrically neutral atom. All electrons have the same weight and charge,

(1) Prepared in part by R. E. Marshak, Ph.D., University of Rochester, Department of Physics.

and the number and arrangement of electrons of an atom determines the chemical properties of the element. This picture of the atom composed of a nucleus and revolving electrons permits an understanding of nearly all the physical and chemical properties of matter. Such a concept, however, would not permit an explanation of the workings of an atomic bomb which depends essentially on the divisible nature of the atomic nucleus.

Since 1932 it has been known that atomic nuclei are constructed out of two fundamental building blocks, namely protons and neutrons. A proton is the nucleus of a Hydrogen atom and carries one unit of positive electrical charge. This unit is of the same magnitude as the unit of negative charge on the electron. A neutron carries no charge at all, and its weight is nearly the same as a proton. The weight of a neutron is about 2000 times that of an electron. The number of protons in the nucleus of an atom is called the atomic number. The combined number of neutrons and protons in the nucleus is called the mass number (or the atomic weight) of the atom. Most elements exist in several different forms, called isotopes. The nuclei of the different isotopes of an element contain the same number of protons, but a different number of neutrons. The nucleus of a uranium atom, for example, always has 92 protons. Three isotopes of uranium occur naturally, the nuclei of which have 142, 143 or 146 neutrons, respectively. It is uranium of mass number (U 235), with 143 neutrons, which was used in the Hiroshima-type atomic bomb. Physicists have succeeded in manufacturing several elements which do not occur naturally. One of these is Plutonium, whose atomic number is 94. This element is produced from the uranium isotope (U 235). One isotope of Plutonium has a mass number (Plutonium 239) which is the material that was used in the Nagasaki-type atomic bomb. This was the type of bomb employed in the Bikini tests.

Extremely strong forces hold the neutrons and protons together inside an atomic nucleus. The forces are a million times as strong as the electrical forces holding the electrons within the atom. The strength of nuclear forces is exhibited by a comparison of the mass of an atomic nucleus with the total mass of the separate protons and neutrons of which it is composed. The former is roughly 99% of the latter. According to Einstein, mass and energy are equivalent and can be transformed into each other. Moreover, a small amount of mass, if completely transformed into energy, is equivalent to an enormous amount of energy. For example, one ounce of mass is equivalent to the output of the power plant of Boulder Dam for an entire month. Therefore, the observed one per cent difference in mass between the atomic nucleus and its component protons and neutrons indicates the tremendous strength of nuclear forces and reveals the large amount of energy that is stored in the atomic nucleus. Tearing the nucleus apart into its separate protons and neutrons by any ordinary means would not release energy but would require more energy than the amount binding the nucleus together. However, in the atomic bomb, the process of nuclear fission supplies the mechanism for releasing some of the energy within atomic nuclei. This occurs because the difference in mass between a nucleus which can undergo fission and its fragments after fission is one-tenth of one per cent.

Nuclear fission was discovered in 1938 when it was found that U235 when struck by a neutron split into two large fragments, one with an atomic weight of about 100 and the other with an atomic weight of about 135. Other heavy nuclei have since been found to undergo fission too, namely, plutonium, thorium, and others of less practical importance. As the atomic weight decreases, nuclear fission becomes less probable, and it is very unlikely that

elements with atomic weights less than 200 are fissionable. It has been found that elements whose nuclei can undergo fission are naturally radioactive, and are generally alpha-ray emitters.

The most striking fact about nuclear fission is that extra neutrons are given off during each fission process. The extra neutrons make possible the release of atomic energy in practical amounts. Without the extra neutrons, nuclear would be an extremely rare event and no appreciable amounts of energy could be released. With the extra neutrons, the fission of one nucleus will produce enough neutrons to induce fission in other nuclei and the process will proceed-under proper conditions - until a great many nuclei are affected. When this happens, it is said that a chain reaction has taken place.

In order to make a chain reaction go, it is necessary to use a sufficiently large amount of fissionable (or, as it is called, active) material. If a small lump of active material is exposed to neutrons, fission will occur and extra neutrons will be produced. But most of these neutrons will escape from the lump and not enough will stay inside to keep a chain reaction going. If a chain reaction is to be supported, then, on the average, at least one of the neutrons produced by each fission must collide with another nucleus of active material and produce another fission. If it is assumed that two neutrons are produced per fission, then not more than one neutron should be allowed to escape from the lump of active material. For example, if the lump of material is the size of a pea, and if two neutrons are produced per fission, more than one neutron will escape from the lump before it can collide with a nucleus of active material and make it undergo fission. As the size of the lump of active material is increased, a point is finally reached at which just as many

neutrons are produced by fissions as escape through the surface. This volume of material is called a critical mass. Amounts of active material greater than the critical mass will sustain a chain reaction. The rapidity with which a chain reaction develops determines whether or not an explosion will occur. If the system is made only slightly over-critical and operates with slow neutrons, the chain reaction develops slowly. The system can be controlled and the energy set free at a slow, steady rate. This is what happens in an atomic energy pile. If the system is made strongly over-critical, and operates with fast neutrons - neutrons having velocities of thousands of miles per second - the chain reaction develops very rapidly. Energy is released at an explosive rate and the active material quickly reaches a very high temperature. The high temperature makes the active material expand and therefore become more dilute. As the active material becomes more dilute, a larger proportion of the neutrons escapes, and after a while the nuclear reaction stops. During the short time available before expansion stops the chain reaction, the fast neutrons cause a sizable fraction of the nuclei of the active material to undergo fission, thereby producing an explosion of unprecedented violence. This is what happens in an atomic bomb.

The nuclear radiations resulting from these reactions constitute the most important part of the present discussion. The fast neutrons emitted during an atomic bomb explosion enter the atmosphere and some are appreciably slowed down - through "elastic collisions" with the nuclei of oxygen and nitrogen within a radius of several hundred meters of air. The slow neutrons can then be "captured" by the nuclei of various elements in the air and on the ground. When a nucleus captures a neutron its charge stays the same, and its atomic weight is increased by one unit. The isotope thus formed has

too many neutrons for its quota of protons, and tends to discard one of its neutrons. Since it cannot eject a neutron bodily, it accomplishes the same result by transforming the neutron into a proton and an electron, or beta ray. The beta ray leaves the nucleus with considerable energy. The resulting nucleus with its additional unit of positive charge (proton) is still surrounded by the original number of electrons. It therefore quickly attracts an outside electron to join the other orbital electrons so that a neutral (uncharged) atom is formed. In addition to the beta ray, some electromagnetic radiations called gamma rays (a gamma ray is a nuclear X-ray) are given off. The gamma rays carry off excess energy and enable the product nucleus to adjust itself to its new quoto of protons and neutrons. Beta and gamma rays are called atomic radiations and the unstable nuclei which emit them are said to be radioactive. Not all of the radioactive nuclei shed their atomic radiations at the same rate; some nuclei do so more rapidly than others, and it is found that on the average it takes a characteristic length of time for half of the radioactive nuclei to emit their atomic radiations. This length of time is called the half-life for radioactive decay.

More important than the atomic radiations associated with the radioactivity induced by the neutrons emitted by the bomb are the atomic radiations emitted during the atomic bomb explosion itself. Gamma rays are emitted in great numbers during the process of nuclear fission. Moreover, the fragment nuclei resulting from fission, the so-called fission products, have far too many neutrons for their quota of protons and are thus strongly radioactive.

For example, suppose that Uranium 235, after being hit by a neutron, splits into a Xenon nucleus of atomic weight 140 and a Strontium nucleus of atomic weight 96. The Xenon nucleus has 54 units of positive charge and normally contains at most 82 neutrons. Similarly, the Strontium nucleus has 38 units of positive charge

and normally contains almost 50 neutrons. Thus the Xenon and Strontium nuclei would normally accommodate ninety-two protons and 132 neutrons. The Uranium 235 nucleus has ninety-two protons and 143 neutrons. Including the original neutron that caused fission there are, then, 144 neutrons. Therefore the Xenon and Strontium nuclei have a large excess of neutrons which they must dispose of in some fashion. They do this partly by emitting neutrons, but mostly through converting the neutrons into protons through the emission of electrons and gamma rays. At the same time, the Xenon and Strontium nuclei decay into other elements which have smaller neutron-to-proton ratios and are therefore more stable. A great variety of elements of intermediate atomic weight are found among these radioactive fission products, with half-lives varying from seconds to years.

Of the types of ionizing radiations discussed, namely, neutrons, alpha and beta particles, and gamma rays, the latter deserve by far the greatest attention. Neutrons are several times as effective as gamma rays in the production of biological effects, and they undoubtedly contributed to the injury of persons directly exposed within a radius of approximately 1000 meters. The presence of fast neutrons on the ground in Japan was demonstrated by the detection of radio phosphorus in the sulfur of electrical insulators. This is a typical fast neutron effect. The presence of slow neutrons on the ground, and the fact that they entered human bodies was demonstrated by the detection of radioactive phosphorus and calcium in bones collected near the center, and in bones of patients who died. It seems likely, however, that persons exposed to fast and slow neutrons would not have survived the other casualty-producing agents, and would therefore not be included in the group of survivors studied. Beta particles could have come only from the fission products, or from radioactive elements induced by neutrons. It is very unlikely that beta rays played

any role in the production of biological effects because of their very short range even in air, and because there was only an insignificant quantity of fission products or induced radioactivity on the ground beneath the bomb. Alpha particles could have come only from the deposit of unchanged active material, and it is unlikely that they could have been important for the same reasons. It seems correct, therefore, to consider the biological effects observed in the survivors studied as due entirely to gamma rays.

The means by which gamma rays affect biological material is not entirely understood. It is known that when electromagnetic radiations pass through tissue, energy is transferred to the orbital electrons of the atoms of the tissue. The absorption of the gamma ray's energy causes an electron to move through tissue with great energy (and speed). This energy is dissipated by the formation of pairs of ions in the atoms and chemical molecules along the path of the electron. An important feature of this process is the fact that more ionization occurs toward the end of the electron's course. Thus, the more energetic radiations produce their greatest biological effect at some distance beneath the surface of the body; while the less powerful ones have their energy dissipated in the skin and in the tissues immediately subjacent to it. It has been stated that the biological effects observed are in some way the consequence of this production of ions within living cells. Whatever the mechanism leading from this point to the modified behavior of cells, it seems clear that the radiologic action begins with these changes in chemical structures.

(C) The term "residual radioactivity" is applied to certain radiologic phenomena which have been discovered in Hiroshima and Nagasaki after the atomic bombing. Soon after 6 August, several groups of physicists under the general supervision of Prof. Y. Nishina of the Institute of Nuclear Physics, visited Hiroshima. They determined that the ground beneath the point in the air where

the atomic bomb exploded, and for a variable distance in all directions, was radioactive to an extent which could be measured by Neher cosmic ray meters, Lauritsen electroscopes and Geiger-Muller counters. The area of the phenomenon was plotted on maps; and a variety of materials: human bones, soil, sulfur from electrical insulators, metallic objects, etc., were collected and examined. These studies demonstrated that the radioactivity had been induced by the well known reactions of fast and slow neutrons. See Appendix 4H (1), (9), (10) and (11). Further studies revealed a region approximately 3.0 Km to the west of the center in the vicinity of Furue and Takasu villages where radioactivity was detectable. An investigation of this phenomenon demonstrated that it was due to the deposit of radioactive fission products from the cloud which formed after the explosion and travelled to the west with the prevailing wind. The residents of the district reported that a "colored" rainfall occurred shortly after the bomb exploded. (Appendix 4H (1) and 4N (17) for further details.) The findings in Hiroshima were verified by the Manhattan Project Atomic Bomb Investigating Group on 8 - 9 September. The technical report of this group is classified, and has not been examined. In the published summary report (1) it is stated, page 33, ". . calculations showed that the highest dosage which could have been received from persistent radioactivity at Hiroshima was between 6 and 25 roentgens of gamma radiation." It is not stated in the report whether this estimate applied to the radioactivity of the center, or of the Takasu area; but one assumes that the latter is meant. The Japanese made careful studies of the rescue workers who came into the center of the city shortly after the bombing and also of the residents of the

(1) "The Atomic Bombings of Hiroshima and Nagasaki" by Manhattan Engineer District, Washington, 1946.

region where the fission products fell and could find no evidence of injury attributable to residual radioactiv ty in any such person.

After the bombing of Nagasaki other Japanese physicists under the general direction of Professor Shinohara, of Kyushu Imperial University, visited the city and measured the intensity of the introduced radioactivity in the vicinity of the center. The details of the investigation of soil, human bones, and other materials can be found in the original reports, Appendix 4N (17),(18) and (19). When the party of American physicists visited the city after 13 - 14 September the measurements of the induced radioactivity in the center were verified. Monitoring groups made surveys of the countryside and located an area of radioactivity 2.7 Km to the eastward. This was subsequently found to be caused by the deposit in a rainfall of fission products, from the cloud that formed after the explosion. The presence of radioactivity was detectable in Shimabara village and Chijiwa village which were 20 Km and 32 Km, respectively, east of Nagasaki. The most radioactive region was the Nishiyama reservoir district,. 2.7 Km distant. The intensity of the residual radioactivity in this region has been followed carefully not only by the Japanese physicists, but also during the period 25 September to 20 November by physicists with Team 11 of the Naval Technical Mission to Japan. The technical details of the study of the residual radioactivity in this region are included in reports which are classified. (1) In the published summary report referred to above, it is stated that the highest dosage that could have been received in the Nishiyama region was between 30 and 110 roentgens of gamma radiation. It would have been

(1)a. "Measurement of the Residual Radiation Intensity at the Hiroshima and Nagasaki Atomic Bomb Sites", Naval Medical Research Institute - 160 A-16 April 1946 (Secret)

b. The report of Captains R. A. Tybout and B. L. Collins to the Commanding General, Manhattan Engineer District. (Title and Classification not known.)

been necessary for a person to remain in the active area continuously for 6 weeks to receive this amount of radiation.

In Nagasaki the Japanese studied rescue workers who entered the city after the bombing (Appendix 4N (19)) and could find no evidence of radiation injury in any such person. The general problem of investigating the possible effects of residual radioactivity was undertaken by Dr. Nakajima, Professor of Radiology, Kyushu Imperial University. A survey was made of the residents of the Nishiyama district and all the members of the families whose homes were closest to the site of the maximum radioactivity were studied. They were first interviewed to eliminate those who might have been at some other place at the time of the bombing. This was an important consideration, for the Nishiyama district was completely shielded by hills from the direct gamma radiation of the bomb. (See Section 10 N). Suitable subjects were selected and white blood cell counts and differential counts were performed on 1, 15 and 28 October 1945 and again on 1 January and 1 April 1946. It is not known for certain whether red blood cell counts and hemoglobin determinations were made. They have not been listed in any of the reports, nor were they mentioned in response to a request concerning them. Some of the subjects of this study were also examined in mid-November 1945 by the members of the Joint Commission, and blood examinations were made at the Shinkozen Hospital laboratory. The blood counts of this group are summarized in Table 1. The actual data and the results of a statistical analysis of the findings are presented in Appendix 2. Blood films from a number of patients were sent to the Army Institute of Pathology (Accession #1580,0-NISH) by Dr. Nakajima, and a summary of the results of the differential counts made were as shown in Table 2.

TABLE 1

-LUKOCYTE COUNTS. NISHIYAMA DISTRICT

DATE	MEAN	STANDARD DEVIATION
1 October 1945	10,200	3,300
15 October	13,500	6,690
28 October	15,700	6,640
*17 November	7,300	1,690
1 January 1946	15,900	9,530
15 April	18,900	7,080

TABLE 2

DIFFERENTIAL LEUKOCYTE COUNTS. NISHIYAMA DISTRICT

AT PERIODS WHEN SIGNIFICANT NUMBERS WERE AVAILABLE.

	1 Oct.	15 Oct.	17 Nov.*	15 April	Normal**
Polys	44.4	47.7	57.6	50.3	53.0
Lymphs	41.6	32.0	32.7	28.3	38.0
Monos	5.6	5.3	4.7	7.9	5.0
Eos	8.4	14.9	4.7	13.5	3.5
Number	15	27	61	10	28
Mean	7572	17370	7356	21849 ***	-

*These data are from Naval Medical Research Institute Report 160-A

**Misao report, Japanese normal, Appendix 4N (3)

***These means are different from those in Table 1, since they are the means only of the subjects for whom differential counts were made.

It is not possible at this time to offer an adequate explanation of the leukocytosis reported by the Japanese. The blood films display indubitable evidence of an increased number of white cells in many of the preparations, so that the easy explanation of technical error cannot be used. The most striking feature of the slides from Japan is the increased number of eosinophils. In the appendix, the absolute counts are tabulated, and it can be seen that the average absolute number of eosinophils increased steadily. The greatest increase occurred in the month of October, and a comparison of the percentage change in the eosinophil counts of the Nishiyama people with those who were probably exposed to ionizing radiation from the bomb-burst shows that the change was much greater in the case of the former. The other elements of the differential count are increased, but there is no systematic significant change of the same order as that observed with the eosinophils. The morphology of all the white cells appeared normal. Stippled red blood cells were seen in some of the preparations but for technical reasons it is not desirable to attempt to say what per cent were involved. Unfortunately the blood films that were made by the Joint Commission in November are not available for comparison, and for independent counting. There is, however, no reason to question the validity and the good faith of the work of either group.

In the Nakajima report (Appendix 4N - 19)it is stated that all of the residents of the Nishiyama District consider themselves perfectly well; and that they appear to be well. It is worth pointing out that except for the normal values reported in November, the changes in the blood picture might be explained on the basis of hookworm infestation. The time relations, and the absence of specific symptomatology is strikingly similar to the changes observed in recently acquired ancylostomiasis and strongyloidiasis among

American Forces in the Pacific.[1] Since there is no record of stool examinations of any of these subjects, it is fruitless to speculate further on the etiology. The most that can be said is that leukocytosis and eosinophilia has occurred in some of the residents of the Nishiyama district. In this district it was found that fission products of the atomic bomb were deposited in amounts such that a gamma ray dosage of 30 to 110 r could be received by persons continuously in the area for a period of 6 weeks.

(1) "Eosinophilia, Ancylostomiasis and Strongyloidosis in the South Pacific Area", by A. A. Liebow and C. A. Hannum, Yale J. Biol. and Med. 18: 381-403, May, 1946.

Appendix 1 (2)

The data pertaining to the residents of the Nishiyama Reservoir District is sufficiently unusual to justify the presentation of all of it. Table 3 is a reproduction of the data sheets submitted by Prof. Nakajina. Table 4 is a reproduction of the absolute differential counts which were made on the 60 blood smears that were sent to the Army Institute of Pathology by the Japanese. An analysis of the data was performed by Mr. M. Geisler, statistician.

ANALYSIS OF WHITE BLOOD COUNTS IN NISHIYAMA

TAKEN AT INTERVALS FROM OCT. 1, 1945 - APRIL 15, 1946

"In addition to the normal variation in white blood counts which occurs in individuals, there were two principal factors, ascertainable from the available data, which introduced further variation. These two factors were the age of the subjects and the date upon which the counts were made, as measured from the date of the atomic bomb explosion. Table 5 presents the data by age groups and for five dates subsequent to the explosion:

TABLE 5

AVERAGE WHITE BLOOD COUNTS BY AGE GROUP AND SELECTED DATA, AFTER ATOMIC EXPLOSION MADE ON NISHIYAMA SUBJECTS

AGE GROUP	NO. OF SUBJECTS	OCT. 1	OCT. 15	OCT. 28	JAN. 1	APR. 15	MEAN
0- 9	45	11.6	15.9	17.7	15.6	18.9	15.9
10-19	46	13.2	15.0	15.7	16.4	20.9	16.2
20-29	20	9.3	11.1	16.0	17.4	19.1	14.6
30-39	16	9.0	13.3	15.0	15.2	12.8	13.1
40-49	17	9.5	13.8	15.3	17.5	17.7	14.8
50-59	18	7.7	10.6	10.9	13.5	15.8	11.7
60 & Over	14	6.3	10.0	14.1	16.1	21.9	13.7
Mean		10.5	13.7	15.5	16.0	18.7	14.9
Standard Deviation of Mean		±.31	±.50	±.58	±.79	±.59	

The average leukocyte counts, except from that based on the counts of October 1, were abnormally high, as examination of the means and standard deviations of the means show. The standard deviations were computed so as to eliminate, to some extent, the variation in counts with age, by determining the standard deviations about the mean count within each age group, rather than about the General Mean for that date.

These data show an increasing deviation from normal in the mean white blood cell counts with time. This trend is indicated for all age groups but 0-9 and 30-39, so that it appears to be independent of age. The variation in the mean counts found for each of the age groups is significantly less than that found for the different dates. In addition, no significant correlation was found to exist between the age of the subjects and the size of the count.

Comparison of the findings based on our data with those given in Table 5 of NMRI - 160A showed consistent results as Table 6 below indicates:

TABLE 6

COMPARISON OF WHITE BLOOD COUNTS

NAVY AND ARMY DATA

DATE	NAVY		ARMY	
	Mean	Stand. Dev.	Mean	Stand. Dev.
Oct. 1	9.6	3.44	10.2	3.33
Oct. 15	14.8	7.40	13.5	6.69
Oct. 28	16.2	8.43	15.7	6.64
Nov. 17	7.3	1.69	-	-
Jan. 1	-	-	15.9	9.53
Apr. 15	-	-	18.9	7.08

The lower standard deviation in the Army series results from the partial elimination of the variation due to age, in the computation of the variation among the counts of the patients on each date.

The major change in the absolute eosinophil count occurred between 1 and 28 October, when the per cent change was plus 309%. This variation is compared

TABLE 4a

ABSOLUTE DIFFERENTIAL COUNTS - 1 OCTOBER

CASE NO.	POLYS	EOS	LYMPHS	MONOS
I- 2	2560	410	4130	490
I- 4	3460	430	2950	360
I- 9	5130	240	3620	600
I-10	4740	1040	2890	800
I-11	3470	220	2300	560
I-32	3020	960	1560	320
I-33	4120	130	4860	200
I-34	9200	290	5940	680
I-35	1690	210	4670	320
I-36	2840	1090	1130	250
I-37	3230	940	2440	230
I-39	2970	970	250	840
I-50	4200	480	5520	1080
I-52	4010	1380	2130	380
I-107	4040	720	2930	240
MEAN	3912	634	3154	490

with the per cent change during the same period for person with radiation injury, in Table 8.

TABLE 8

Comparison of eosinophil change in Nishiyama subjects, and in patients with radiation injury.

	8th WEEK		12th WEEK		PER CENT ABSOLUTE CHANGE BETWEEN 8th & 12th WEEK
	NUMBER	PER CENT	NUMBER	PER CENT	
Hiroshima*	236	2.3%	390	5.7%	+66%
Nagasaki*	491	6.8%	641	8.7%	+30%
Nishiyama	630	7.8%	2593	13.2%	+309%

*Patients in exposure groups A and B. (See tables 21, 22, Section 6.)

TABLE 4b

ABSOLUTE DIFFERENTIAL COUNTS - 15 OCTOBER

CASE NO.	POLYS	EOS.	LYMPHS	MONOS.
II - 10	4310	1800	2820	860
II - 34	6430	1040	5300	1330
II - 35	3940	200	2880	870
II - 12	8570	1690	4290	2140
II - 13	27120	2430	5790	2130
II - 60	5820	3650	4000	1710
MEAN	9365	1802	4180	1505

TABLE 4c

ABSOLUTE DIFFERENTIAL COUNTS - 28 OCTOBER

CASE NO.	POLYS	EOS.	LYMPHS	MONOS
III - 37	4150	3240	7520	260
III - 12	7370	1980	7530	1720
III - 13	21530	2250	10510	2000
III - 3	14540	7390	5080	230
III - 7	9060	5790	8300	1540
III - 8	9140	4230	9460	1350
III - 17	3610	810	2750	230
III - 19	10530	9930	10330	810
III - 20	8490	5810	7300	1340
III - 51	6220	180	3880	540
III - 58	8400	2320	4780	1160
III - 71	4190	590	5920	590
III - 75	17720	830	4970	1160
III - 83	8360	4960	8630	550
III - 88	11110	2070	8290	1240
III - 91	6200	2920	3700	580
III -106	2680	300	1840	340
III -110	4310	900	1800	580
III -114	6700	310	2340	250
III -120	11500	750	2260	1290
III -122	12570	4390	5600	2340

TABLE 4c-continued

CASE NO.	POLYS	EOS.	LYMPHS	MONOS
III 123	4610	990	2570	260
III 124	3810	760	5170	760
III 126	6560	1190	3690	690
III 148	4690	3200	5330	960
III 156	8490	110	5520	1270
III 202	6970	1820	5310	1030
MEAN	8278	2593	5570	928

TABLE 4d

ABSOLUTE DIFFERENTIAL COUNTS - 1 JANUARY

CASE NO.	POLYS	EOS.	LYMPHS	MONOS
IV - 37	8030	1480	2220	550
IV -132	35150	2450	6720	3060

TABLE 4e

ABSOLUTE DIFFERENTIAL COUNTS - 15 APRIL

CASE NO.	POLYS	EOS.	LYMPHS	MONOS
V 7	4070	3600	4160	280
V 8	9000	3160	12320	1110
V 91	13140	10100	11740	2820
V 110	5320	1050	450	520
V 120	19280	1290	2760	2570
V 122	21600	4320	5830	1940
V 123	6330	540	1970	750
V 121	6420	290	3140	640
V 135	7380	2950	7380	1140
V 203	17300	2260	8090	750
MEAN	10980	2956	6189	1720

TABLE 7

AVERAGE ABSOLUTE DIFFERENTIAL COUNTS

	1 OCT. 1945		28 OCT. 1945		15 APRIL 1946		NORMAL JAPANESE* AVERAGE
	Mean	$S\bar{X}$**	Mean	$S\bar{X}$	Mean	$S\bar{X}$	
Polys	3360	343.6	8278	854.7	10984	2014.8	3710
Lymphs	3155	421.2	5570	499.4	6189	1751.8	2660
Monos	423	68.3	929	109.2	1720	448.7	350
Eosin	634	103.3	2593	288.0	2956	901.8	252
Total WBC	7572	-	17370	-	21849	-	7000
Number of Cases	15		27		10		28

*Misao data, Appendix 4N (3)
**Standard error of Mean.

Section 3H

HIROSHIMA CITY. GENERAL REMARKS*

Prepared by Averill A. Liebow, Lt. Col., MC

The effects of the explosion of the atomic bomb at Hiroshima were determined by the nature of the terrain, the structure of the city, and the distribution and occupations of the population. Consequently, these factors must be reviewed, since this report is as much concerned with casualty rates and protection from injury as it is with detailed clinical observations.

Hiroshima, "Broad Island," is really a congeries of six islands, which lie among the terminal branches of the River Ota. Lapping their southern shores are the waters of a beautiful bay where loom the sharp peaks of many guardian islands.

SITE AND STRUCTURE OF HIROSHIMA

The city is built upon the flat delta-land of the Ota. Only the truncated cone of Hijiyama (height 69 meters) interrupts the table top flatness of the delta and even this elevation is more than a mile from the center of the explosion. Its shielding effect is relatively slight since most of the land in its shadow is occupied by a storage area. On two sides of the delta which has its apex at the north, the hills rise sharply. It is as if a great flat iron had been pressed into the hilly country inland from the sea.

*Some of the statements in Section 3H are based upon the following reports:
1. Governor of Hiroshima Prefecture: Damage Sustained from the Air Attack against Hiroshima on 6 August and Countermeasures Taken. Dated 21 August 1945. (Translation of Japanese Document).
2. United States Strategic Bombing Survey: The Effects of the Atomic Bombings of Hiroshima and Nagasaki.
3. British Mission to Japan: Report of Investigation of the Effects of the Atomic Bombs Dropped on Hiroshima and Nagasaki.

A view of the city from the air (figure 1) shows that it consisted largely of closely packed, fragile, comparatively typically Japanese one, two, or one-and-a-half story wooden lathwork and clay houses. The business section, within which were most of the concrete buildings, was largely along the main street at the southern boundary of the military reservation that occupied much of the center of the city and along the large thoroughfare which runs perpendicularly to this street, directly south from the main entrance of the military area.

Brick buildings generally were few and small for fear of earthquakes. For the same reason the concrete structures were surprisingly massive. The heavy buildings were not arranged in solid rows as in the large cities of Tokyo and Osaka but were scattered among numerous ordinary inflammable dwellings and places of business. This circumstance was not such as would tend to limit the spread of fires. Natural fire-breaks were the branches of the Ota on their way to the sea but the separate islands were large and additional protection against fire seemed necessary. In recognition of this, even before April 1945, the citizenry had organized to construct firebreaks by levelling blocks of homes. These lanes are clearly shown in the air photograph (figure 2).

Hiroshima was not primarily an industrial center. The few large factories were scattered on the fringes of the city. For this reason they sustained little damage. There were a large branch of Toyo Industries, a large Mitsubishi shipbuilding company, a Mitsubishi machine tool factory, and at least two large rayon plants. The great mills of the Japan Steel Company were to the southeast protected by a range of hills. Consistent with the Japanese plan of total war, were the many small factories occupying nature

buildings in which thousands were employed, and the innumberable home workshops. It is estimated by the United States Strategic Bombing Survey that 75 per cent of the industrial output was from the great factories previously named.

Hiroshima's place as a military center overshadowed its industrial importance. Just north of the center of the explosion in a roughly pentagonal area was concentrated the military power of central Japan. From this had come the authority for the conquest of Manchuria and in earlier days for the successful attack upon Port Arthur. The headquarters of the Second Grand Army were located on an artificial island protected by a moat. On this same island was the ornate castle, a relic of the Tokugawas. In the southwestern part of the pentagon, very close to the center of explosion, were the divisional headquarters and barracks, row on row. Other units were disposed as shown in Figure 4. The exact number of military personnel in the central area is difficult to assess as what records had survived the bombing had been destroyed by military order after the surrender. In the city there was an army ration depot, a large clothing storage depot, and behind Mt. Hiji, a large ordnance area. Much of the ammunition was, however, stored in caves in the hills on the roads leading to the naval bases of Kure to the north and Iwakuni to the south. The city had been at one time a major shipping point for army supplies and men but this function had lately atrophied.

Disposition of the Population: Most of the population was concentrated within 2,000 meters (slightly over a mile) of the center. Here, leaving the military area out of consideration, lived roughly 145,000 of the 255,000 inhabitants. The population density was at its greatest here,

about 55 per acre, in contrast with less than half of that density beyond 2,000 meters. This data is presented in detail in Section 10 H. Practically this entire population was at risk on account of the flatness of the terrain that has previously been described.

Activities of the Population: To reconstruct something of the scene we rely on eye-witness accounts and on various official reports that are summarized elsewhere. Much of the detail was obtained from patients during their visits to the hospitals and clinics. The city was just entering upon its bustling morning activities when the bomb was released at approximately 15 minutes after 8 AM of the 6th of August 1945. Labor in the fields and the activities of the military camps had long since begun. Much of the population was in the street. The night workers had just been relieved and were on their way home. The factories and offices in most instances had opened for business or were about to open and the staffs of the City Hall and of other municipal establishments were at their desks. Even in the banks, the waiting rooms were filling but the people, as at the Sanwa, had not as yet been admitted to the floor. The department stores, including the 7-story Fukuya, were just receiving their first customers but these were as yet few.

A considerable proportion, approximately 5%, of the population was organized into patriotic work-parties (Giyutai). Many of these had already taken up their tasks. One group, numbering almost 600, had traveled from the distant village of Otake and were just entering the city over the Koi bridge when the bomb exploded. Some of their fellow-townsmen were lined up in front of their administrative office, near the Temma bridge, awaiting

instructions. The fate of these groups is recorded below.* An important factor is that many, including some 6,000 school children, were engaged in clearing fire-breaks. The lane had been prepared by destroying the flimsy wooden buildings and evacuating the tenants to other places in the city or to nearby villages. The workers were removing debris in these completely exposed areas. It happened that the firebreaks were near the center of the explosion and the people were consequently completely unshielded from its direct effect. The position and extent of the fire-breaks before the bombing are shown in the air view (figure 2). The activities of the school children and the casualties are summarized in several reports that are detailed below. Actually more of the children were engaged in factory and manual labor than in school work.

The warmth of the day was an important factor in determining casualties. Many wore scanty, short-sleeved clothing and shorts rather than long trousers and had shed their coats and shirts at labor, or at home. They were thus deprived of the protection against burns that clothing afforded over a considerable range of distance. On the other hand, the loose, baggy, bloomer-like "mompe" trousers ("Japanese women's national utility garment") gave partial protection to many who otherwise would have been bare-legged. Most people wore wooden "clogs" or straw sandals, often without socks. The protective effect of clothing is discussed in a separate section of this report.

Surprise Nature of the Attack: Important was the element of surprise. The population was tense in expectation of a large-scale raid since the only previous air raids by American planes had occurred after the middle of March

*Section 10H

and on the 30th of April, 1945. These had inflicted practically no damage. We learn from the report of the Governor of the Hiroshima Prefecture that the bomb exploded some 45 minutes after the "all-clear" had scunded. It is stated in this report that four B-29 bombers, which had withdeawn to the northwest of Hiroshima shortly after 0700, suddenly returned and released several objects by parachute. The tendency of the people was to continue at work after it was determined that a raid in force was not to be immediately expected. This caught a large part of the population unsheltered at their work and in the street who otherwise would have taken refuge. The public air-raid shelters which were sufficient to accommodate one-third of the population were almost empty, as were the home shelters that some had built by excavation beneath their own houses.

The Moment of the Explosion:

The poignant accounts of the soul shaking experiences of eye-witnesses have been appended to this report (Appendix 1 (3H)). The following is a recapitulation of some of the salient statements of these observers, together with what information we have been able to gather from certain official reports. The first impression of survivors was that of a tremendous all-permeating glare that filled the sky. Some describe it as a prolonged lightning or arc-like flash. To others it seemed as if a great photographic magnesium flare had suddently gone off. This impression of intense light was perceived even though it was a clear, bright summer day. One observer at Eba (3.5 Km) described perceiving an after-image of a series of red rings.

Accompanying the light was an instantaneous wave of heat perceptible even as far away as Ninoshima, 8 kilometers across the harbor. Thousands in the open, within a radius of 4 kilometers, were burned, more or less

severely depending on distance and clothing.

After an interval that was obvious to those at a distance came a violent shock-wave that flattened the fragile wooden houses, and which hurled some people several feet from where they were standing. Viewed from the hills, the houses fell in succession as though a gigantic cyclone were passing across the city. Those closest by heard almost no sound except for that of the falling buildings and masonry. At a distance was heard a rumbling roar like that of thunder. The first thing many knew was that their houses had collapsed. Throughout the city almost everyone, including the priests in the monastery at Nagatsuka 4.2 Km away, received the first impression that a bomb had fallen in his immediate vicinity.

Thousands were injured, killed, or trapped, among the fallen timbers, tiles and masonry. Many lost consciousness for a few seconds or minutes even though there was no trauma to the head. Almost total darkness added to the confusion, for a tremendous umbrella of cloud had blotted out the sun and great masses of dust were soon swirled about by high winds (figure 5). The darkness lasted some 20 minutes as shown by a continuous record at the observatory (figure 6).

In reviewing the detailed account of the blast (see Yasuda School Study in Section 10H, Appendix 2) the interesting fact became apparent that many of the wooden buildings collapsed rather slowly and sometimes toward the blast.

Several of the eye-witnesses recount how they made attempts to free themselves and their families form the debris. Such efforts were soon hampered or completely stopped by fire. Some of these arose at once from ignition of inflammable materials such as paper and tarred poles. Much of the fire re-

sulted from upsetting the open charcoal stoves that are standard household equipment throughout Japan. Many of these were alight, for the breakfast hour had not as yet passed. Thus, the fires had numerous points of origin. The gentle southerly breeze that had played upon the city before the blast had as a result of the gathering conflagration risen to a wind which increasingly fanned the flames. The fire soon swept the entire city and doomed many who, though alive and only slightly injured, were caught under the debris.

Before discussing the immediate and late effects upon the population, a rapid orientating view of the city after the bombing may be helpful in understanding the nature and extent of the casualties.

Effect Upon the City: Some inkling of the effects upon the city is obtained from air views before and after the bombing (figures 2,3 and 7), by comparing photographs taken from approximately the same position (figures 8 to 17) and by a panoramic view (figure 18). The most striking feature is the total destruction of the wooden buildings within the inner 2.4 kilometers. Against the level background the concrete structures stand out starkly (figure 8). After the blast and fire, there were only 50 buildings standing in the central area, all of which were of reinforced concrete. An estimate of the building damage is obtained from the Prefectural Report of 21 August. Of some 90,000 buildings standing before the bombing, the following suffered partial or complete destruction:

Completely burned - - - -	55,000
Partially burned - - - -	2,290
Totally destroyed by blast alone -	6,820
Partially destroyed by blast - -	3,750
Total - - - - -	67, 860

The shock wave, if at all similar to that resulting from the detonation of high explosives, travelled at approximately 2 miles per second for a relatively short distance. The speed of the wave then reached that of sound (1100 feet per second). The pressure probably rose to a sharp peak for a brief interval, following which it fell below atmospheric for a period of perhaps three times that of the positive phase. It is probable that the positive phase was probably longer than is the case with high explosives. It was more effective in producing destruction than the negative phase. Evidence of the downward pressure is in the stripping of branches from trees which remained upright near the center of the explosion, but which were felled by the lateral pressure beyond 500-750 meters. There is also "dishing" of the roof slabs of concrete buildings. The building suffered in some cases, a mass distortion, away from the blast (fig. 19). Evidences of the effect of the negative phase were visible in the direction in which some metal window frames were bent in concrete buildings. Some wooden buildings fell toward the blast but this may indicate fracture of the primary structural members rather than a suction effect. Reflection phenomena were observed as demonstrated by the fact that the distal parapet of a roof was often broken, in contrast with the parapet closer to the explosion, apparently the result of direct action on the far side, supplemented by the rebound from the roof slabs.

The zone of complete destruction of the wooden structures was encompassed within a rough circle with an average radius of 2.4 kilometers about the center. Fire had completed the destruction in the inner four-fifths of this area. Consequently, a more accurate idea of the scene immediately after the bombing is obtained by an inspection of portions of the city that

were destroyed by fire (figure 20).

Structural damage to the wooden buildings such as distortion of the frame or fracture of a structural member appears within 2600 meters. Beyond that there was a huge and irregular zone of "superficial damage," characterized by displacement of tile, partial breaks in the walls of buildings and the breaking of windows and their frames.

In the case of the Japanese buildings, possibilities of severe trauma lay in the great tree-beams (figures 20,21,22) which ran longitudinally, and supported the arch-like tie beams. These in turn held up a lattice of struts that braced the heavy roof. Curved overlapping tiles (pantiles) embedded in clay, made the roof. These tiles were heavy and were the cause of many injuries. The walls, approximately 3" thick, were supported by 4" or 6" posts and usually consisted of clay supported upon a bamboo network. The dust raised by their collapse billowed up over the city soon to be mingled with the smoke of fires. The sliding partitions (shoji) which are so important a part of the Japanese house, consisted of a frame supporting numerous either small, thin oblong glass panels or paper. The glass in itself was a danger since it often splintered into long, spear-shaped penetrating fragments. Splintered wood sometimes acted in a similar fashion.

On closer inspection, concrete buildings that seemed so well-preserved from a distance are seen to have suffered greatly. Many, despite their fire-proof construction, are charred exhibits, proving the fallacy of filling a fire-proof structure with highly inflammable woodwork. The City Hall (1100 meters) is an example (figure 13). The concrete buildings in the first 1000 meters were safer than the wooden structures (fig. 11 (10H)) as

far as ultimate survival is concerned, but the traumatic casualties were very great. Only within the first 500 meters did the reinforced concrete structures suffer actual partial collapse (see Hiroshima Gas Company, fig. 23). The chief factors concerned in inflicting trauma were the relatively flimsy construction of the partitions in the buildings and the loose trim of the ceilings and walls. The effect of the blast on one such partition is demonstrated in the Nippon Bank (450 meters) where the concrete and plaster were fragmented as the light frame was crushed toward the far wall. Flying glass was particularly dangerous in the concrete building. The windows here were large and numerous in contrast with those in the ordinary Japanese house. Glass was shattered as far away as Kure (11 miles). Closer to the bomb, it sprang from the large metal window frames and was hurled at bullet speed and accounted for many casualties (figure 24). Brick buildings with weight bearing walls which were close to the center of the explosion, collapsed in large lethal fragments. The Shima Hospital which was within 50 meters of the point above which the bomb exploded, is an example. There were no survivors in this building for reasons which are obvious when a photograph is examined (figure 25).

shelters: In Hiroshima, the city had provided sufficient shelters to accommodate approximately one-third of the population. Along the river banks below the "T" Bridge and in the military headquarters near it, they were of reinforced concrete or consisted of excavations supported by beams and roofed in wood and earth (figure 26). These withstood the blast even at 500 meters. Many of the unsupported excavated shelters, however, within the first kilometer suffered collapse.

EFFECT ON SPECIAL FACILITIES OF THE CITY

Water Supply: The concrete and earth-covered reservoir situated at Ushida, some three kilometers from the center, was undamaged. The large mains were damaged only in a few instances where they crossed bridges that had suffered severe damage. There were, however, some 70,000 breaks in the water lines feeding the individual buildings. This together with the damage to the main supply for many days resulted in a great reduction of water pressure. Water could be seen bubbling up from the sidewalks even three months after the explosion, but this was not from damage to the large underground mains.

Wells were also numerous throughout the city and there was no lack of water.

Electric Power: There was almost no interruption in available power, although of course, the distribution largely ceased. By 15 August, however, it was possible to supply electric power line from the central district to Ujina at the tip of the largest of the finger-like islands.

Transportation: During the first few days after the bombing, transportation was largely by the remaining trucks and ambulances from the outskirts. The railroad was repaired by some 1,500 mobilized military workers and by 8 August was open to traffic. The tram lines have already been mentioned.

Effect on Administrative and Other Defense Personnel and Facilities: Among the important administrative personnel who were killed were the mayor, the Inspector General of the Chugoku District and the Military Commander of the city. Only 25% of the 300 workers in the Prefectural Office (900 meters, figure 17) remained alive and well after the bombing. In the City Hall less than 10% of the 216 employees in the building were killed, but almost

every person suffered lacerations or other mechanical injuries.

Even had the entire defense organization remained intact, their efforts to stem the multicentric fires or to rescue the injured and trapped from the flames would have been in vain. As it was, almost the entire Civilian Defense Corps was wiped out. At the municipal police department there was a total of 120 casualties with 37 fatalities. In the Fire Department, the casualties numbered 250, including 39 dead and 64 missing, presumed dead.

Medical Personnel and Facilities: It is stated in the Prefectural Report that only 28 of 298 physicians in the city were uninjured, but 59 were able to take part in ministering to the sick. Likewise, all but 126 of the 1760 nurses in the city were casualties, but many of these bound up their wounds and gave their services.

Three of forty-five hospitals in the city remained standing after the explosion. Most of these had been small private establishments, caring for some 10-50 patients. The two largest and most modern institutions were the Red Cross Hospital and the Communications Dept. ("Post Office") Hospital. Both of these were reinforced concrete structures, but were severely damaged by the blast. Essentially, these remained only as convenient treatment stations and shelters for the most severly injured and cannot be regarded as truly functional hospitals. Partitions, windows and ceilings had been carried away by the blast. The sterilizing, distilling, and other essential equipment had been largely rendered useless (figure 27). In the Red Cross Hospital there were 90% casualties mostly due to flying glass and debris.

85% of the medical supplies had, with forethought, been dispersed to adjacent villages such as Matsukaichi and as far away as Saijyo. Even these

stores were totally insufficient to meet the tremendous demands created by casualties on so vast a scale.

THE MEDICAL PROBLEM

Dead and Injured: The death toll of the first day will never be accurately known. Perhaps it was between 40,000-50,000. This figure represents two-thirds of those dead by the middle of December, who numbered some 64,000 and is, from all that can be learned, a reasonable estimate. Many died of burns and trauma. Some died of an effect of the bomb that was not immediately apparent--that of the ionizing radiations whose actions will be discussed at length.

The number of injured as of the middle of December, 1945, was 72,000. If to those is added the difference between 64,000 and 45,000 (representing those who died after the first day) a total of 91,000 injured is the immediate problem of medical care that confronted the survivors. Of the total population of some 255,000, the uninjured, or those whose injuries were negligible, numbered 119,000.

The methods of arriving at these estimates will be presented in detail in Section 10H.

Types of Casualties: No completely accurate classification of the types of injuries as of the first day is available. The following is a summary of the records of various aid stations and provides a crude estimate.

1. From the Report of the Japanese Army Medical College and First Tokyo Military Hospital: (See Section 4H, Appendix 1)

Burns only	146	50.2%
Burns and injuries	48	16.5
Injury only	97	33.3
Total	291	100.

2. From Japanese Navy Report of Biologic Action of Atomic Bomb, No. 2, November, 1945:

Kure Relief Party A	1845 Patients
Burns	90.0%
Severe	14.0
Moderate	26.6
Slight	59.4
Lacerations	10.0
Kure Relief Party B	95 Patients
Burns	65.0%
Lacerations	35.0%

3. In the report of the Army Medical College it was also stated that at the Hiroshima Shipping Department Aid Stations the incidence of burns was 70-80%.

4. The official Japanese Army Medical Committee* in Hiroshima on 11 August found that the incidence of burns to be 95% of the hospitalized patients.

*Full Translation of Reports of Effect of Atomic Bomb at Hiroshima, Part I. Report of Army (Japanese) Medical Committee (30 members) on cause of casualties, types of damage, study of relief measures undertaken and proposals for future action, dated 13 August 1945. Translation by G-2, GHQ, AFPAC Advisory Committee.

5. The Medical Section of the United States Strategic Bombing Survey obtained the following estimate of the causes of death from the Hiroshima Prefectural Health Department:

Burns (all)	60.0%
Falling Debris	30.0
Other Causes	10.0
Total	100.

These figures must be treated with reserve.

Rescue and First Aid Activities: Hospitalization. Whatever attempts were made at immediate rescue were necessarily hurried by the onrushing flames. The immediate problem was to seek safety in flight to the river banks or beyond the confines of the city. The Asano Park (figure 28) was one such place of refuge, but was itself partly swept by fire. To this place among others, there were carried or wheeled on the many carts that were available, hundreds of the injured and dying. There is a graphic description in Father Siemes' account of the rescue of his Father Superior from this park. The river served as a highway of escape and some of the townsmen had mobilized their boats and carried many upstream to safety. Food was also ferried to those stranded. From Father Sienes' vantage point at the Novitiate in the hills of Nagatsuka, high above the river, he could see a stream of refugees pouring up the valley within one-half hour of the bombing. First aid was given them by the brothers of the monastery and the farmers of the neighborhood took many hundreds of the injured into their homes. Later on that day and on the next, Father Siemes made several trips to the city. His impression was that there was no organized first aid for some 30 hours after the explosion. Such aid as was possible was administered

purely on individual initiative and without a central plan. The administrative authorities and much of the personnel had ceased to exist with the city itself and help from without was required.

The first step in reorganization was to establish administrative authority. This was vested in the Commander of the 2nd General Army, but was then divided among the Governor of the Prefecture, the Acting Major, and the Military Commander of the city. The help of adjacent communities was enlisted but little was forthcoming on the first day. The police stations in the adjacent towns of Kabe and Kaitaichi were contacted and by 7 August, some 2,159 civilian defense workers and 190 police were dispatched into the city. Their function was to aid in the care and evacuation of the injured who were still on the river banks, to guide the hundreds that streamed back to the city in search of relatives or to assess the damage to their property, to prevent looting, and to dispose of the dead. The military carried on a large part of this work. In the two weeks following the bombing, the Civilian Defense Corps furnished more then 16,500 man days and the police some 1,043 man days of duty.

The first relief station from outside was set up at Tamon in the Hijiyama district on 6 August and came from Toyoda. By the next day 33 stations were in operation. Five had come from as far away as Okayama. The total number of physicians at work on 7 August was approximately 150. Some idea of the chaotic conditions during the first few days may be gathered from views taken shortly after the bombing (figure 29).

Aid was given also by personnel of the Armed Forces. From the naval base at nearby Kure were dispatched 2 relief parties which between the 6th and 9th of August treated a total of 1,940 patients. The naval hospital

at Iwakuni also received by ambulance 51 patients, many of whom had been at the "Banker's Club" in Hiroshima where the administrative offices of the Navy were situated. After 1 September, small numbers also were treated at the Naval Hospital in Kure. The army also assumed responsibility for the care of civilian as well as military casualties. The two large army hospitals which were in the military reservation near the center of the explosion lost most of their personnel and patients, and all of their buildings (figure 296). Two military hospitals, however, were established in other sites. Ten medical officers and two enlisted men were sent from the Kokura Army Hospital to become the Hiroshima #1 Army Hospital at Tozaka. The 2nd Provisional Fukuoka Army Hospital became the Hiroshima #2 Army Hospital. These served as a nucleus to which other military physicians were added. Some of the earliest autopsies, beginning with 9 August, were performed by members of the Tokyo 1st Military Hospital. In addition, accessory aid stations were put into operation at Ninoshima, 8 kilometers out in the harbor (figure 30), to which many patients were brought by boat, and at Eba, Niho, Itsukaichi and other places on the fringes of the city.

The Hiroshima #1 Hospital began functioning immediately at Tozaka. by 13 August more than 3500 patients had received treatment. The mortality was as follows:

3rd day	-	-	110
4th day	-	-	37
5th day	-	-	71
6th day	-	-	73
Total	-	-	291 (8.3%)

The hospital at Ujina, where the Joint Commission was to assume its work, was opened on 25 August by a group including members of the First Tokyo Military Hospital. It received some 500 patients. In all the military had given first aid or provided hospitalization to some 15,000 patients during the first two weeks. Most of these were gradually transferred to civilian establishments. At the same time, the Army transferred many of its own military patients to its hospitals at Fukuyama, Okayama and Himeji. A report concerning 712 of these patients was compiled by the personnel of the First Tokyo Military Hospital and will be discussed in detail, as it represents some of the best work that was accomplished.

The civilian hospitals in Hiroshima itself had suffered great damage as previously described. The pressure wave had passed through the fine modern building of the Communications Department Hospital, breaking all windows and damaging equipment (figures 34 to 36). Some of the partitions also were broken. The operating room was left practically out of doors (figure 35). According to the Director, Dr. Hachiya, there were 40 people in the building, of whom 35 were injured. Most of the doctors and nurses, however, were able to take up their duties by 9 AM. Fifty patients had appeared for treatment and by the end of the first day, 400 had been given immediate care. Approximately 1,000 were handled by this small institution during the days of the emergency. There was an overflow of patients into the adjacent office building of the Communications Department. Careful records were kept of approximately 150 patients and autopsies were performed by Prof. Tamagawa of Okayama University in a makeshift autopsy room (figures 37, 38), beginning on the 29th of August. An outpatient clinic was established and was maintained until about 15 November. Some

of the work of the Joint Commission was performed in this clinic, beginning in the second week of October.

The Red Cross Hospital, despite severe damage to its fine building and personnel (figures 39-42), accommodated a total of approximately 1,000 patients. Outpatient clinics were conducted in this hospital. Some 600 patients died, but no autopsies were performed.

Accessory Aid Stations: Certain buildings that had resisted the blast or the partly damaged school buildings on the outskirts of the city and in adjacent communities were likewise taken over for the care of the injured. The Osiba Aid Station is one example (figures 43-46). There are no available records of the numbers of cases treated in these temporary establishments. They were merely allowed to take shelter and to receive whatever care could be brought to them. A large part of this was administered by the families of the patients (figure 45). One of the most active aid stations was in the city itself at the Fukuromachi School (figures 47, 48). This station had ceased to function by the middle of October. A clinic in progress is illustrated (figure 48). The Prefectural Hospital at Kusatsu was active until November, 1945. Autopsies were performed by Professor Araki of the Kyoto Prefectural University (figures 49,50).

By official and unofficial arramgement more or less distant communities, in time, took under their care large numbers of the injured and homeless. Following is an estimate of the numbers of evacuees and the places of refuge, as detailed in the Prefectural Report:

NAME OF STATION	NUMBER TAKEN IN
Kabe	1,000
Hatsukaichi	1,000
Otake	1,000
Kaitaichi	500
Hiro	500
Tadanoumi	1,000
Takehari	1,000
Saijyo	1,000
Kochi	500
Yoshida	500
Miyoshi	1,000
Shobara	1,000
Total	10,000

This list is incomplete, as at the time the Commission arrived, there were also many patients in other communities such as Miyazima, Jigozen, and Gion. Not all of these patients were hospitalized. Of those at Saijyo only 300 came under surveillance in the sanatorium and its outpatient clinics. These are described in a detailed report by Dr. Fujii and his staff. Some civilian patients found their way to distant cities such as Osaka, Okayama, Kobe and Tokyo where they were treated in the University Hospitals and at the private hospitals which are so numerous throughout Japan. Records were collected from these by the Joint Commission after the work at Hiroshima itself was completed.

Summary: The treatment of some 30,000 cases is accounted for by these various groups, but this is a partial list.

Nature of the Medical Care Administered: The list of personnel and institutions presented in the preceding paragraphs may give the impression that it was possible to give even a modicum of care to more than a very few. This was not the case. The number of patients was overwhelming and every inch of available space was soon occupied. Some idea of the state of af-

fairs during the first week may be obtained by a glance at the conditions at the 2nd Military Hospital near the central district of Hiroshima. (figures 51 and 52). Here is shown as no words can describe, the terrible crowding of the patients, the confusion and the obvious lack of care. During the first few days, flies were almost absent from the city, presumably on account of the flash of heat from the bomb and the subsequent fires. They returned in vast numbers before the middle of August. Medical supplies that had been re-assembled and brought into the city after their precautionary dispersal, proved to be totally inadequate, for no such need as existed had been envisioned.

According to the Japanese Medical Committee reporting on the conditions, as of 11 August, the burns had received no more than "ointments" and salt water compresses for treatment. Even dressings were scarce. It was recommended that dirty surfaces be cleansed with Ringer's solution and treated with cresol. General treatment consisted of administering water, oxygen*, "heart stimulants", and Ringer's solution and salt water subcutaneously. These last two were given only in the smallest quantities. Sulfonamides were available in very small amount and consisted of sufanilamide and sulfapyridine. These substances came only under the proprietary names that are plague of Japanese therapeutics, and were given by rote according to the labels, with no knowledge of the content of the active material. Often the dosage was homeopathic. A little penicillin of low potency and high tocicity was sparingly used. In the second report dated 1 September 1945, another Japanese Medical Committee recommended for treatment (chiefly of the radiation casualties):

1. Autotransfusions of 20-30 cc
2. Calcium preparations to "promote hemostasis".
3. "Blood building preparations" such as liver extract and vitamins such as E, C, and D. (the vitamin preparations also were given in token dosage and their potency was supported only by the reputation of the manufacturer.).
4. The physician was instructed also to administer 500 cc of 5% glucose subcutaneously. (The dehydrating effects of this procedure are now well known).

5-6. Other instructions were to keep the patient warm and to administer analgesics.

This represents the recommendation of the highest Japanese authorities. A great deal of "moxa" therapy also was carried out, even in some reputable institutions. This consists of burning an incense-like material on the skin in the hope of producing a general "stimulating" effect.

It is interesting to speculate on how many fewer would have died had it been possible to give the patients medical care under sanitary conditions, in modern hospitals abundantly staffed and supplied. Certainly the following therapeutic measures would have saved many:

1. Fluids, plasma, transfusion of whole blood in adequate quantities.
2. Penicillin and other chemotherapeutic agents.
3. Debridement of wounds.
4. Cleanliness and nursing care.

* There is considerable theory involved in this schedule of therapy, which obviously could have been employed only in the rarest instances.

OTHER PROBLEMS RESULTING FROM THE BOMBING

1. Information:

As soon as the fires had begun to cool there was a tremendous reflux of the distraught citizens seeking for membbrs of their family - and family ties are strong in Japan. It was necessary to set up road-blocks. Attempts were made on the part of aid stations to issue bulletins as soon as conditions allowed but this was not for several days. Some records of these survive (figure 54). Large numbers of postcards were distributed to aid stations by the Prefectural Goverment. Thene were largely useless since the city had been leveled and no one knew where his family or neighbors had gone. Throughout the city signs were left on wooden boards and walls in an effort to re-establish contact (figures 55 and 56).

2. Disposal of Dead:

In the warm days of late summer putrefaction of the human and animal dead became a problem. Disposal of the dead was, according to Japanese custom, by cremation. This was performed on the spot or, as has been described by Father Siemes, in great funeral pyres at the margins of the city. An attempt was made to issue death certificates but thousands of bodies could not be identified. Thousands of others were buried in the wreckage and had not been recovered as late as December, 1945. Collection and cremation were performed by military and police organizations. By the end of 2 weeks, the Prefectural Report presents the figures as follows:

DISPOSAL OF BODIES

By Police Organizations	17,865
By Military Organizations	12,054
Total	29,919

3. Epidemics:

In association with the damage to the water lines and the failure of bacteriological controls, increased use of wells on the delta land of the city, the new swarming of flies after the third day, and the appalling crowding and lack of sanitary facilities, it is most remarkable that no great decimating epidemics occurred during the first three months.

The cases of epidemic (almost entirely intestinal) disease during the first two weeks are stated in the Prefectural Report to have numbered 418. Details are available only for the Eba Military Branch Hospital as follows:

Typhoid	75
Dysentery	110
Total	185

There were also 3 cases of influenza in that group. These figures are unreliable since bacteriological diagnosis was obtained only in rare instances and then almost entirely by military hospitals, such as the Eba, who sent the material to the Quarantine Station Laboratory at Ninoshima. Some of the "dysentery" may have been the direct or indirect result of gamma radiation as described in the clinical and pathologic sections of this report.

4. Food:

Food was supplied from emergency stocks under the care of the police of adjacent communities such as Kabe. By 12 August, among other staples of the diet, some 130,000 meals of rice had been imported. On the first and second days food was brought by boat to those still stranded on the shores. Normal rationing was resumed after 12 August. According to the report of the Medical Section of USSBS, the Japanese diet for city dwellers was even more meager than appeared on paper, for there was not a sufficiency of the

prescribed fish that were supposed to furnish much of the protein. The country people, however, were well-nourished, probably as a result of abstracting more than their share of food. Some of the local food supply also suffered damage from the heat of the explosion, but beyond 4 kilometers fat [illegible] were ready for harvesting early in November.

5. Shelter:

More than 100,000 homeless found temporary shelter with friends or relatives in the outskirts of town in distant communities. Soon makeshift dwellings began to spring up. Many of these were on the sites of former homes or shops. The central section of the city remained almost deserted, an impression of the fate of the former inhabitants. With the threat of occupation of the Nagasaki area early in October there was a renewed exodus so that when the Commission arrived the city was empty. When the news spread that there was no molestation by the Americans, the population returned in increasing numbers. In November, some 170,000 citizens were registered for the rice rations.

6. Summary:

The atomic bomb caught the population completely unsheltered (the all-clear had sounded) and unprepared for devastation of such magnitude. These factors, together with the flimsy and inflammable nature of the city, probably gave the bomb its maximum effect. With the simultaneous destruction of the large urban area, the defense organization was wiped out. Even had it been intact, it could not have coped with the immediate or could it have conducted rescue operations. Medical care was hopelessly inadequate in scope, and deficient in most materials and supplies.

Appendix 1 (34)

EYEWITNESS REPORTS OF THE ATOMIC BOMB EXPLOSION AT HIROSHIMA
6 August 1945

Collected and Edited by [illegible] Lasor, Col., MC

The following accounts of the effects of the explosion of the atomic bomb at Hiroshima 6 August 1945, were obtained from a number of individuals who were in Hiroshima or its environs at the time of the bombing. These documents vary in degree of credibility but are reproduced practically in their entirety. They were translated from Japanese to English by a Canadian-born lad with the help of a Japanese physician and, so far as possible, are literal translations. Every effort was made to convey the exact meaning of the author but this was oftentimes difficult owing to the vagaries of the Japanese written language and, at times, to the impossibility of deciphering the Chinese characters. For the most part these documents are published here without editorial comment, although in a few instances some explanatory remarks will be offered.

MY EXPERIENCE OF THE "ATOMIC BOMB DISEASE"

By Yoshinobu Monden, student of
The Yamaguchi Medical School, Ube

On the morning of 7 August 1945, I received information of the disaster of Hiroshima by the atomic bomb. How astonished I was, because there dwelt my family (my sister, brother-in-law)! And on 8th August about 8 o'clock in the evening I returned to Hiroshima from Ube City.

Thousands of deep emotions crowded on my mind at the sight of the devastated city, because I had spent my middle school days there.

I put up for the night at my friend's home in Fuchu-Cho, 4 kilometers away from Hiroshima. On the next day (9th August), at 8 o'clock in the morning, I started from there and went to Yagi-Mura, 16 km. away from Hiroshima, and settled in the village as my base of operation. At once I started for Hiroshima to seek my families, but in vain. I wandered half day long through the devastated city filled with so many cadavers when some one told me that the possible place where I could find my families might be Gion, 4 km. away from Hiroshima. I went there by a truck just passing by, but also in vain. I was there greatly disappointed, when fortunately, I encountered an acquaintance, who told me where to find my families. I felt just like I had found "a friend in need", and with fresh courage I started again for Hiroshima, and wnet to the dyke (bank path) at Ushida water supply center in the outskirts of Hiroshima. How could I express my deep emotions, when I had found my families there, lying in a poor humble cabin, moaning! How changed the world was! Already three sisters-in-law dead, and my grandmother moaning with burns!

On that day, I buried my sister-in-law and gave my best treatment to my grandmother, and slept there during the night.

I promised my families to go back to my old home and return there with provisions, clothing, etc., and on 10th August, I went first to Yagi-mura and then to Kumura-Station, 16 km. from Hiroshima, to catch a train. Since I went along the road on foot, I was very tired when I arrived there at 1 o'clock, p.m. There I met a military doctor (Lieut.) who spoke to me: "Are you not a student of the Yamaguchi Medical School? I find great difficulty to get members of the relief station. If you study medicine, it's a good chance to perform your duty as a future doctor. Will you please assist us to rescue the people in such calamities?"

I refused once, remembering my promise to my families, but on reflection of my present situation as a medical student and of the call of duty, I made up my mind to accept his proposal. Thus I went back again to Hiroshima - without knowing, it may be the cause of that cursed disease from which I could only recover by fortune.

It was 2 o'clock, 10th August, when I arrived at the "Honkawa first-aid station", settled up in the debris of the bank "S", after passing through the bad road and commanding a panoramic view of the burnt down

city of Hiroshima. There I was under the command of Major Dr. Sawaki.

Eleven members of the "Rescue-Station", and so many patients waiting! I was so busy, working all day long, gave treatment, afterwards sending the patients to Kabe-cho after treatment.

Only glycerine, oil of olive, tincture of iodine, gauze: that was all we had. No materials for dressing the wounds! Poor people! I slept there in a corner of the rescue station, in three sheets of blanket, and it was so cold that night!

On 10th August, got up in the morning at half past six. Already so many patients waiting for treatment. I felt almost too faint with the intolerable offensive smell of the patient and intense heat, together with extreme busyness of my work. Ordered to accompany Major Sawaki who was going to Iwakuni Military Hospital to get the apparatus for blood examinations and on the motor-car I felt rescued. Came back after an hour and examined the leucocytic count of patients. And I was greatly astonished to find that the leucocytic count, of the patients with burns showed 4,000-5,000, while those with no burns at all showed remarkable reduction of the leucocytic count, e.g. 300 -600. Lieut. Dr. Oki reported that the dead people amounted to 80 today. Slept at eleven o'clock p.m., dog-tired.

11th August. Got up at six o'clock. Always many patients waiting. Doctors without medicine are just like a motor-car without gasoline. How helpless they are! How awkward our situation was, with even not an ampoule of champhor for the dying patient. We treated nearly 500 patients in the morning, and 20 per cent of them dying in an hour! How cruel it was! In the afternoon I went to the relief station at Sentei, near Hakushima, with Lieut. Oki. Was greatly relieved to meet an acquaintance there to give information to my family.

So many patients, intense heat and offensive smell, cadavers, wandering soldiers with burns. "Horrible" is the only word that describes the scene.

There I met a soldier who was fortunate enough to be free from the disaster. He was there to clear up the debris and to take the burned bones of his friends out of the soil. He was hoeing up the soil, taking burned debris out of the way, when suddenly he felt dizzy and fell down. I treated him as "sunburns" and gave him alcohol, cooled his head, but no effect. Gradually he became worse and died in the evening with many questions.

On the day, 60 percent of the patients treated died! I slept there, anxious about the air raid.

12th August. This morning I feel very dull. Also some of the members said that they had headaches. I thought that the cause might be due to over working and continued my work. In the afternoon I also had nausea and headache, at night I couldn't sleep well.

13th August. Orders from Major Sawaki: to cure the milder cases first, and to leave behind the severe ones. But it was too difficult to follow the order, for there were so many severe cases. The dullness also

continues today. Two nurses absent. From today on injections of the auto-blood intramuscularly given to the patients! Patients after patients go on dying as usual. It was now quite clear that the remarkable leucopenia and the degenerative changes of blood constituents had something to do with the death.

14th August. Headache was so severe, as if racking. Had also sore throat and swelling of the gums: extreme dullness continues. Worked all day long, very busy to treat so many patients. At night I slept with racking headache, but couldn't sleep well.

15th August. Headache was so severe that I couldn't get up this morning. I asked Major Sawaki to go back to my old home, and with his permission I went with a truck to Tomo-Station, 8 km. away from Hiroshima and from there to my old home. On the train I felt just like I were in a house flamed up by incendiary shells, with cold sweating, nausea, dizziness, and after I had given my tickets to a railway-man I had fallen to the ground, unconscious.

When I awoke, I was in a house, sleeping in bed, headache also severe. I was in my aunt's home. I had thirst and drank water: it was so sweet. Soon a doctor came and gave me injection of camphor and tablet of calmotin (barbital). Becoming so sleepy, I felt just like I am falling into a bottomless pit.

16th August. From early morning my parents and elder sister came to my bedside, and I felt greatly rescued. Fever: 38 C, I couldn't get up. All day long I had racking headache, and on reflecting afterwayds I cannot explain my nostalgia to go back to my old home, which was only 12 km. away from my aunt's home. And persuading my father, I went back to my old dear home in a motor car. At night, when I awoke, I had pains in swallowing the saliva.

From 17th to 20th August. I lost my freshness because of the continuous high fever, which was always higher than 39 C. Had no appetite, but was forced to take milk, juice, etc. Also had severe headache, but no nausea, no vomitus, no stools. Father fave me injections of glucose, Vitamins A, B, C, K, and $CaCl_2$, also injections of auto-blood intramuscularly. Marks of injections suppurate, become edematous and also pain! From today they gave me injections of Neo-Gerison (Sulfonamide). Pains of gums and larynx increases. On 19th I heard the first news of "Defeat" and I wept in secret at the sad news. In newspapers was reported vividly of the atomic bomb, and I had great sympathy for the citizens of Hiroshima, supposing that they were dying day by day, but at that time I had no idea that I myself was the victim of that dammed bomb. In the afternoon I found spots of petechiae on my body. Greatly astonished I searched all over the body. They were most abundant on the chest, inside the upper arms, over the abdomen, and rarer on the under extremities and on the back. I became so nervous that I could not sleep that night.

From 21st to 25th August. It was already night when I awoke. The electric light was very dazzling. And I suffered much from pains in my upper arms and upper legs. When I looked around, I saw the faces of my father

mother, and sisters gathering around me: All looked pale with anxiety. "Oh, had you recovered youse sense?" My father peeped into my face in a worry. They said that I was unconscious during whole four days, and they thought that I were already lost. I could not understand my situation, but felt as if I had fallen into a deep sleep. Father said that he had given me injections of cardiotonics every one hour, but my consciousness did not come back, and my pulse becoming very feeble day by day, he thought I were lost and was in deep sorrow.

28th August. This morning my fever was 38.0 C. My families were very glad because the fever declined, but my father looked gloomy for my general symptoms were not so good. From this time the signs of severeness became mainfest; painful swallowing as a result of necrosis of larynx, and my gums had also become purulent, so that I could take no nutriment. As I felt very uncomfortable in my mouth I rinsed my mouth with a gargle of boric acid, and by some chance or other, I had hemorrhage from gums and the bleeding lasted about 20 minutes before it stopped. In such a miserable state I was, my consciousness gradually recovered and I wondered whether I also were not a victim of the atomic bomb, but the thought that I was absent from Hiroshima at that time convinced me that surely I am not. Constipation as usual. Fever about 40 C. in the night.

30th August. Fever declines gradually. Morning 37.9 C. Maximum 38.5 C. It was evident that I was recovering. From the beginning to today no stools at all. They gave me enemas everyday, but in vain. I had no appetite and they gave me thin rice-gruel, juice, milks, etc.

As it rained all day long, I felt gloomy and I had severe headache every time I moved in bed. Injections after injections, oh, how I had antipathy to injections at that time! In an ennui I read newspapers and was greatly astonished to fine there the study of Prof. Dr. Tsuzuki; at the first time I was quiet clear of my disease. The symptoms of the atomic bomb patient are quiet identical to that of mine except one point - the epilation. "Oh, then I also was a victim of the atomic bomb'. I cannot be rescued. Oh! how dreadful!" And for the first time in my life I had my skin cauterized with "Kyu" (Moxacautery), which was reported to be of effect by the newspaper -- that disagreeable Kyu. Fever rose.

1st September. From the time I knew of my disease as atomic bomb injury, I felt so gloomy. Also my room was dark and sultry as it rained every day. I had a very hard time, getting up early in the morning and at night I could hardly sleep. Fever about 38 C; in the morning I felt better. It was already half a month since I was lying in bed. Every day I thought, "Can I be rescued?"

My skin was dry and my conjunctiva became oedematous and hyperemic. They gave me injections of Ringer solution. Vitamins Sulfonamides.

4th September. Today fever: 37.5 C. From today I had some appetite. I took rice-gruel, fruits, etc. Painful swallowing also waned and it became easier to take food. But the petechiae were always numerous. From this time I realized that I was rescued. I was in bed thinking of the truth of defeat reported by newspapers and of the atomic bomb ...

From 5th to 10th September. From this time I had marked diuresis, and also evacuation of the bowels - which was in a state of constipation for a long time. Also fever subsided gradually, and I had fever of 37.5 C. today. Headache and painful swallowing also had become milder, I had better appetite, and especially I felt fruits very sweet. In the afternoon fever rose to 38 C., and I was sorry afterwards for reading the newspapers. At supper I took rice-gruel, eggs, which was so sweet, a long time since.

11th September. Today I feel very agreeable, headache slight. And it was so fine today. I moved my bed into the sunshine, and sat up in my bed. All of a sudden I felt vertigo and nausea, and I hurriedly retired in a shadow. From 4 O'clock p.m. fever rose 39 C. With icebag on my head, I rested in bed. Took tablets of Calmotin.

13th September. Fever: 37 C. I had better appetite and waiting for the breakfast. By this time I was convinced that I shall be cured and refrained from taking too much food. The marks of injections of the upper arms did not pain much, also pus diminished. Pus and bleeding from gums also decreased, but no changes to petechiae. I could sleep better. It was evident that I was recovering.

15th September. Fever about 37 C.

16th September. Owing to the continuous rainfall of about a month, the river has swollen and also the wind got up; at night water came up 4 feet above the floor of my house and with my father's help I took refuge to the 2nd floor.

That night the river increased every hour, and it was flowing with horrible sounds, I could hardly sleep an hour with fear.

18th September. From dawn water decreased. I had singing in the ear, because I couldn't sleep well in the night, also fever was a little higher than usual. Appetite became better day by day. Pain in swallowing also diminished. How thankful I was my father was a doctor and that my house was in a rural country!

Excretion of the bowel was two times a day.

20th September. Water already gone and my families were very busy to clear away the house.

When I look upon the ceiling absent-minded, I thought of my school, and of my friends. For the first time petechiae faded, and I was so glad.

From 26th to 28th September. Fever 37 C. No sore throat and no pains in gums. Only headache continues to exist.

1st October. Gained flesh greatly, and returned to normal dietary. Petechiae also fading gradually. But headache only did not cease after I had left my bed. Thus I recovered day by day -----

My father also went to Hiroshima from 7th to 10th August, to rescue the patients of atomic bomb disaster. After he had returned home, also had

headache, malaise and some petechiae but recovered soon.

I also had fallen victims of the atomic bomb disease, an entirely new and unexperienced malady, but was fortunate enough to be rescued. For the progress of medicine, and for the study of atomic bomb disease I wrote this manuscript and I shall be very happy, if it be of any use.

COMMENT

This report was written in English by a Japanese medical student. It is reproduced with only minor corrections in order to make it more intelligible. The nature of the illness described by this narrator is not known. However, since he entered the bombed area two days after the bombing it is now certain that his illness was not caused by the effects of residual radio-activity in the City of Hiroshima. The report is important since it represents one type of evidence which led the Japanese to believe that the City of Hiroshima had captured so much radio-activity that it could not be inhabited again with safety for 50 to 75 years.

b. Ota, Sukenou - Eyewitness Account by a Student

At exactly 8:20 AM, August 6, 1945, a B-29 suddenly appeared over the mountains of Hiroshima. The plane left after dropping one parachute bomb. About 600 meters in the air this bomb exploded. A lightning-like flash appeared and in the next instant the entire City of Hiroshima was enveloped in a dense cloud. This was the atomic bomb; the most highly developed war weapon of the second great world war. At this time an all-clear signal had been given and the women in the homes were removing their mompe and other prople started to their places in occupation. These people were either in crowded street cars or on the streets. Most of the people in the center of the city on that morning were removing their belongings from their homes preparing to leave for the country and many people had come to help them. The citizens of Hiroshima thought some one was descending in a parachute or that propaganda leaflets were to be let loose. Since about the end of June 1945, planes had been bombing the smaller Japanese cities and people of Hiroshima believed their city would be bombed after the 1st of July. Since the city had not yet been bombed the people became careless. At this time, however, Kyoto and Hiroshima were thought to be safe. People payed little attention to the sirens. Many people had lost sleep owing to air raid sirens by day and by night. I stayed all night of the 5th of August, at the school in Minamimachi. I only got three hours sleep because the air raid warning was on especially long. I went from the shelter and ate breakfast and went to bed under a quilt. Suddently I felt a gust of wind, the walls of the tokonoma crashed as I awakened. On top of me were tiles and beams. I was covered with blood and several parts of my scalp and two places on my left arm were bleeding from severed vessels. The left side of my body was cut in more than ten places. Both legs were bleeding from several places. These wounds were caused by debris, splinters, and glass, I hurried to stop the bleeding of my arms and knew I had been injured by the bomb. I rushed to the clothing department of the army and left my belongings behind. The center of the city was filled with white smoke and I thought a gas storage tank was afire. I went to a hospital aid station by truck. After treatment of the injuries at the aid station, while traveling in the truck I saw how serious the danage was. Fires had broken out. I reached the hospital which was crowded and hellish. My injuries, compared to others, were relatively slight. The corriodors of the hospital were so crowded with severely injured people that one could hardly get his foot in. I could not stand the fishy smells. The window panes of the hospital were shattered, doctors and nurses were injured but bandaged their wounds and cared for the patients. People were burned all over their bodies except those who had on heavy clothing. Some who were in the inner parts of their homes when they collapsed were severely injured or killed. Many of these victims were burned alive when the fire started and only their bones were found. I could not help the people pinned under the buildings because I was injured. The houses collapsed away from the direction of the blast. I grew faint and cold sweat broke out because of anemia of the brain. I got better after a hypodermic injection. The patient in the next bed said that three B-29's came and dropped parachutes which gave out lightning flashes and it suddently grew dark. The hospital was full of children crying for their mothers; patients were asking for water and help. Most of them died before evening was past. When I realized my life wasn't in danger I felt the pain of my injuries. Memories of my parents in the country came into my mind. Biscuits and rice were distributed and

doctors arrived. The severely injured were removed by boat or train. Patients who came early were well cared for but those who came later were not cared for owing to lack of supplies. In the evening I went home with the help of a cane and my lodging was not burned. The view of the destroyed city filled me with deep emotion. The round scarlet sun in the western sky was descending in a beautiful sunset. The center of the city was still burning. The fires produced enough light that one could read a newspaper until about 4 A.M. I slept under a mosquito net in the open that night. On the 7th of August, I tried to go home to have my injuries treated. Along the road people were moving but no one could take care of them. Everything was flattened, trees, houses, poles, except a few large buildings, of concrete. The destruction was beyond my imagination. The castle in the center of the city was destroyed in a moment. The voluntary disaster control groups helped collect the dead, gave food to the victims and prepared milk for the children. Burned and naked bodies were lying every 5 to 10 meters along each side of the road. Cows and horses were dead, swollen and eviscerated. Street cars were burned and destroyed. People in the trams died in their seats. I started home from Koi-machi station. Several days later I found out this was all caused by the atomic bomb.

People near the center of the explosion often received no wounds but died within two or three days. Some who died two or three weeks later had epilation, pharyngitis, diarrhea, bleeding gums, and diminution of the blood cells. The white cell count went as low as 200 or 300. My white count was 3600. I was 3 km. from the center of the explosion. My injuries healed slowly and were well only after two months.

At last, for this reason, Japan acceded to the Potsdam Declaration, three years, eight months after the beginning of the greater Asiatic War.

4. Hasegawa - Eyewitness Account by a Citizen of Hiroshima.

This new type of bomb was like lightening on a bright, cloudless day. Although I was expecting a raid at some time this one came right after the all clear signal had been given. In a moment buildings collapsed, people were injured and killed and the crash of the buildings falling was like the striking of hundreds of bolts of lightning.

All of my hopes were shattered on the 6th of August 1945. This was a day never to be forgotten in a life time. On this day the people of Hiroshima lost parents, brothers, sisters, and their homes were burned. Many were burned to death. We lost the war because of science but we hope to build a finer Japan by new advances in science.

On this day I left the Seno station at 7:06 A.M. and reached the Hiroshima station before 8 A.M. I went to my office in front of the station across the street. My companions were Mr. K. and Mr. N. We had been talking about false rumors and air raids. When we had left on the train an air raid warning has been sounded. All this time I knew that B-29's were in the locality. The all clear signal had been given and people in the train were not alert. However, over the radio news had been given that an enemy plane was approaching. People in the train and in the crowded station did not hear this warning and could hot have heeded it. I sat in the train smoking and making plans for the day, as the enemy plane came in. The plane had been near since about 6 A.M. but few people paid attention to the warning since they saw the plane over the city. On their way to work people heard the all clear signal and thought they were safe. Since many people customarily went to work at 8 A.M. they pondered over whether they should go to work. The sky was ultramarine. I rushed to my work. Suddenly the front of Hiroshima station was crowded with waves of people. These streamed towards the platform and some of these saw the B-29. One worker was heard to say that one of the planes was returning and it was not necessary to pay any attention to it. When the explosion occurred I was on the train. It was 8:16 or 8:17 A.M. I think. I was dressed in black serge trousers and in a shirt similar to a military uniform. I had on also, a brown working shirt with a zipper. My sleeves were rolled to the elbows. Just as the explosion occurred I was taking a magazine from my brief case and started to get up. I felt the heat on my bare arms and I heard a sound like "shu". At the same time that I felt the heat I saw a flash with my eyes. I lost my spectacles and my identification sewn on my shirt and my cap. In one moment I thought a large incendiary bomb had been dropped. On the other hand it didn't seem to be a raid but something inexplicable had happened. There was a flash that I did not understand. Just as I felt that I was crushed and I covered my ears and eyes. I fell flat on the floor. The sound of the explosion was similar to the noise made by incendiary bombs. The window panes were shattered and brown smoke came through into the train. I felt pain in both arms but my hands were covering my ears. I heard a loud crackling sound. I was unable to determine what had happened because I couls not see around. I thought the train had lurched. The train, it seems, was still standing in the station and the ceiling caved in. I thought the bomb had dropped near the station. My one thought was to get away from the station. When I left the station my cap, glasses, and identification were gone. My arms felt itchy. I didn't get

other burns because my shirt was zippered up the front. My body felt warm and I thought debris of the incendiary bomb were on me. I had a box of matches in my coat and these caught on fire. I soon realized that the heat was caused by the matches. The train was in complete darkness. As I ran out of the train my arms felt sticky and felt painful. When I reached the back entrance of the station I notices it had collapsed. Since I could see no remains of the bomb I thought it must have exploded in midair. I wrote in my diary dated August 6, 1945, that it was a new type of bomb. The roof above the train had crashed down. The building in front had been blown 50 meters ahead onto the tracks. The walls surrounding the east drill grounds were down. I was dazed and dumfounded. I had an intuition that the plane would return. I became more and more confused as I saw the extent of the destruction. Since I have lived many years in Hiroshima my worry was that the whole city might be destroyed. At this time the entire city was in smoke and there were many fires in every direction. I could not see the destruction through the smoke. I learned form the people who were seeking shelter how badly the city had been damaged. The bleeding from my arms continued and the pain became more severe, so I ran on. Women were running with burns and injuries. A woman and a man were running. A middle aged lady was running. There were many other casualties. Many were covered with blood and were suffering from serious burns. It was a hideous sight. Just like hell. The whole sky was filled with black smoke and in the midst of this I saw a reddish glow. I heard a soughing wind like a breeze through the pines.

After the explosion, about 10 A.M., I looked around and saw that the surrounding mountains were afire. Some of the trees were fallen as though struck by lightning. About noon I went home. On my way I met a mother and child and gave them my food although I was tired and hungry. My burns and injuries were treated when I got home. Altogether I had seven injuries on my right arm, right index finger, on the second digit with a fracture, my wrists and elbows were injured by glass, my left thumb and index finger and elbow were cut by bits of glass. My ears were also injured by glass and the ear lobes were burned. The palm of my left hand and to my elbow were burned. I sterilized my wounds with alcohol and bandaged them. I didn't recover until 15th September, because my leucocyte count was low. The wounds began to suppurate and smell like fish fried in fat. I had to keep my arms in slings because they pained when they hung down. I ate vegetables to get vitamins and to get my energy back. The pains got less.

After 20 days I was fully recovered. From September I lost appetite, had diarrhea, and felt tired. This was well about the first of October. The most unfortunate people were those whose houses burned. Although I received injuries and burns and wanted to leave the aid station I could not because the trains were not running. At the first aid station unidentified patients died.

3. Matuda, Akinobu - Eyewitness Account by a Soldier.

Even to think of the 6 August 1945, gives me cold chills and shivers. I was a soldier located at the former cavalry regimental headquarters of the 2nd Army. I was a telegraph operator. I was working the night before so was not asleep when the bomb exploded. I was busy receiving messages all night. At 8 A.M., 6 August 1945, the shifts changed. Ten workers went home but I stayed behind for 15 minutes later. I started to walk 0.1 km. to my quarters. On the way I met an officer and walker 10 paces with him. At that time I saw a B-29. This was circling over the city as usual. I remembered that the all-clear signal had been given. I took three steps and heard a shushing sound and saw yellow smoke arise. I found myself flat on the ground but do not know whether the blast knocked me over. The next moment I was searching for shelter. I could not see the shelter just in front of me on account of smoke and soot. I looked up after 2 or 3 minutes because I felt nothing more would happen. My glasses and hat were blown off and I didn't realize what had happened. Here and there people came out and they had burns of their hands and faces. Not one was without burns. I had burns on the back of my head on one side. People collected together and those not seriously burned or injured were happy. The barracks and working places completely collapsed. I heard moaning from the destroyed buildings. After that soldiers with blood stains came staggering from here and there. At that time I felt a raid was occurring. These people suffered burns and began to attempt to remove friends from under the wrecked buildings. An hour later fire started and spread from buildings in this area. I took three officers to the east soldiers' field. At that time I had pain from my burns. It was unbearable and I put cold water on my head. I was thirsty and drank much water. I took a sip of a mixture of alcohol and water. I drank 1/5 liter of alcohol. Some people thought it better to drink water and some not to drink. Which is correct? The eastern soldiers' field was like hell on earth. Men, women, aged, and children were all half naked. These people were wandering in a daze, half-conscious, The night of the 6th of August, this drill ground was a terrible sight owing to the numbers of dying people and the odor, and the presence of some on the verge of death. In one moment almost the entire City of Hiroshima was gone and I felt a lonely sensation. I was munching a biscuit and tears began to well up owing to my hatred of war. Even now I can hear the screams of children crying for their mothers and mothers for their children. My burns caused little pain until the 4th day when the pains became severe and fever kept me in bed. After the 13th of August, I spent a week in the hospital at Kobe. My burns became infected and my hair had to be cut and the burns were treated. On the 19th, I left the hospital although by burns weren't entirely healed. I gave my place to other victims. My burns healed only three months later leaving a red scar. Fortunately for me I still have not had radiation sickness. Am I still in danger? My leucocyte count in mid-September was 8500. Three months after the raid I can't erase the memory of these terrible scenes from my mind. I can still hear the screaming of soldiers for water and for help.

5. Kawanichi, Tsuneo - Eyewitness Account by a reporter of the Hiroshima Chugoku News.

I usually sleep late but on the morning of August 6, 1945, I awakened at about 7 A.M. to have some films developed by a friend. The night was rather warm so I slept with only trousers on. I put away my films in the desk and as I did so I picked up the newspaper. After glancing through the newspaper I went to the kitchen to wash and while smoking a cigarette and leaning against a pillar in the house my wife was preparing breakfast. Suddenly, without warning, the ceiling of the house came down and made a crackling sound. At the same time all around me was complete darkness. Also I heard my wife scream and as soon as I heard that sound it flashed in to my mind that an enemy plane had dropped a bomb. I thought the bomb had dropped near my home but I was surprised that I did not hear the roar of the plane, so I imagined a plane overhead had dropped one bomb. It all happened in a flash and after everything had quieted down and I could look around I saw all the kitchen utensils on the floor on top of my wife; the tiles were off the room; the ceiling had fallen and the uprights were down. The walls were damaged. I did not notice any injuries but later I noticed some injuries on my hands and feet, but I was too confused to notice any pain at first. I tried to pull my wife out of the debris but she was caught between the uprights by her legs. I tried 3 or 4 times without success. Her face was covered with dust. She said it was useless but I finally got her out by sheer force and by removing the uprights. The house had collapsed completely but my wife and I climbed out through an opening in the roof. We gazed around in a daze and I thought that only my neighborhood had been attacked, although the whole city was dim as in the dusk. I could see many houses collapsed all around and I could hear cries for help, husbands calling wives and children's voices wailing. The woman next door with dishevelled hair was searching for her 5 year old boy. Her husband in a tattered shirt showed his burned areas on his body and blood was coming from his head. He was standing in a daze. After looking at this demoniacal scene I looked eastward toward the center of Hiroshima which was already in flames. A few houses away from my home the fires had started. I tried to get my shoes and shirt but they were buried under the debris. So I gave this up and with my wife left the house. One of the neighbor's children cried for her mother. The mother was under her house so I picked up the child and ran. On my way I had to go over the roofs of crashed houses. The child was heavy and I though of dropping her. If I did she would perish. It must have been an act of God that this child was put in front of me for me to save. Because of that belief I clutched the child until I reached the Fukushima River. About 100 meters ahead was the Okochi bridge swarming with people heading for the mountains. The railings of the bridge were aflame. I gave up the idea of crossing the bridge and walked into the river. The river, fortunately, was shallow and the water came to my chest. Then many people entered the river. They walked upstream or downstream with their burdens. At last I reached the opposite bank of the river. I found myself in rice paddies and knew I was safe. The child cried continuously for her mother. I scolded the child and told her I would drop her so she stopped crying. Even the child knew it would be terrible to be left alone. With pity for the child I carried her on and on. My wife had crossed the bridge and I came across her in the fields. She had taken shelter with an old woman and other people. All were womenfolk and I had all the care of them.

Crowds of people kept coming. Such groups of people would have made excellent targets for enemy planes.

I borrowed clothing of the brother of a girl from my neighborhood. At last I was clothed properly. I went to find shelter near the mountains of Koi-machi and I took the other people with me. A neighbor's daughter was applying salve to the face and head of an old lady. After I felt a breeze on my face it began to rain heavily. I made a roof out of a piece of tin near the mountains as shelter for the women. They thought the heavy rains might extinguish the fires and even though they didn't like the rain they thought it would do good. After everything was quiet I began to worry about the safety of my relatives and neighbors. My wife worried also because her family lived near Hijiyama. I work in a newspaper office and was worried about my fellow employees.

A plane came but it flew away toward the east. It probably came to observe the bombing. Somewhere in the district of Yokogawa, I heard unfamiliar sounds caused by explosions in the factories. The rain increased. I do not exaggerate when I say the sky was full of black smoke. This dreadful scene must be the end of the world. It was like a spectacular scene in a movie. Only one who was actually there could imagine the scene. The women tried to stop me but I recrossed the river because I wanted to get a more vivid impression of the spectacle. I was drenched to the skin. The victims suffering from injuries and burns threw up their hands in despair. People were so burned, especially the hair and clothing, that one could not tell men from women. One could tell only by the lighter complexion of their skin and by their breasts. People were vainly grasping and groaning for help that did not come. The dead were lying with legs twisted in a dreadful manner. Nearby a baby was lying, dead. I could not look at this scene - a mother and child lying dead. Every step one saw dead people and it was impossible to walk between the bodies. I looked at the dead faces and got the impression that they were cursing me since I was alive and they had been killed. The rain seemed to pour without thought of the people who had sacrificed their lives. My home is situated in Tenmacho about 2 kilometers from the point where the bomb was dropped. Although I worry about the nearness of my home to the center of the explosion, I have remained well. Amazingly, my wife, who suffered from peritonitis has been well ever since. The rays released by the bomb must have cured my wife's illness. When the bomb exploded we were both inside the house so we neither saw the flash nor heard the blast.

6. Hanada, Kazumi - Eyewitness Account by a Minor City Official.

This date, August 6, 1945, will be remembered by every civilian of Hiroshima. On this morning also, there was a cloudless sky. My mother went to work near Dobashi. I went, about 7 A.M. to catch a street car at Yokogawa to get certain measurements of a mountain, Mt. Eba. Exactly at 7 A.M. an air raid siren sounded. We were anticipating this because nearby Kure had been bombed early in July. These raids, however, occurred at night. Until this time raiders came over Hiroshima only at night. They usually attacked the factories in the daytime and the residences at night so the people of Hiroshima did not expect an air raid in the morning. The day was hot and the women had on mompe and the men had spiral leggings. Both had on thin clothing above the waist; the neck and arms were often bare. There would have been fewer casualties had the air raid wardens been more alert. I boarded the street car about 7:14 A.M. and reached Mt. Eba at about 7:40 A.M. I went to the office but I could not open the door because it was locked. So I sat down on the sand and waited. At about this time an all-clear signal was apparently given. I heard the roaring of a B-29 which I thought was only observing. I looked up at the airplane because the roar of the plane was getting less. I coundn't see the plane. I went to the west side of the office and there I saw a light which nearly blinded me. I did not "feel this light on my body" because I was sheltered by the office. A woman walking about 10 meters ahead of me fainted or collapsed and I thought the plane had dropped a flare bomb.

After the flash I looked up at the mountain and saw scarlet red rings, double and triple in the sky. These were going in circles, spinning round and round, and they were so beautiful I kept looking at them and I was able to count four of them. At this time I heard a loud blast and everything about me began to darken. I was knocked down on the sand and above me small stones began to roll down on me. I jumped into an air raid shelter. Later when everything was quiet, I came out of the shelter and looked at the factory where I worked and the roof was caved in. I saw a large cloud of greyish smoke behind the mountain. This obscured the sun. I tried to reach the building of the Department of Engineering since I am an employee. On my way I saw houses collapsing and telephone posts falling and perceived an indescribable odor. Then I saw waves of yellowish smoke in the sky. Near the Sumiyoshi-hashi I saw fire arising from all the houses. Many houses had already collapsed. Many of the victims crowed into the factory for shelter. It was a sight, unforgettable and some of the people who were the most severely injured were completely naked. Fires broke out all over the city. Many people who had fainted and fallen owing to burns were crying for help to the people who were passing by. Many people had burns of their entire bodies, and although it was a cruel sight I was helpless to give aid. In the neighborhood of Takano-hashi I heard cries for help from a house that had collapsed and was now surrounded by flames. I wanted to help but I could not approach near the fire or I would have been burned to death. In the same neighborhood I saw dead bodies lying here and there. I caught my feet in telephone poles because so many were down. Several hundred people who were burned or injured sought shelter in front of the city hall of Hiroshima, among these I saw high school girls which seemed more cruel. At the entrance of the city hall 2 women were lying. The window frames were blown out. The stairs were covered with blood. Many people were dead on the 2nd and 3rd

floors. About this time the fire broke greater and I went below. When I went outside the building I saw that if I went towards Kusatsu I would be safe. I couldn't reach Kusatsu owing to being engulfed by a sea of flames. I went to the side of the river after leaving Ko and passing the military hospital. In front of the hospital several hundred burned victims were congregated. They were moaning, while awaiting treatment. About this time a shower of rain began so I went into the house of a citizen to take shelter. After the rain stopped I crossed the river to Koi-Machi. There the houses were standing and undamaged. The districts of Yokogawa were still in flames. The rain fell heavily for about half an hour and owing to this the fires around Yokogawa were extinguished. I went to see the remainder of my home and when I remembered this was the home I had left in the morning I was filled with deep emotion. At this moment I felt my mother must be dead. At present I am living in Kobemachi in the home of relatives through their kindness.

7. Suga, Kiyoharu - Eyewitness Account by a Medical Student.

The atomic bomb was the most remarkable affair of the century. Many people had to sacrifice their lives unfortunately. Why do there have to be so many deaths? Whether owing to lack of doctors or lack of treatment. I believe that it was to be blamed on the doctors and on the ignorance of civilians. The people did not know that the injured should be kept warm and quiet after the bombing. The people became excited and weakened their hearts and bodies. They went outdoors and became chilled and thereby killed themselves. They lacked knowledge of medical care. Blood transfusions and other necessary treatments. and other general treatments are necessary and especially the will to recover. The injured should have water and warmth, etc. The most harmful things are cold, wet, and hunger. The patients should have had liver preparations, vitamins, etc. Should also have had Ringers, glucose, etc. When patients feel well they should be careful after injuries. Patients with burns should have the lesions sterilized and bandaged but instead the patients suffered by removal of areas of suppuration and by removal of crusts. Open treatment of deep wounds was well done. (Then he gives a list of magazines and newspapers which told how to treat the wounds.)

Message to Prof. Tsuzuki:

Exhorting him to do all that is possible about the health of the civilians and to do all that is possible to improve the civilian medical care.

8. Ishii, Kikuo - Eyewitness Account by a Civilian.

I heard the roar of a plane over my home, and looked up to be certain whether it was a B-29 or a Japanese plane. The western side of the house was protected by a wall. I could not see the plane although I heard it distinctly. Suddenly I saw something while like an electric arc. I thought this was unusual. I was about to enter a room in the house when my whole body seemed to be crushed. All sorts of debris fell on me. I stopped without thinking and my ears felt like they were stopped up by something. I covered my ears and kept still. When I opened my eyes and looked around the room was dark and everything was down in disorder and I could hardly breathe. After a while it grew lighter as though a fog were lifted. Soon afterward I began to worry about the safety of my family and I screamed with all my might. The four adults in the house were safe. A four year old girl was buried under the debris but I could not locate her exactly. All of this happened in 2 or 3 minutes about 8:15 AM on 6th of August 1945. I tried to save the little girl, but she was pinned down by the neck by a heavy timber that was lying sidewise. Finally I got a saw and tried to free her without injuring her tiny hands or her neck. I was able to free her but by that time she was no longer breathing. I tried artificial respiration and this was successful and I was able to save one life. We prepared to find shelter but about 50 meters away smoke started from the debris. Our lives were in danger and I tried to determine where to run for safety. At that time I saw a woman pinned down by debris calling for help. With the saw I cut the timbers and was able to rescue her. While I was freeing her I saw that the house was afire and I had to abandon it. A small stream of water was coming from a water faucet and I drank a few sips. The water came out like saliva from a child's mouth. I felt my throat was sore. A large pine tree in my yard had fallen toward the east. All the rooms of my house were completely destroyed and I could not go in nor bring anything out. From the air raid shelter I took 5 sho of rice and an umbrella. I started to pick up buckets and basins and to hunt shelter. At that time all around me fires broke out and people in the street were shouting to take shelter quickly. After the explosion, about 20 - 30 minutes later, I took my family to find shelter in the eastern army drill ground by crossing the Enkohashi. On our way I calculated that the bomb had dropped near the end of the car line at Motoba. I thought this was not the usual type of bomb but one that exploded in midair, because when I stepped outside I saw that every house had been destroyed. As I ran toward the military field I saw that the telephone poles were down. By the time I reached the field people were lying along the roadside with burns on faces, hands, and feet. I was struck by a strange sensation. The burns were nor like ordinary burns but were greenish-yellow in color. The eyelids were closed and swollen and the lips were swollen. This gave the appearance of a mask. A young girl lying near was asking for water. Almost all of her clothing was gone and her skin was the color of green devil. There was no help that any one could give. I thought it was strange that none of my family was burned. The people were injured by glass and some were covered by blood. Their shirts and trousers were burned and they were hunting shelter with their wives. Once I left my house and until I reached the military field all was in confusion and this reminded me of the grand deluge of the Bible. I was in Tokoyo during the

raid of 10th March, and I had experienced air raids. I was prepared for hideous sights but this excoeded all that I had seen before. I was in a refuge in the northern slope of the field for about two hours. My watch showed 11 A.M. The city was engulfed in red flames. Black smoke was arising from the city. Many people were watching their houses going up in smoke. About this time in the Koi and Yokogawa districts I heard sounds like explosions and saw lightning-like delayed bombs were exploding. In the western and northern parts of the city it was raining heavily. Since I could not remain forever I came out of the shelter and started towards Nakayama. Swarms of people were moving towards the first-aid stations. Some were in bare backs because their clothing was burned off and they were blistered. The scene was one of hideous misery. About this time I took shelter in a home in Nakayama. One B-29 was seen overhead at a high altitude but I didn't have the strength to take shelter and I stood dumfounded. The people in the farmhouse where we reached shelter began preparing meals. I ate a lunch I had with me quickly and turned back to see the last of my house in Kyohashi. The Yaga primary school was crowded and there was a shortage of medicine. This was a sad, miserable sight. I tried to go into Kyohashi town by the way of Hiroshima stations and by crossing the Enkohashi but the remains of fires stopped me. Fires were burning everywhere. The city was ruined in its entirety There were no passersby at this point. After 3:30 P.M., I again turned back to Nakayama village. At the station I saw a boy in the entrance of a shelter lying with his face, hands, and feet burned and felt pity for him. Sometimes I could hear the crackling of fires. Hiroshima station was completely burned. This brought back memories of my high school days, 14 or 15 years ago. I cried in my mind for these boys compared to my high school days. I thought have courage and the boy replied faintly, "Yes." The boy was dazed. He was lying quietly without asking for water or succor. He didn't mention his suffering. I prayed that since I could do nothing the boy would live until he got proper treatment. That night with my wife I walked to Kaitaichi and from there took the last train to Saijo to my home. At home my people were doubtful of my safety and they were preparing for my funeral. It is useless to tell how happy they were to see me. Towards the end of August I felt weak and my neighbors who were unwounded started to die. My blood was examined at the Saijo sanitarium and the leukocyte count was 4300. I was given advice on my care by the doctor. I was told to rest like patients with tuberculosis. I have been getting better since and feel I am safe now. My wife had lacerations of her feet and was healed in October. I imagine the suppuration was caused by the radiation sickness (sickness of the atomic bomb.) August 6, 1945, was certainly a fatal day and long to be rememembered. I left Saijo station at 7 by train with two companions. As usual I went to Hiroshima with companions. One of the other usual companions had been killed in the raid. Another companion was waiting for a street car - his face had been burned in the explosion. He owes his life to the use of counter-irradiation by burning incense on the skin. I went to my home at Kyohashi-machi. It was impossible to imagine how quickly one's life could change. The film called "Titanic" showed a young couple on the deck about to enter the stateroom when they saw a buoy with the word Titanic written on it. I was comparing the fate of the people of Hiroshima with the fate of those on the Titanic. The companion who was working in my office was earning money to raise her child. Unfortunately the mother died.

I lay down my pen praying for the happiness of this child.

9. Takada, Shizuo - Eyewitness Account of Atomic Bombing of Hiroshima by an Olympic Athlete.

The night of 5th of August, I was with my business company on night duty. I changed shift at 8 A.M. 6 August 1945. I had just left my desk when the bomb exploded. I didn't see the flash nor feel the heat. I felt as though I were struck by a great gust of wind and I fell to the ground. At that instant the room was in complete darkness but my mind was clear. I was in a three story concrete building. The furniture was knocked down and some woman underneath were asking for help. I rescued 6 or 7 people by listening for the direction of their voices. Fires started so I rushed out of the building but no one else came out. The reason was that the employees kept at their posts until the last. I could move so fast because I was well trained by sports. I was 650 meters from the center. I was not injured nor did I get sick later. I lost much weight hunting my daughter who died in the raid. I lost 15 Kgm and could stand this because of my strength and will power. I think I was saved because I was in a concrete building. When I got down from the third story the city was covered with black smoke and fires had broken out. I felt I could escape towards Hijiyama and I started that way. I went through fire and smoke and on the way I saw many injured and dead in piles on top of each other. Especially unforgettable were dead mothers carrying their wailing babies. Even now I feel chills when I think of those scenes. When I reached home my eldest son was severly burned. At 3 P.M. I searched for but could not find my daughter. I went where my daughter worked but so many dead and injured were lying there that I could not find her. Later I found she had been taken to the hospital at Eba. I brought her home but two weeks later she died.

10. Iwatake, Masaru - Eyewitness Account by a Nisei written in English.

HELL HITS HIROSHIMA

I, as a student of the Hiroshima 1st middle school, would hereby like to submit my experience of that day hoping that it may be of any help to Colonel Oughterson and his inquiring group.

It was on the fateful morning of August 6, 1945, a clear summer day that the atomic bomb, first of its kind, was dropped on Hiroshima. I went as usual to the Kansai factory where we were working as the students special labor corps. I got there about 7:30 in the morning and we finished our morning exercise as usual. Then I changed to my overalls and started to work. It was about 8 o'clock then. When about fifteen minutes lapsed a brilliant flash something like the light when one burns magnesium was seen outside. Thinking that the motor running the machinery burned or something of that sort I changed glances with the boys when all of a sudden a terrible "wham" was heard. Glasses flew, roofs fell, and walls crashed in, and before I knew it I was beneath the lathe that I was running. Nobody ever thought that the brilliant flash was a bomb for there was no alarm at that time (It was lifted about 30 minutes prior) and of course no airplane motor was heard. After things quieted a bit I moved my body and seeing that my body was free got up. The factory was covered with a blackish mist which choked my throat. I quickly covered my nose with a towel and got out. When I got out I gasped as I saw that the boys who were working at the gauge with their shirts off were burned above their waist and their faces were all smeared with blood. Their faces were hit by flying debris and glass. We were told to gather at the Hiroshima City Girls High School nearby. There were students of nearby factories gathered too, but one could not recognize one another for lots of them were smeared with blood.

Here we had a roll call and half of my classmates were found injured. I surmised what a terrible incendiary bomb was dropped for all the houses nearby were damaged badly and houses were burning here and there. After getting cooled down a bit I went back to the factory to get my clothes and cap. Here I saw D. for the last time for he was injured badly and he died the following day. We got back to the school which was burning at the roof then. We got out the hand pump immediately but as the pump did not reach the top of the two story building five of us were ordered to climb the roof. We got up and started to throw the tiles and sands that were beneath the tiles. By this time water was brought up by means of ropes. We got the fire controlled in no time. Here I had a birdseye view of Hiroshima City with fires broken out here and there. It was burning with all its fury. The sky above Hiroshima was covered with black smoke. Here I noticed that this was not and ordinary bomb for no B-29 was to be seen. It was really a ghastly sight. We got down and all of us were told to return to our homes immediately with care. I started but when I got to the Sumiyoshi bridge traffic was stopped for both sides were burning so I crossed the river in a ferry which was filled with the injured which surely was not a pleasant sight. After crossing the river I walked my way. There were lots of injured people, mostly burned.

About this time ugly low black clouds hung over the Koi district or the

western part of the city and boom, boom, something like the noise of cannon rather bombs exploding were heard. Later I learned that the Koi district had thunder followed by rain. As I continued now I was confronted by the whistling noise of a bomb which made me lie flat on the ground. Fortunately no bombs fell. When I reached the second river there was no ferry so I waded across it with my clothes above my head. I changed immediately to my clothes and here I began to worry for the safety of my mom and brother.

Continuing my way I saw many burned people and could not tell if they were men or women for they were all swollen. Also I saw people brazenly watching their homes burn. Just then I heard the drone of a B-29 which made me duck into an air raid shelter fearing that it may drop some more of its eggs. When it cleared I beat it to my home. In this way I was at last at home. But I was dumfounded when I reached my home for from the front I could see the back of the house. Every bit of glass was broken and some even intc the wall a good four yards away. Of course all paper walls were broken to pieces when the wall crashed in toward the house.

My mom and small sister were safe so here I sighed a relief as I told my mother of the things I saw when returning home. But my small brother who was in the 1st grade at the same school did not return home so it made us worry very much. At about 7 P.M. I tried going to the school for my brother but as the roads were blocked and fires still continuing I wasn't able to make much headway. So I went to a teachers home nearby. Here I heard the sad story that most of the 1st graders were killed. This teacher too died the following day. That night we all slept in the grape fields nearby for houses were a wreck and mostly we all feared that the B-29 would drop some more of this terrible bomb. It surely was a sleepless night with sky toward the city colored with a crimson color.

Since my brother did not come home I went to school the next day. On my way I saw many dead people (they were all swollen up) lying strewn here and there with may badly burned people lying about crying for water. There were horses dead too with a terrible odor. As I suspected the school was clearly burnt with charred bodies lying here and there. I knew the room and desk of my brother so I quickly went to it and started to find the body of my brother. Finding the key to his rucksack I looked about carefully and found it with the charred name Iwa left on his pants. Unfortunately all the first graders at school at that time were killed. I imagined how they must have struggled as the building collapsed and burned.

Burning it thoroughly I brought home some remains (for a decent burial) and buried the rest in the schoolyard. (Later I heard that people who dug holes with the same purpose with me died because of breathing a gas. Naturally hairs dropped off, fevers ran high and they died.) As for me I'm as healthy as ever.

About three days later I went all over the city to find my uncle (who was burned and now recuperating). There were so many corpes strewn about that I could not tell how many. Anyway it surely was a most disastrous sight one could have seen. As this all happened in a twinkling all the people were caught unaware for they all thought that they could run away, yes if it was an incendiary attack. This I could say is the experience I went through that I can think of now.

Let us hope that never a war will ever rise again with Hiroshima as an example of what modern warefare could do overnight. August 6, 1945, yet, that is the day humanity must never, never forget.

P.S. I wrote my experience in the English language because I was born in Hawii and came to Japan after finishing the 6th grade. I am in the 3rd grade in the middle school now but I would very much like you to forgive me for the errors and mistakes that you may find.

Yours truly,

Masaru Iwatsake

11. Friedrich Tappe

Eyewitness Account Written by a Jesuit Priest in Nagatsuka.

Our home, the Novitiates' House of the Society of Jesus, in Japan, lies about 4 to 5 km. distance from the center of the City of Hiroshima. On the morning of August 6, 1945, I was about to sit down at my typewriter when a sudden brilliancy struck my eyes and let itself traverse the window. It was as though a giant magnesium light had been burned over Hiroshima, as if a man had used it to make a photograph. At that time I had the impression as though just in front of my window a fire bomb had fallen. I sprang up and ran out of the window in order to extinguish it. The air pressure, however, held me immobile and threw me through the Japanese sliding doors into a connecting room. Around me and on me fell glass, wood, and paper, with a crashing noise. I sprang up and hurried outside. In the heavens above Hiroshima hung a great rose-colored cloud. In the village a few hundred meters nearer the city fire broke out here and there in isolated areas. Our house still stood, although all the outer and inner doors, all the windows at the front and back of the house were broken, and moreover the greater part of the roof in the corridors and rooms, the ceilings were pushed up in certain areas and in other areas were crashed downward. The books were torn from the shelves and were lying strewn on the floor. Everything was covered with splinters of glass. Still after weeks one must be careful when he opens books or moves pillows or unfolds bed covers or puts on his hat that he is not pricked by splinters of glass. Even the piano which, although closed on all sides and on top, was filled with broken glass. The air pressure must have pressed in and out from the ground. The walls directly above the windows were punctured by glass particles like little arrows, Fusumas (Japanese sliding paper doors) were as though cut by knives. The chapel was the most seriously injured. Its total front wall was pressed in. The single thing that stood uninjured was the clock tower which was built in the architectural type of Japanese pagoda. It stood probably because it had a greater ability to sway. Whether I heard a crash or felt an especial heat, I can no more recall to myself exactly. Other occupants of the house, however, had noticed the heat distinctly. The tips of the leaves of many bushes in front of the house were withered. The same thing was noticed among the rice plants in the surrounding paddies. A cupboard in one room of which the window had remained open on the opposite side of the room about 50 square cm of the paint had been torn off.

12. Eyewitness Account of P. Siemes

Until August 6th, only occasional bombs, which did no great damage, had fallen on Hiroshima. Many cities round about, one after the other, were destroyed, but Hiroshima itself remained protected. There were almost daily observation planes over the city but none of them dropped a bomb. The citizens wondered why they alone had remained undisturbed for so long a time. There were fantastic rumors that the enemy had something special in mind for this city, but no one dreamed that the end would come in such a fashion as on the morning of August 6th.

August 6th began with a bright, clear, summer morning. About seven o'clock, there was an air raid alarm which we had heard almost every day and a few planes appeared over the city. No one paid any attention to them and at about eight o'clock, the all-clear signal was sounded. I am sitting in my room at the Novitiate of the Society of Jesus in Nagatsuka, where about a half year earlier the philosophical and theological section of our Mission had been evacuated from Tokyo. The Novitiate is situated approximately 4.5 kilometers from the center of Hiroshima, half-way up the sides of a broad valley which stretches from the town at sea level into the mountainous hinterland, and through which courses a river. From my window, I have a wonderful view down the valley to the edge of the city. Suddenly - the time is approximately 8:14 A.M. - the whole valley is filled by a garish light which resembles the magnesium light used in photography, and I am conscious of a wave of heat. I jump to the window to find out the cause of this remarkable phenomenon, but I see nothing more than that brilliant yellow light. As I make for the door, it doesn't occur to me that the light might have something to do with enemy planes. On the way from the window, I hear a moderately loud explosion which seems to come from a distance and, at the same time, the windows are broken in with a loud crash. There has been an interval of perhaps ten seconds since the flash of light. I am sprayed by fragments of glass. The entire window frame has been forced into the room. I realize now that a bomb has burst and I am under the impression that it exploded directly over our house or in the immediate vicinity. I am bleeding from cuts about the hands and head. I attempt to get out of the door. It has been forced outwards by the air pressure and has become jammed. I force an opening in the door by means of repeated blows with my hands and feet and come to a broad hallway from which open the various rooms. Everything is in a state of confusion. All windows are broken and all the doors are forced inwards. The book-shelves in the hallway have tumbled down. I do not note a second explosion and the fliers seem to have gone on. Most of my colleagues have been injured by fragments of glass. A few are bleeding but none are too seriously injured. All of us have been fortunate since it is now apparent that the wall of my room opposite the window has been lacerated by long fragments of glass. We proceed to the front of the house to see where the bomb has landed. There is no evidence, however, of a bomb crater; but the southeast section of the house is very severely damaged. Not a door nor a window remains. The blast of air has penetrated the entire house from the southeast, but the house still stands. It is constructed in the Japanese style with a wooden framework, but has been greatly strengthened by the labor of our Brother Gropper as is frequently done in Japanese homes.

Only along the front of the chapel which adjoins the house, have three supports given way (it has been made in the manner of a Japanese temple, entirely out of wood. Down in the valley, perhaps one kilometer toward the city from us, several peasant homes are on fire and woods on the opposite side of the valley are aflame. A few of us go over to help control the flames. While we are attempting to put things in order, a storm comes up and it begins to rain. Over the city, clouds of smoke are rising and I hear a few slight explosions. I come to the conclusion that an incendiary bomb with an especially strong explosive action has gone off down in the valley. A few of us saw three planes at great altitude over the city at the time of the explosion. I, myself, saw no aircraft whatsoever.

Perhaps a half-hour after the explosion, a procession of people begins to stream up the valley from the city. The crowd thickens continuously. A few come up the road to our house. Their steps are dragging. Many are bleeding or have suffered burns. We give them first aid and bring them into the chapel, which we have in the meantime cleaned and cleared of wreckage, and put them to rest on the straw mats which constitute the floor of Japanese houses. A few display horrible wounds of the extremities and back. The small quantity of fat which we possessed during this time of war was soon used up on the care of the burns. Father Rektor who, before taking holy orders had studied medicine, ministers to the injured, but our bandages and rags are soon gone. We must be content with cleansing the wounds. More and more of the injured come to us. The least injured drag the more seriously wounded. There are wounded soldiers, and mothers carrying burned children in their arms. From the houses of the farmers in the valley comes word: "Our houses are full of wounded or dying. Can you help, at least by taking the worst cases?" The wounded come from the sections at the edge of the city. They saw the bright light, then their houses collapsed and buried the inmates in their rooms. Those that were in the open suffered instantaneous burns, particularly on the lightly clothed or unclothed parts of the body. Numerous fires sprang up which soon consumed the entire district. We now conclude that the epicenter of the explosion was at the edge of the city near the Yokogawa Station more than three kilometers away from us. We are concerned about Father Kopp who, that same morning, went to hold Mass at the Sisters of the Poor, who have a home for children at the edge of the city. He had not returned as yet.

Toward noon, our large chapel and library are filled with the seriously injured. The procession of refugees from the city continues. Finally, about one o'clock, Father Kopp returns together with the Sisters. Their house and the entire district where they live has burned to the ground. Father Kopp is bleeding about the head and neck, and he has a large burn on the right palm. He was standing in front of the nunnery ready to go home. All of a sudden he became aware of the light, felt the wave of heat and a large blister formed on his hand. The windows were torn out by the blast. He thought that the bomb had fallen in his immediate vicinity. The nunnery, also a wooden structure made by our Brother Gropper, still remains but soon it is noted that the house is as good as lost because the fire, which had begun at many points in the neighborhood, sweeps closer and water is not available. There is still time to rescue certain things from the house and to bury them in an open spot. Then the house is swept by flame, and people fight their

way back to us along the shore of the river and through the burning streets.

Soon comes news that the entire city has been destroyed by the explosion and that it is on fire. What became of Father Superior and the three other Brothers who were at the center of the city at the Central Mission and Parish House? We had up to this time not given them a thought because we did not believe that the effects of the bomb encompassed the entire city. Also, we did not want to go into town except under pressure of dire necessity, because we though that the population was greatly perturbed and that it might take revenge on any foreigners whom they might consider spiteful onlookers of their misfortune or even spies.

Brother Stolte and Brother Erlingnagen go down to the road which is still full of refugees and bring in the seriously injured, who have fallen by the wayside, to the temporary aid station at the village school. There iodine is applied to the wounds but they are left uncleansed. Neither ointments nor other therapeutic agents are available. Those that have been brought in are laid on the floor and no one can give them any further care. What could one do when all means are lacking? Under those circumstances, it is almost useless to bring them in. Among the passersby, there are many who are uninjured. In a purposeless, insensate manner, distraught by the magnitude of the disaster, most of them rush by and none conceives the thought of organizing help on his own initiative. They are concerned only with the welfare of their own families. It became clear to us during those days that the Japanese displayed little initiative, preparedness, or organizational skill in preparation for catastrophes. They despaired of any rescue work when something could have been saved by a cooperative effort, and fatalistically they let the catastrophe take its course. When we urged them to take part in the rescue work, they did everything willingly, but on their own initiative they did very little.

At about four o'clock in the afternoon, a theological student and two kindergarten children, who lived at the Parish House in the city, come and report that the Church, Parish House and adjoining buildings had burned down, and that Father Superior LaSalle and Father Schiffer had been seriously injured and that they had taken refuge in Asano Park on the river bank. It is obvious that we must bring them in since they are too weak to come here on foot.

Hurriedly, we get together two stretchers and seven of us rush toward the city. Father Rektor comes along with food and medicine. The closer we get to the city, the greater is the evidence of destruction and the more difficult is it to make our way. The houses at the edge of the city are all severely damaged. Many have collapsed or burned down. Further in, almost all of the dwellings have been darkened by fire. Where the city stood, there is a gigantic burned-out scar. We make our way along the street or the river itself by the heat and smoke at the level of the street. Frightfully burned people beckon to us. Along the way there are many dead and dying. On the Misasa Bridge which leads into the inner city, we are met by a long procession of soldiers who have suffered burns. They drag themselves along with the help of staves or are carried by their less severely injured comrades—an endless procession of the unfortunate. Abandoned on the bridge, there

stand with sunken heads a number of horses with large burns on their flanks. On the far side, the cement structure of the local hospital is the only building that remains standing. Its interior, however, has been burned out. It acts as a landmark to guide us on our way. Finally we reach the entrance of the park. A large proportion of the populace has taken refuge there, but even the trees of the park are on fire in several places. Paths and bridges are blocked by the trunks of fallen trees and are almost impassable. We are told that a high wind, which may well have resulted from the heat of the burning city, had uprooted the large trees. It is now quite dark. Only the fires, which are still raging in some places at a distance, give out a little light. At the far corner of the park, on the river bank itself, we at last come upon our colleagues. Father Schiffer is on the ground pale as a ghost. He has a deep, incised wound behind the ear and has lost so much blood that we are concerned about his chances for survival. The Father Superior has suffered a deep wound of the lower leg. Father Cieslik and Father Kleinsorge have minor injuries but are completely exhausted.

While they are eating the food that we have brought along, they tell us of their experiences. They were in their rooms at the Parish House - it was quarter after eight, exactly the time when we had heard the explosion in Nagatsuka - when came the intense light and immediately thereafter the sound of breaking windows, walls and furniture. They were showered with glass splinters and fragments of wreckage. Father Schiffer was buried beneath a portion of a wall and suffered a severe head injury. The Father Superior received most of the splinters in his back and lower extremity from which he bled copiously. Everything was thrown about in the rooms themselves, but the wooden framework of the house remained intact. The solidity of the structure that was the work of Brother Gropper again shone forth. They had the same impression that we had in Nagatsuka: that the bomb had burst in their immediate vicinity. The Church, school, and all buildings in the immediate vicinity coppapsed at once. Beneath the ruins of the school, the children cried for help. They were freed with great effort. Several others were also rescued from the ruins of nearby dwellings. Even the Father Superior and Father Schiffer, despite their wounds, rendered aid to others and lost a great deal of blood in the process. In the meantime, fires which had begun some distance away are raging even closer, so that it becomes obvious that everything would soon burn down. Several objects are rescued from the Parish House and were buried in a clearing in front of the Church, but certain valuables and necessities which had been kept ready in case of fire could not be found on account of the confusion which has been wrought. It is high time to flee, since the oncoming flames leave almost no way open. Fukai, the secretary of the Mission, is completely out of his mind. He does not want to leave the house and explains that he does not want to survive the destruction of his fatherland. He is completely uninjured. Father Kleinsorge drags him out of the house and he is forcibly carried away. Beneath the wreckage of the houses along the way, many have been trapped and they scream to be rescued from the on coming flames. They must be left to their fate. The way to the place in the city to which one desires to flee is no longer open and one must make for Asano Park. Fukai does not want to go further and remains behind. He has not been heard from since. In the park, we take refuge on the bank of the river. A very violent whirlwind now begins to uproot large trees, and lifts them high into the air. As it reaches the water, a water

spout forms which is approximately 100 meters high. The violence of the storm luckily passes us by. Some distance away, however, where numerous refugees have taken shelter, many are blown into the river. Almost all who are in the vicinity have been injured and have lost relatives who have been pinned under the wreckage or who have been lost sight of during the flight. There is no help for the wounded and some die. No one pays any attention to a dead man lying nearby.

The transportation of our own wounded is difficult. It is not possible to dress their wounds properly in the darkness, and they bleed again upon slight motion. As we carry them on the shaky litters in the dark over the fallen trees of the park, they suffer unbearable pain as the result of the movement, and lose dangerously large quantities of blood. Our succoring angel in this difficult situation is an unknown Japanese Protestant pastor. He has brought up a boat and offers to take our wounded upstream to a place where progress is easier. First, we lower the litter containing Father Schiffer into the boat and two of us accompany him. We plan to bring the boat back for Father Superior. The boat returns about one-half hour later and the pastor requests that several of us help in the rescue of two children whom he had seen in the river. We rescue them. They have severe burns. Soon they suffer chills and die in the park. The Father Superior is conveyed in the boat in the same manner as Father Schiffer. The theology student and myself accompany him. Father Cieslik considers himself strong enough to make his way on foot to Nagatsuka with the rest of us, but Father Kleinsorge cannot walk so far and we leave him behind and promise to come for him and the housekeeper tomorrow. From the other side of the stream comes the whinny of horses who are threatened by the fire. We land on a sandspit which juts out from the shore. It is full of wounded who have taken refuge there. They scream for aid for they are afraid of drowning as the river may rise with the sea and cover the sand spit. They themselves are too weak to move. However, we must press on and finally we reach the spot where the group containing Father Schiffer is waiting. Here a rescue party had brought a large case of fresh rice cakes but there is no one to distribute them to the numerous wounded that lie all about. We distribute them to those that are nearby and also help ourselves. The wounded call for water and we come to the aid of a few. Cries for help are heard from a distance, but we cannot approach the ruins from which they come. A troop of soldiers come along the road and their officer notices that we speak a strange language. He at once draws his sword, screamingly demands who we are and threatens to cut us down. Father Laures, Jr., seizes his arm and explains that we are German. We finally quiet him down. He thought that we might well be Americans who had parachuted down. Rumors of parachutists were being bandied about the city. The Father Superior who was clothed only in a shirt and trousers, complains of feeling freezing cold, despite the warm summer night and the heat of the burning city. The one man among us who possesses a coat gives it to him and, in addition, I give him my own shirt. To me, it seems more comfortable to be without a shirt in the heat.

In the meantime, it has become midnight. Since there are not enough of us to man both litters with four strong bearers, we determine to remove Father Schiffer first to the outskirts of the city. From there, another group of bearers is to take him over to Nagatsuka; the others are to turn back in order to rescue the Father Superior. I am one of the bearers. A

student of theology goes in front to warn us of the numerous wires, beams and fragments of ruins which block the way and which are impossible to see in the dark. Despite all precautions, our progress is stumbling and our feet get tangled in the wire. Father Kruer falls and carries the litter with him. Father Schiffer becomes half conscious from the fall and vomits. We pass an injured man who sits all alone among the hot ruins and whom I had seen previously on the way down. On the Misasa Bridge, we meet Father Tappe and Father Luhmer, who have come to meet us from Nagatsuka. They had dug a family out of the ruins of their collapsed house some fifty meters off the road. The father of the family was already dead. They had dragged out two little girls and placed them by the side of the road. Their mother was still trapped under some beams. They had planned to complete the rescue and then to press on to meet us. At the outskirts of the city, we put down the litter and leave two men to wait until those who are to come from Nagatsuka appear. The rest of us turn back to fetch the Father Superior. Most of the ruins have now burned down. The darkness kindly hides the many forms that lie on the ground. Only occasionally in our quick progress do we hear calls for help. One of us remarks that the remarkable burned smell reminds him of incinerated corpses. The upright, squatting form which we had passed by previously is still there. Transportation on the litter, which has been constructed out of boards, must be very painful to the Father Superior, whose entire back is full of fragments of glass. In a narrow passage at the edge of town, a car forces us to the edge of the road. The litter bearers on the left side fall into a two meter deep ditch which they could not see in the darkness. Father Superior hides his pain with a dry joke, but the litter which is now no longer in one piece cannot be carried further. We decide to wait until Brother Kinjo can bring a hand cart from Nagatsuka. He soon comes back with one that he has requisitioned from a collapsed house. We place Father Superior on the cart and wheel him the rest of the way, avoiding as much as possible the deeper pits in the road. About half past four in the morning, we finally arrive at the Novitiate. Our rescue expedition had taken almost twelve hours. Normally, one could go back and forth to the city in two hours. Our two wounded were now, for the first time, properly dressed. I get two hours sleep on the floor; some one else has taken my own bed. Then I read a Mass in gratiarum actionem: it is the 7th of August, the aniversary of the foundation of our Society. Then we bestir outselves to bring Father Kleinsorge and other acquaintances out of the city.

We take off again with the hand cart. The bright day now reveals the frightful picture which last night's darkness had partly concealed. Where the city stood everything, as far as the eye could reach, is a waste of ashes and ruin. Only several skeletons of buildings completely burned out in the interior remain. The banks of the river are covered with dead and wounded, and the rising waters have here and there covered some of the corpses. On the broad street in the Hakushima district, naked burned cadavers are particularly numerous. Among them are wounded who still live. A few have crawled under the burnt-out autos and trams. Frightfully injured forms beckon to us and then collapse. An old woman and a girl, whom she is pulling along with her, fall down at our feet. We place them on our cart and wheel them to the hospital at whose entrance a dressing station has been set up. Here the wounded lie on the hard floor, row on row. Only the largest wounds are carefully dressed. We convey another soldier and an old woman to this place but cannot move everybody who lies exposed in the sun. It would be

endless and it is questionable whether those whom we can drag to the dressing station can come out alive, because even here nothing really effective can be done. Later, we ascertain that the wounded lay for days in the burnt-out hallways of the hospital and there they died. We must proceed to our goal in the park and are forced to leave the wounded to their fate. We make our way to the place where our Church stood to dig up those few belongings that we had buried yesterday. We find them intact. Everything else has been completely burned. In the ashes, we find a few molten remnants of the holy vessels. At the park we load the housekeeper and a mother with her two children on the cart. Father Kleinsorge feels strong enough, with the aid of Brother Nobuhara, to make his way home on foot. The way back takes us once again past the dead and wounded in Hakushima. Again no rescue parties are in evidence. At the Misasa Bridge, there still lies the family which Fathers Tappe and Luhmer had yesterday rescued from the ruins. A piece of tin had been placed over them to shield them from the sun. We cannot take them along for our cart is full. We give them and those nearby water to drink and decide to rescue them later. At three o'clock in the afternoon, we are back in Nagatsuka.

After we have had a few swallows and a little food, Fathers Stolte, Luhmer, Erlinghagen and myself, take off once again to bring in the family. Father Kleinsorge requests that we also rescue two children who had lost their mother and who had lain near him in the park. On the way, we were greeted by strangers who had noted that we were on a mission of mercy and who praised our efforts. We now met groups of individuals who were carrying the wounded about on litters. As we arrived at the Misasa Bridge, the family that had been there had gone. They might well have been borne away in the meantime. There was a group of soldiers at work taking away those that had been sacrificed yesterday. More than thirty hours had gone by until the first official rescue party had appeared on the scene. We find both children and take them out of the park: A six year old girl who was uninjured, and a twelve year old girl who had been burned about the head, hands, and legs, and who had lain for thirty hours without care in the park. The left side of her face and the left eye were completely covered with blood and pus, so that we thought that she had lost the eye. When the wound was later washed, we noted that the eye was intact and that the lids had just become stuck together. On the way home, we took another group of three refugees with us. They first wanted to know, however, of what nationality we were. They, too, feared we might be Americans who had parachuted in. When we arrived in Nagatsuka, it had just become dark.

We took under our care fifty refugees who had lost their all. The majority of them were wounded and not a few had dangerous burns. Father Rektor treated the wounds as well as he could with the few medicaments that we could, with effort, gather up. He had to confine himself in general to cleansing the wounds of purulent material. Even those with the smaller burns are very weak and all suffered from diarrhea. In the farm houses in the vicinity, almost everywhere there were also wounded. Father Rektor made daily rounds and acted in the capacity of a painstaking physician and was a great Samaritan. Our work was, in the eyes of the people, a greater boost for Christianity than all our efforts during the preceding long years. Three of the severely burned in our house died within the next few days. Suddenly the pulse and respirations ceased. It is certainly a sign of our good care

that so few died. In the official aid stations and hospitals, a good third or half of those that had been brought in died. They lay about there almost without care, and a very high percentage succumbed. Everything was lacking; doctors, assistants, dressings, drugs, etc. In an aid station at a school at a nearby village, a group of soldiers for several days did nothing except to bring in and cremate the dead behind the school.

During the next few days, funeral processions passed our house from morning to night, bringing the deceased to a small valley nearby. There, in six places, the dead were burned. People brought their own wood and themselves did the cremation. Father Luhmer and Father Laures found a dead man in a nearby house who had already become bloated and who emitted a frightful odor. They brought him to this valley and incinerated him themselves. Even late at night, the little valley was lit up by the funeral pyres.

We made systematic efforts to trace our acquaintances and the families of the refugees whom we had sheltered. Frequently, after the passage of several weeks, some one was found in a distant village or hospital but of many there was no news, and these were apparently dead. We were lucky to discover the mother of the two children whom we found in the park and who had been given up for dead. After three weeks, she saw her children once again. In the great joy of the reunion were mingled the tears for those whom we shall not see again.

The magnitude of the disaster that befell Hiroshima on August 6th was only slowly pieced together in my mind. I lived through the catastrophe and saw it only in flashes, which only gradually were merged to give me a total picture. What actually happened simultaneously in the city as a whole is as follows: As a result of the explosion of the bomb at 8:15, almost the entire city was destroyed at a single blow. Only small outlying districts in the southern and eastern parts of the town escaped complete destruction. The bomb exploded over the center of the city. As a result of the blast, the small Japanese houses in a diameter of five kilometers, which comprised 99% of the city, collapsed or were blown up. Those who were in the houses were buried in the ruins. Those who were in the open sustained burns resulting from contact with the substance or rays emitted by the bomb. Where the substance struck in quantity, fires sprang up. These spread rapidly. The heat which rose from the center created a whirlwind which was effective in spreading the fire throughout the whole city. Those who had been caught beneath the ruins and who could not be freed rapidly and those who had been cut off by the flames, became casualties. As much as six kilometers from the center of the explosion, all houses were damaged and many collapsed and caught fire. Even fifteen kilometers away, windows were broken. It was rumored that the enemy fliers had first spread an explosive and incendiary material over the city and then had created the explosion and ignition. A few maintained that they saw the planes drop a parachute which had carried something that exploded at a height of 1,000 meters. The newspapers called the bomb an "atomic bomb" and noted that the force of the blast had resulted from the explosion of uranium atoms, and that gamma rays had been sent out as a result of this, but no one knew anything for certain concerning the nature of the bomb.

How many people were a sacrifice to this bomb: Those who had lived through the catastrophe placed the number of the dead at at least 100,000.

Hiroshima had a population of 400,000. Official statistics place the number who had died at 70,000 up to September 1st, not counting the missing . . . and 130,000 wounded, among them 43,500 severely wounded. Estimates made by ourselves on the basis of groups known to us show that the number of 100,000 dead is not too high. Near us there are two barracks, in each of which forty Korean workers lived. On the day of the explosion, they were laboring on the streets of Hiroshima. Four returned alive to one barracks and sixteen to the other. Six hundred students of the Protestant girls' school worked in a factory, from which only thirty to forty returned. Most of the peasant families in the neighborhood lost one or more of their members who had worked at factories in the city. Our next door neighbor, Tamura, lost two children and himself suffered a large wound since, as it happened, he had been in the city on that day. The family of our reader suffered two dead, father and son: thus a family of five members suffered at least two losses, counting only the dead and severely wounded. There died the Mayor, the President of the Central Japan district, the Commander of the city, a Korean prince who had been stationed in Hiroshima in the capacity of an officer, and many other high-ranking officers. Of the professors of the University, thirty-two were killed or severely injured. Especially hard hit were the soldiers. The Pioneer Regiment was almost entirely wiped out. The barracks were near the center of the explosion.

Thousands of wounded who died later could doubtless have been rescued had they received proper treatment and care, but rescue work in a catastrophe of this magnitude had not been envisioned; since the whole city had been knocked out at a blow, everything which had been prepared for emergency work was lost, and no preparation had been made for rescue work in the outlying districts. Many of the wounded also died because they had been weakened by under-nourishment and consequently lacked in strength to recover. Those who had their normal strength and who received good care slowly healed the burns which had been occasioned by the bomb. There were also cases, however, whose prognosis seemed good who died suddenly. There were also some who had only small external wounds who died within a week or later, after an inflammation of the pharynx and oral cavity had taken place. We thought at first that this was the result of inhalation of the substance of the bomb. Later, a commission established the thesis that gamma rays had been given out at the time of the explosion, following which the internal organs had been injured in a manner resembling that consequent upon Roentgen irradiation. This produces a diminution in the numbers of the white corpuscles.

Only several instances are known to me personally where individuals who did not have external burns later died. Father Kleinsorge and Father Cieslik, who were near the center of the explosion, but who did not suffer burns became quite weak some fourteen days after the explosion. Up to this time small incised wounds had healed normally, but thereafter the wounds which were still unhealed became worse and are to date (in September) still incompletely healed. The attending physician demonstrated a leucopenia. There thus seems to be some truth in the statement that the radiation had some effect on the blood. I am of the opinion, however, that their generally undernourished and weakened condition was partly responsible for these findings. It was also noised about that the ruins of the city emitted deadly rays and that many workers who went there to aid in the clearing died, and that the central district would be uninhabitable for some time to come. I have my

doubts as to whether such talk is true and myself and others who worked in the ruined area for some hours shortly after the explosion suffered no such ill effects.

None of us in those days heard a single outburst against the Americans on the part of the Japanese, nor was there any evidence of a vengeful spirit. The Japanese suffered this terrible blow as a part of the fortunes of war... something to be borne without complaint. During this war, I have noted relatively little hatred toward the Allies on the part of the people themselves, although the press has taken occasion to stir up such feelings. After the victories at the beginning of the war, the enemy was rather looked down upon, but when the Allied offensive gathered momentum and especially after the advent of the majestic B-29's, the technical skill of America became an object of wonder and admiration. The following anecdote indicates the spirit of the Japanese: A few days after the atomic bombing, the secretary of the University came to us asserting that the Japanese were ready to destroy San Francisco by means of an equally effective bomb. It is dubious that he himself believed what he told us. He merely wanted to impress upon us foreigners that the Japanese were capable of similar discoveries. In his nationalistic pride, he talked himself into believing this. The Japanese also intimated that the principle of the new bomb was a Japanese discovery. It was only lack of raw materials, they said, which prevented its construction. In the meantime, the Germans were said to have carried the discovery to a further stage and were about to initiate such bombing. The Americans were reputed to have learned the secret from the Germans, and they had then brought the bomb to a stage of industrial completion.

We have discussed among ourselves, the ethics of the use of the bomb. Some consider it in the same category as poison gas and were against its use on a civil population. Others were of the view that in total war, as carried out in Japan, there was no difference between civilians and soldiers, and that the bomb itself was an effective force tending to end the bloodshed, warning Japan to surrender and thus to avoid total destruction. It seems logical to me that he who supports total war in principle cannot complain of a war against civilians. The crux of the matter is whether total war in its present form is justifiable, even when it serves a just purpose. Does it not have material and spiritual evil as its consequences which far exceed whatever the good that might result? When will our moralists give us a clear answer to this question?

Fig. 1--(3H). Hiroshima: general view from South by airplane--before bomb. (Photo File #HB 131.)

Fig. 2--(3H). View of Hiroshima before the bombing. Firebreaks are indicated by the cleared areas that course transversely across the islands, just above the center, and elsewhere. (Photo File #HB 132a.)

Fig. 3--(3H). View of Hiroshima after the bombing. (Photo File #HB 132b.)

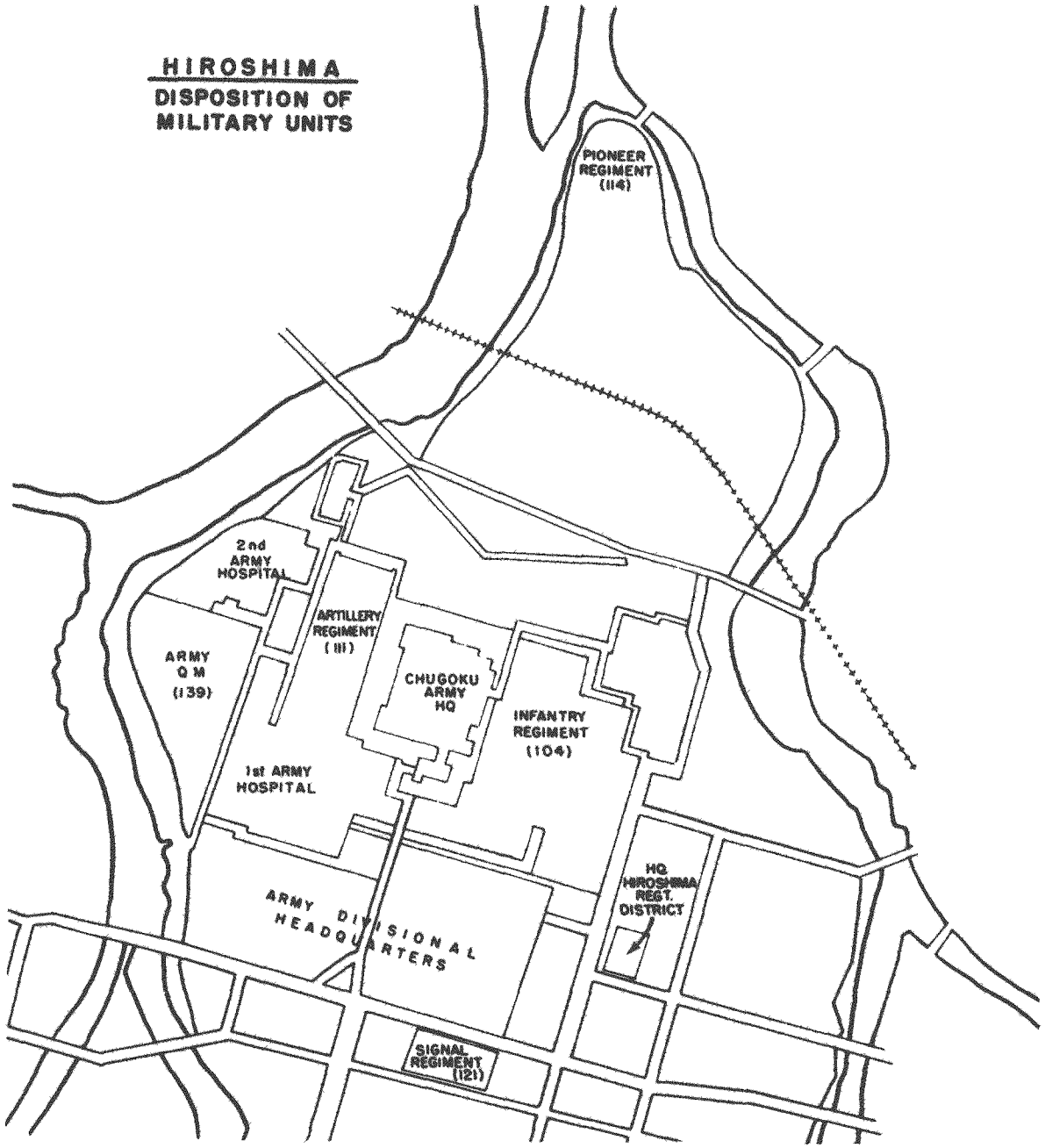


Fig. 4--(3H). The point above which the bomb exploded is just below and to the left of the entrance to the divisional Hq. Many of the patients who died of radiation effects came from the 104th Infantry Regiment. The appearance of the 2nd Army Hospital after the bombing is shown in figure 29. Hiroshima castle which stood at the far left corner of the moated area is shown in figure 22. A concrete underground shelter here is depicted, and the casualties therein are discussed in Section 11H. (Photo File # HG 269.)

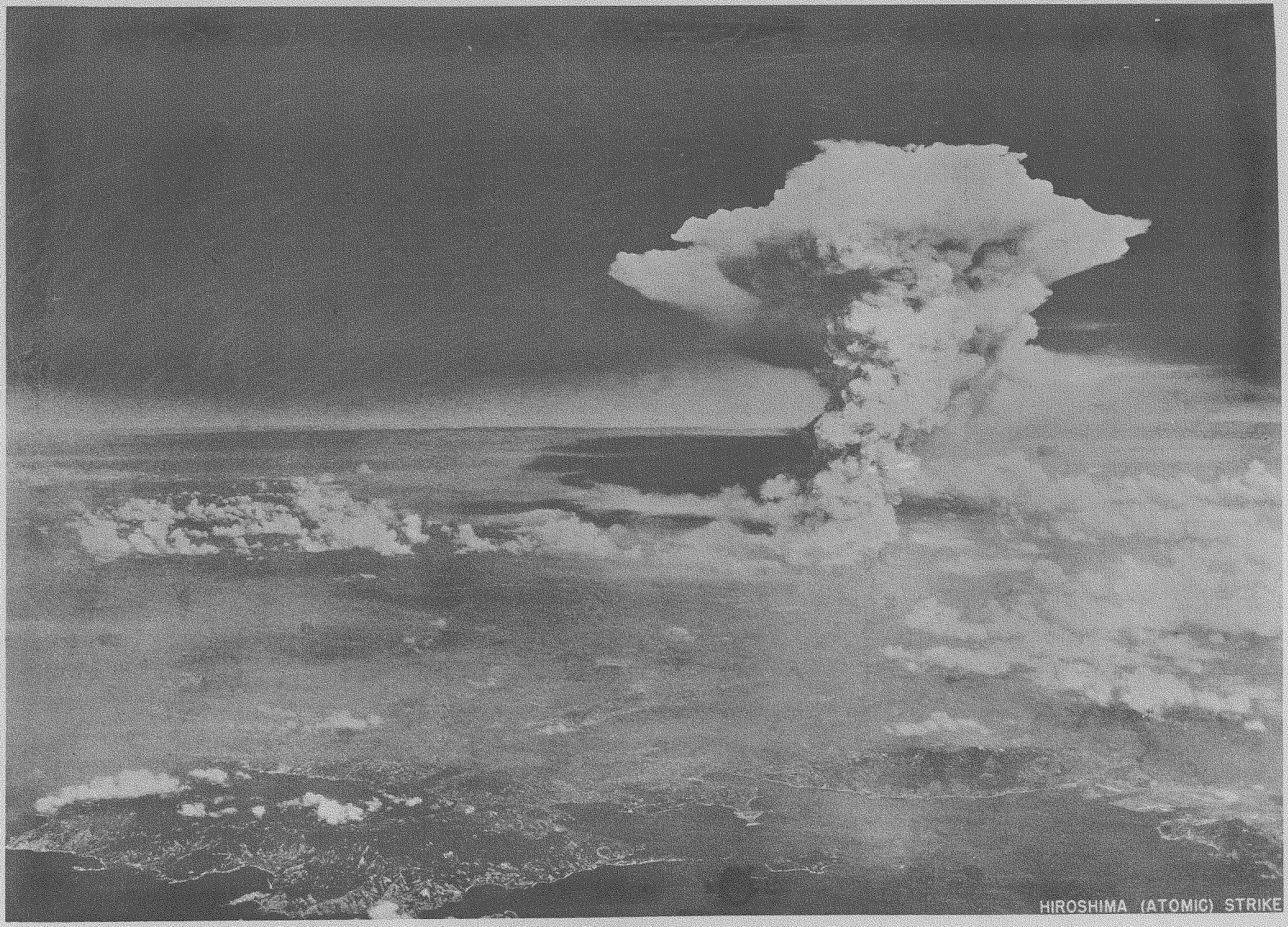


Fig. 5--(3H). The black shadow cast by the umbrella of cloud resulting from the bombing is clearly shown. (Photo File # HG 273.)

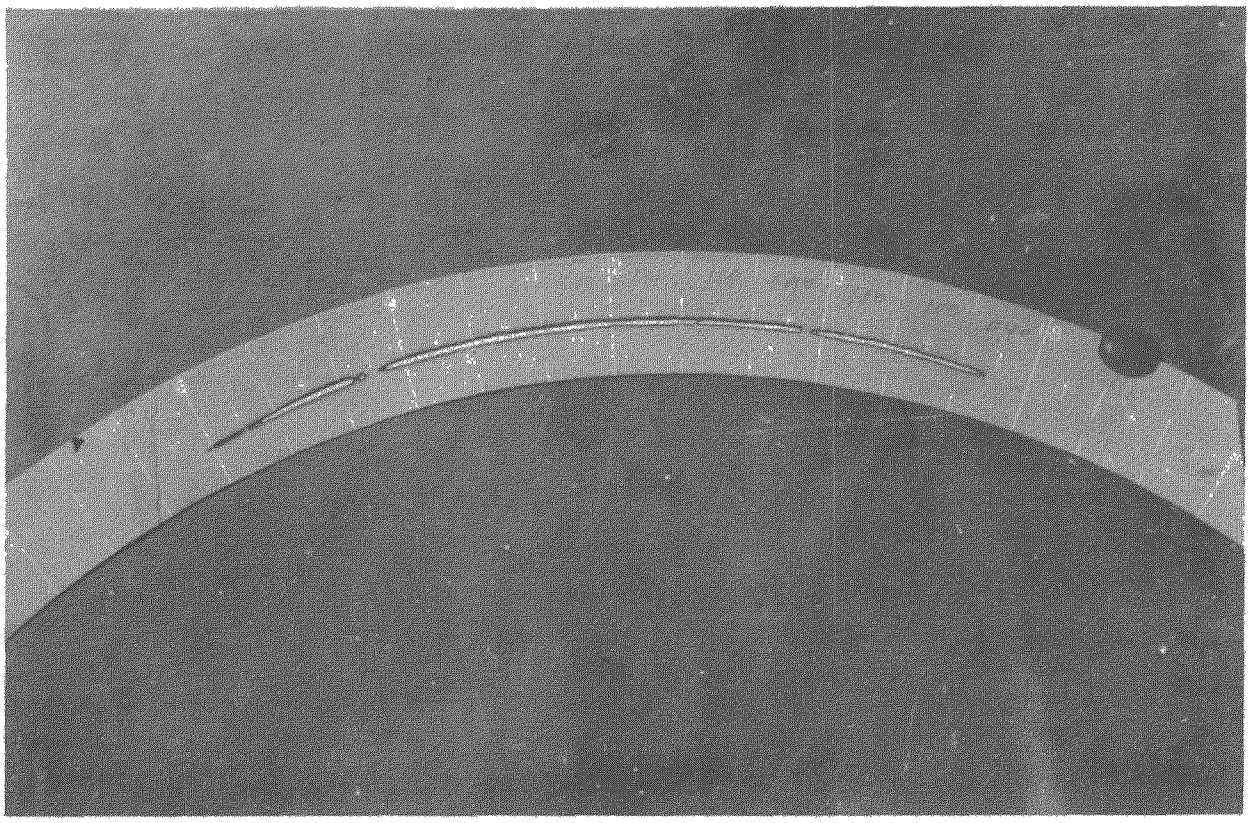


Fig. 6--(3H). Record of sunshine at Hiroshima Meteorological Observatory. Note that space at left indicates time when bomb dropped. This space resulted from a mass of clouds which darkened the sky from the sun's rays at 8:15 A. M. The sun coming out again, approximately 25 minutes later, further burned its track into the paper. (Photo File #HH 180.)

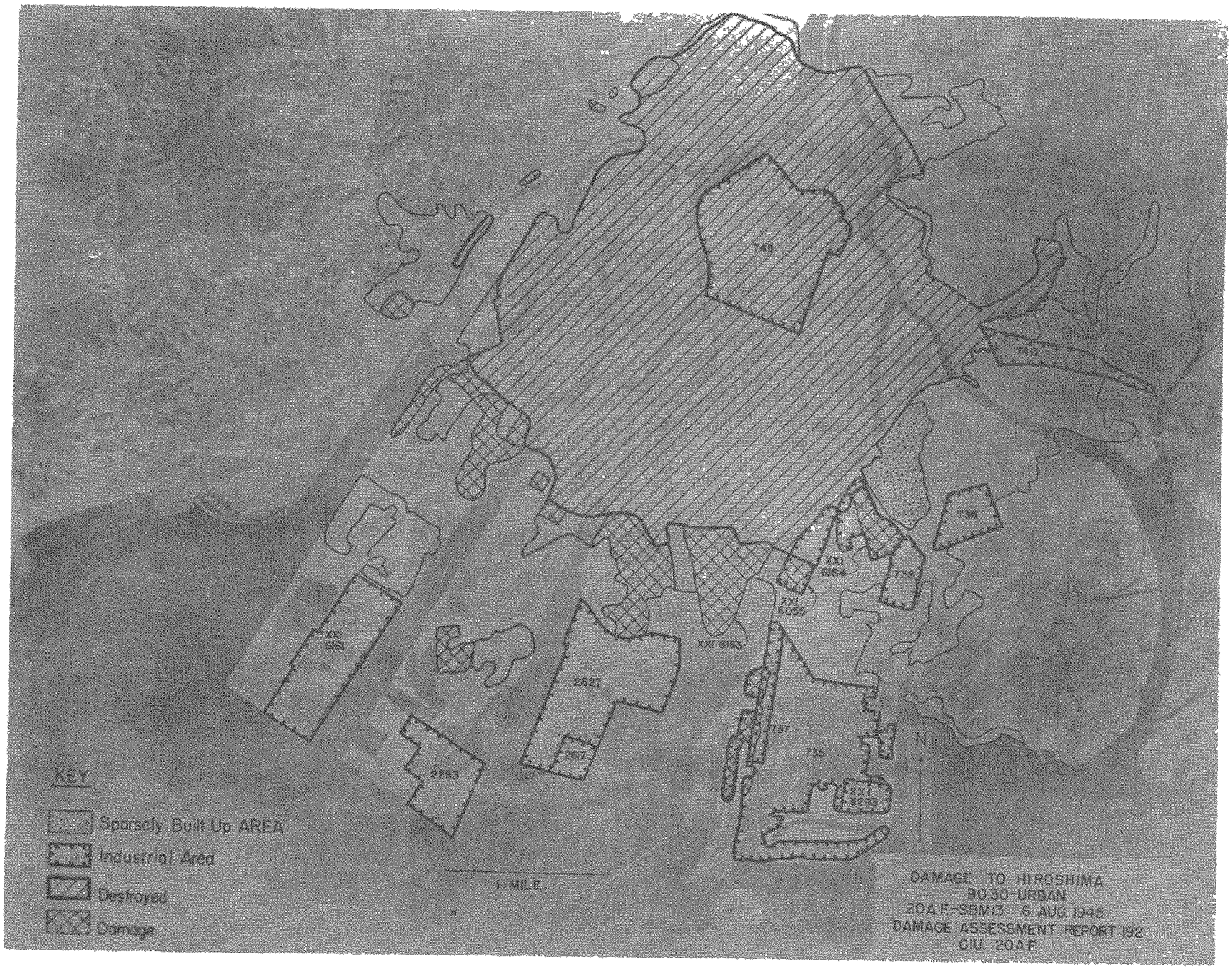
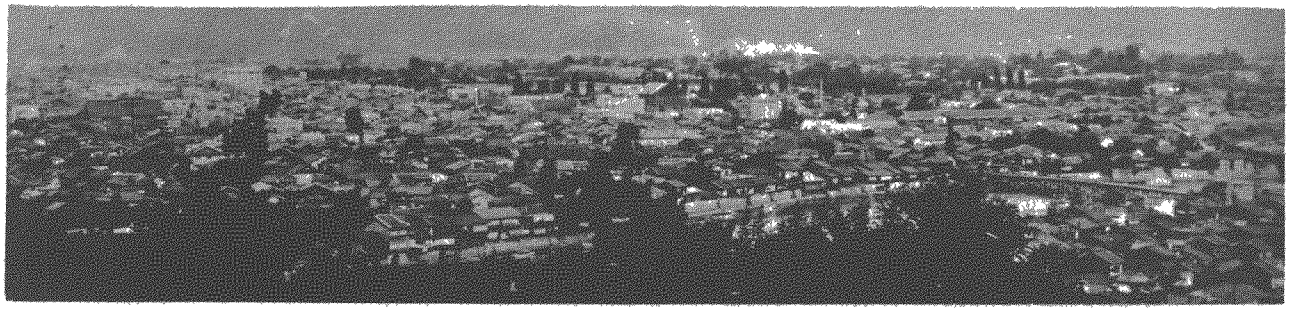


Fig. 7--(3H). (Photo File # HG 272.)



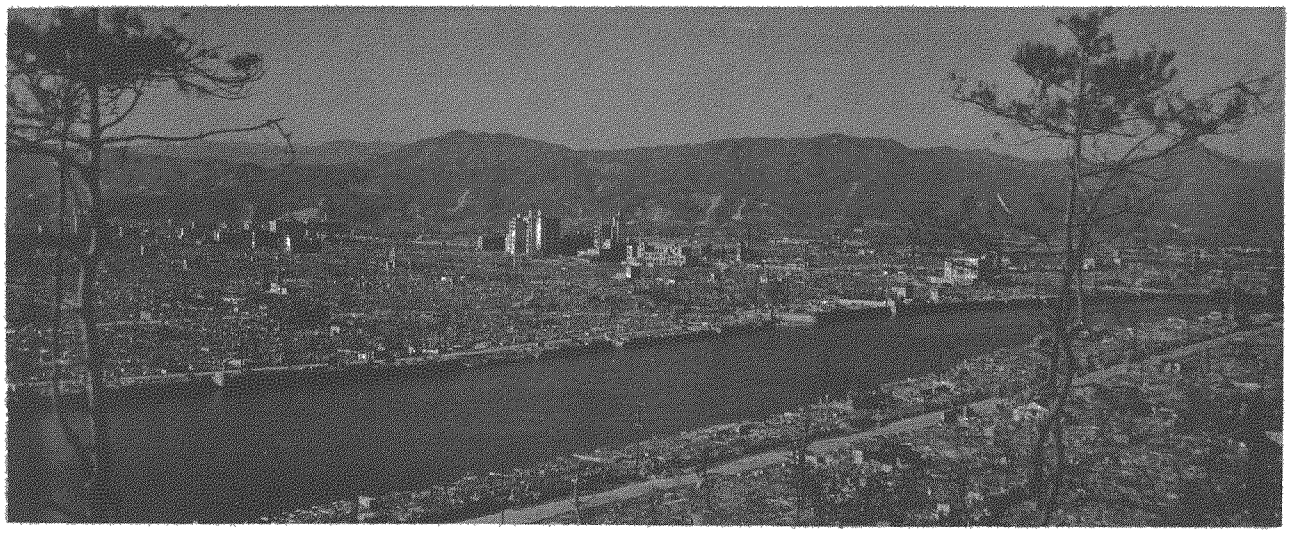


Fig. 8 a, b--(3H). Hiroshima, general view of the city before and after bombing, as seen from Hijiyama (2200 meters). First photo made before 1935. All wooden houses in the central area destroyed by fire following their collapse. (Photo File #HB 100 a, b.)

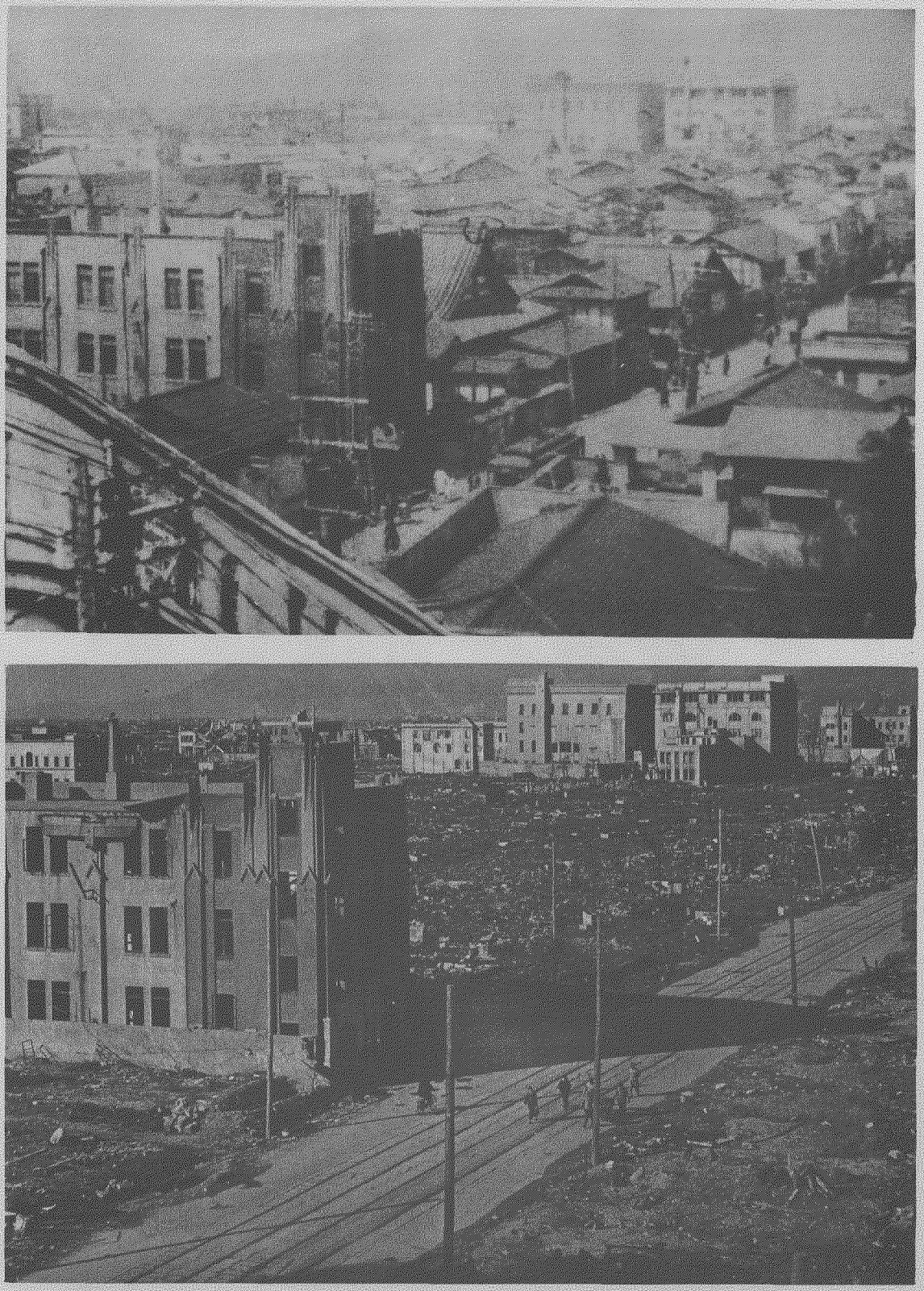


Fig. 9 a, b--(3H). Rear view of Geibi and Sumitomo Buildings before and after bombing. Taken from Fukuya Department Store (700 meters) looking toward center. Complete destruction of wooden buildings by blast and fire. Concrete structures stand. Note that parapet of the ecclesiastical structure in the foreground has fallen away from the center of the blast on the far side. The proximal parapet stands. This is probably the result of a blast reflection phenomenon. (See text.) (Photo File # HB 111a, b.)

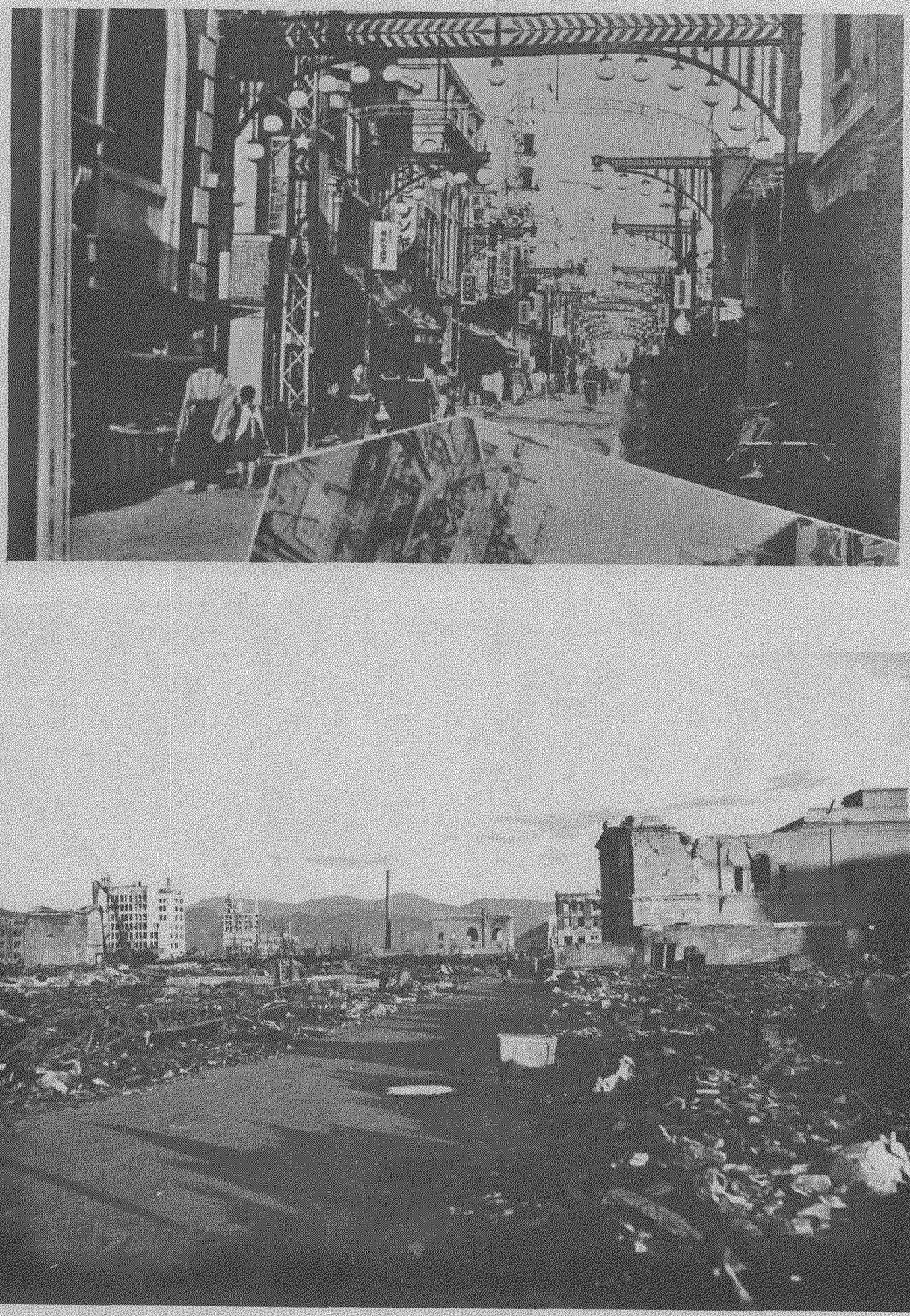


Fig. 10 a, b--(3H). Komiya Street (750 meters) before and after bombing. The archlike heavy lamp posts have fallen. One lies at the left of the lower photograph. (Photo File # HB 117 a, b.)

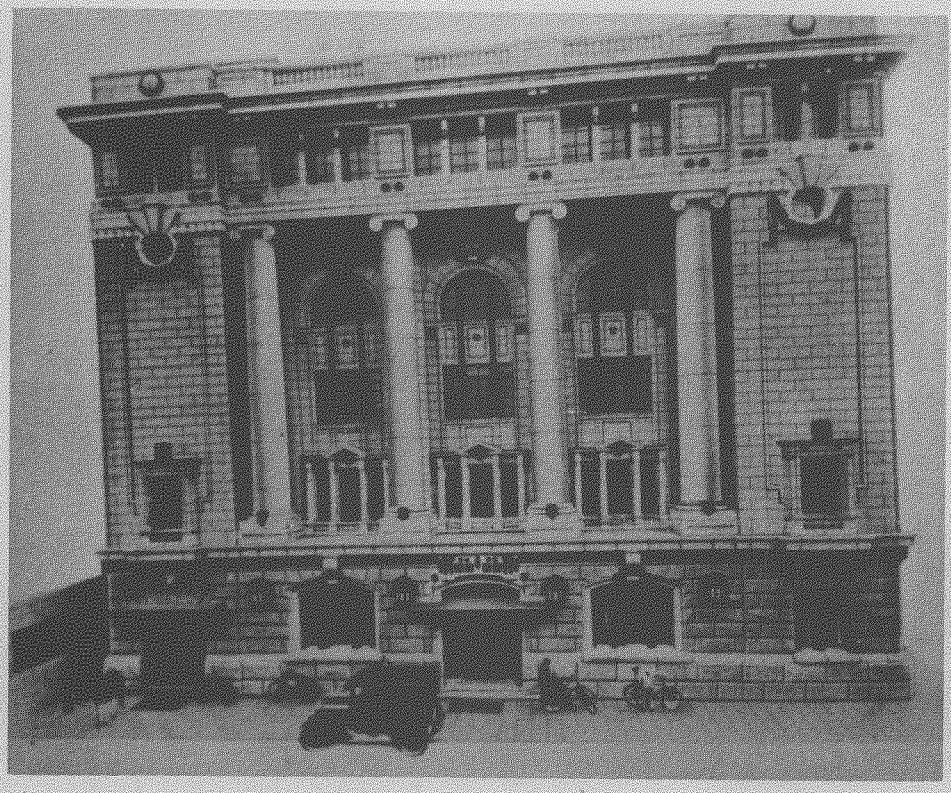


Fig. 11 a, b--(3H). Geibi Bank (250 meters) before and after bombing. This massive reinforced concrete structure withstood the blast but was swept by fire. (Photo File # HB 106 a, b.)

Fig. 12 a, b--(3H). Hiroshima Railroad Station (1800 meters) before and after bombing. Structure stands, but roof has collapsed (see figure 12 c). (Photo File # HB 105 a, b.)

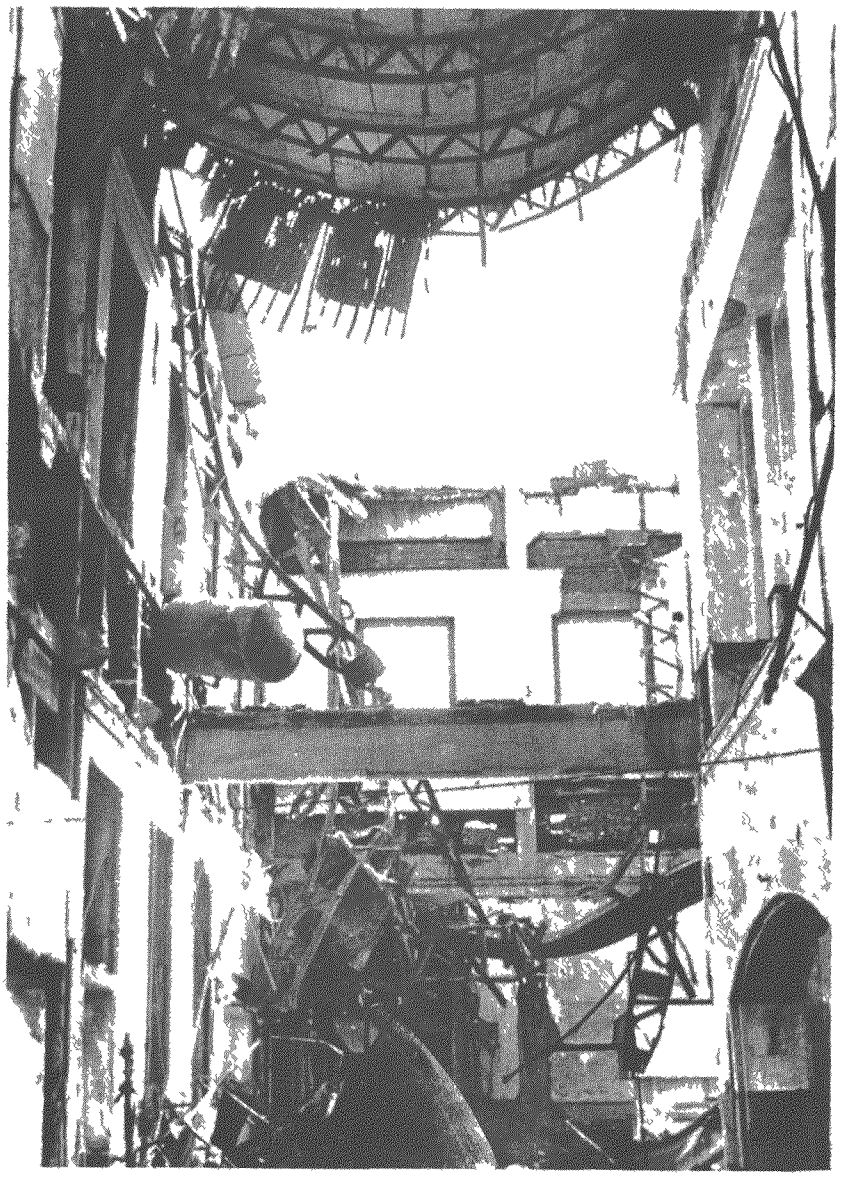


Fig. 12 c--(3H). View of interior of Hiroshima Station (1800 meters). Despite the apparently well-preserved appearance of this massive reinforced concrete structure tremendous damage has been done to the interior. (Photo File # HB 408.)

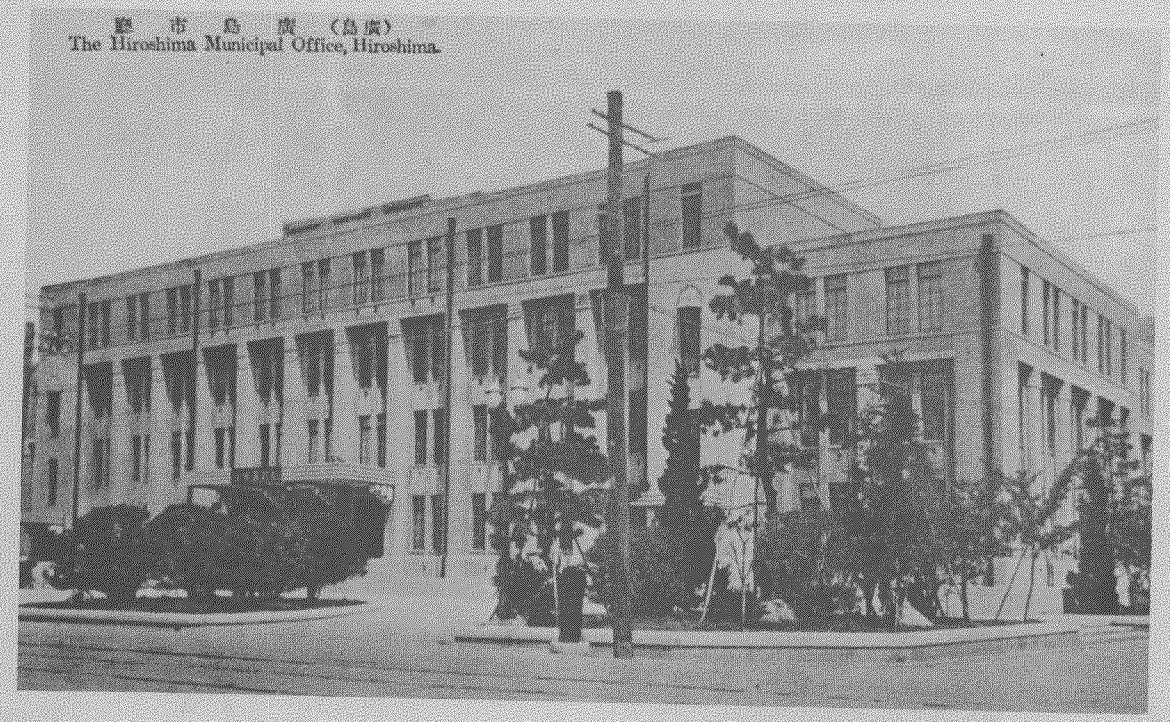


Fig. 13 a, b--(3H). Municipal Office (City Hall) (1100 meters) before and after the bombing. The "fire-proof" building has not suffered structural damage from blast, but suffered a disastrous fire. (Photo File # HB 102 a, b).

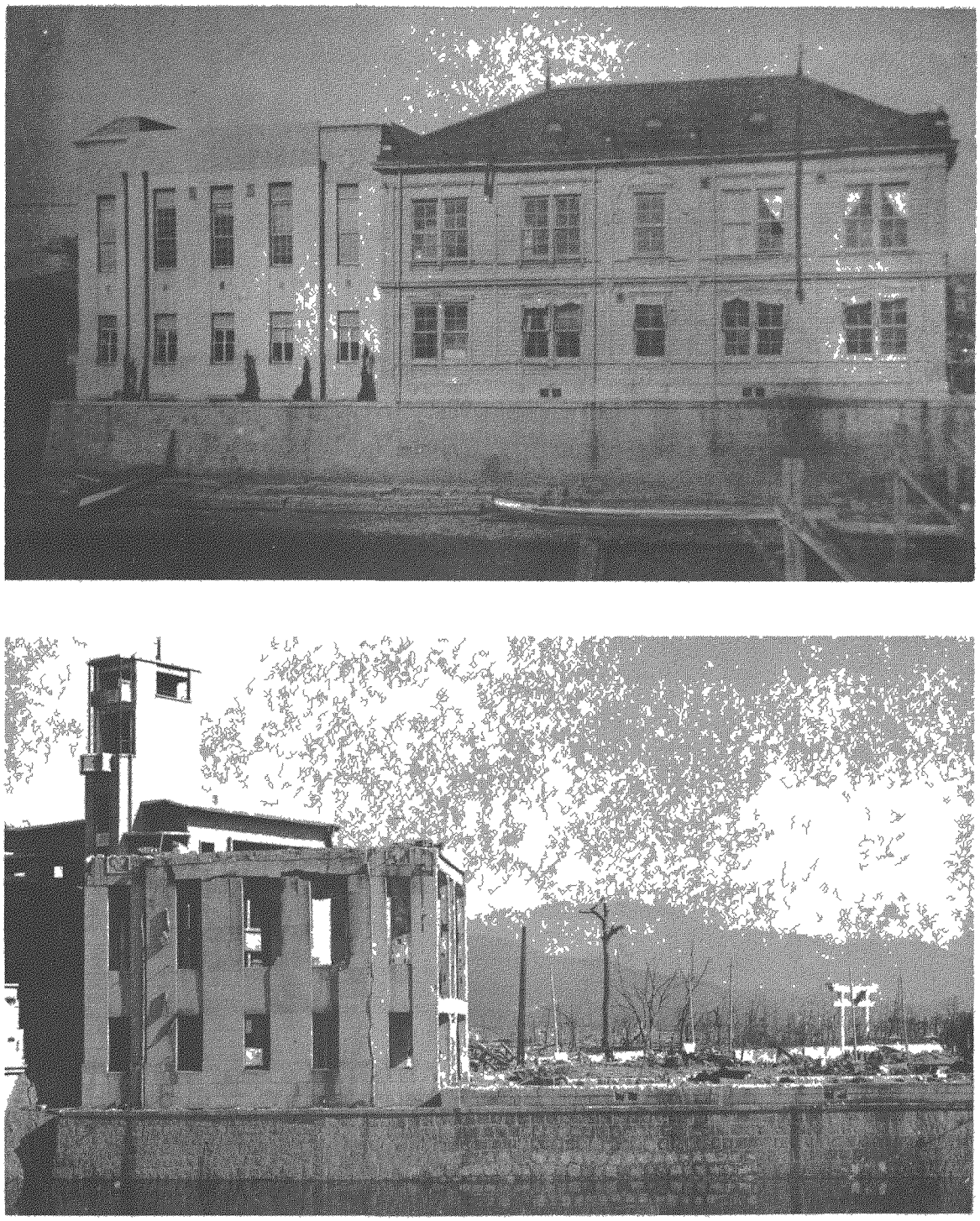


Fig. 14 a, b--(3H). Chamber of Commerce (300 meters) before and after the bombing. Complete destruction of the wooden building. Severe damage to the concrete structure. A new building ("Business-men's Club") has been constructed in the interval between the two photographs and looms at the rear. (Photo File # HB 115 a, b.)

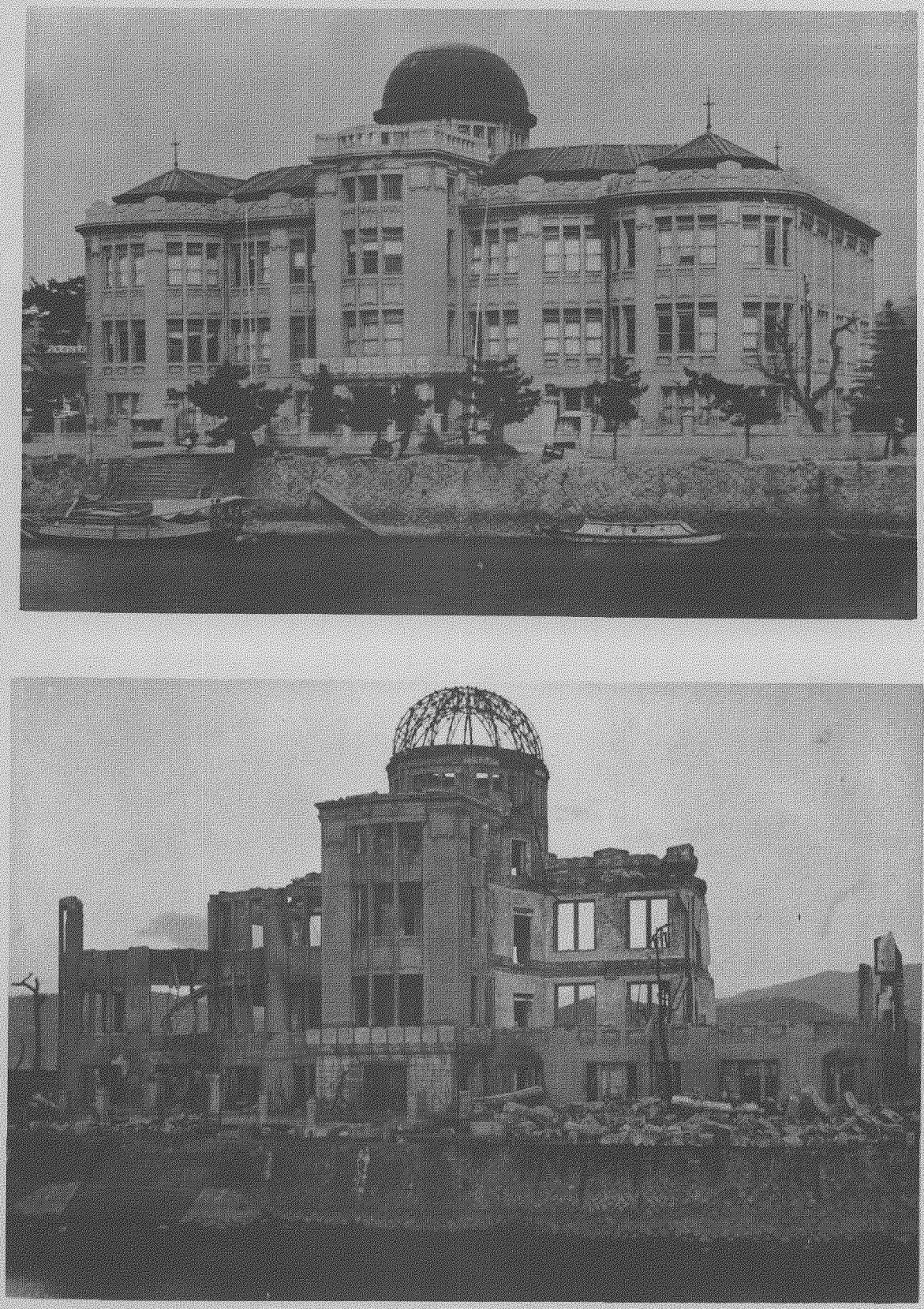


Fig. 15 a, b--(3H). Commercial Museum (300 meters) before and after bombing. Collapse of massive brick and reinforced concrete walls. (Photo File # HB 118 a, b.)

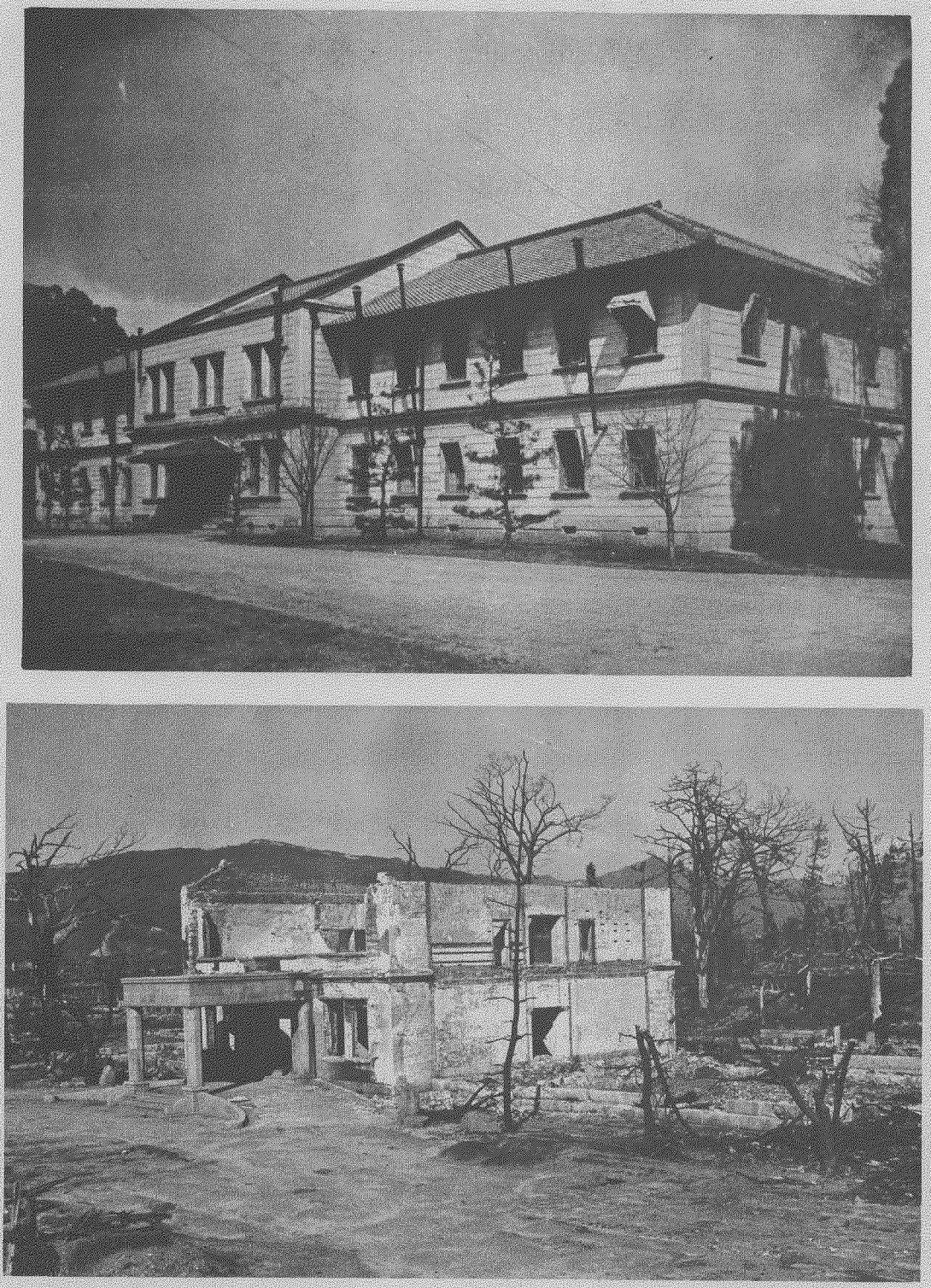


Fig. 16 a, b--(3H). Hqs. Chogoku Army (800 meters) before and after bombing. (A portico has been added since the first photograph). The wooden wings have collapsed and burned. The brick central section has partly collapsed. (Photo File # HB 113 a, b.)

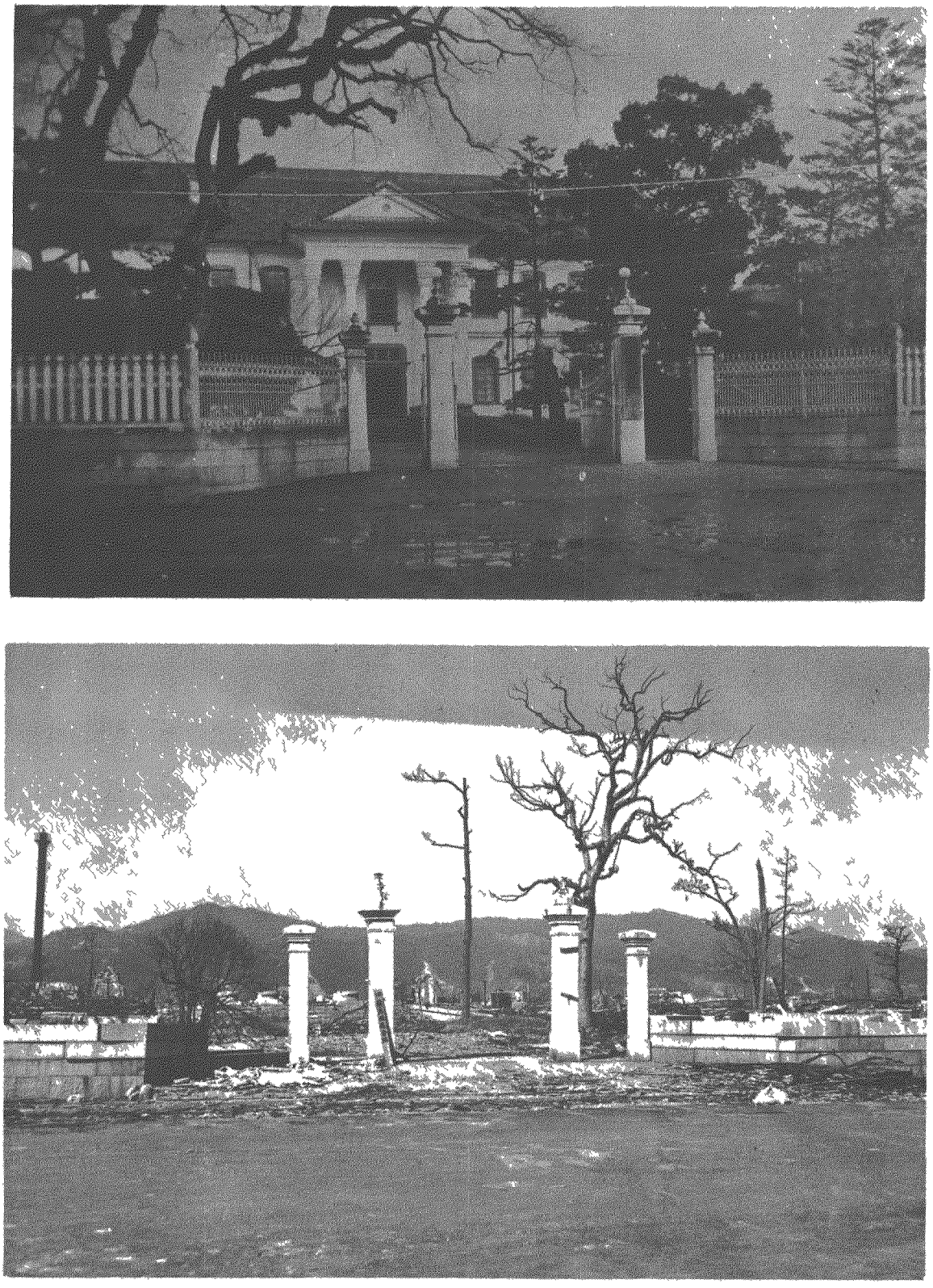


Fig. 17 a, b--(3H). Prefectural Office (900 meters) before and after bombing. The wooden structure has collapsed and burned. Note displacement of the heavy granite blocks of the wall. (Photo File # HB 112 a,b.)

Fig. 18--(3H). Panoramic view of Hiroshima taken within 50 meters of the point above which the bomb exploded. There is some overlap of adjacent views. (Photo File # HG 100-109.)

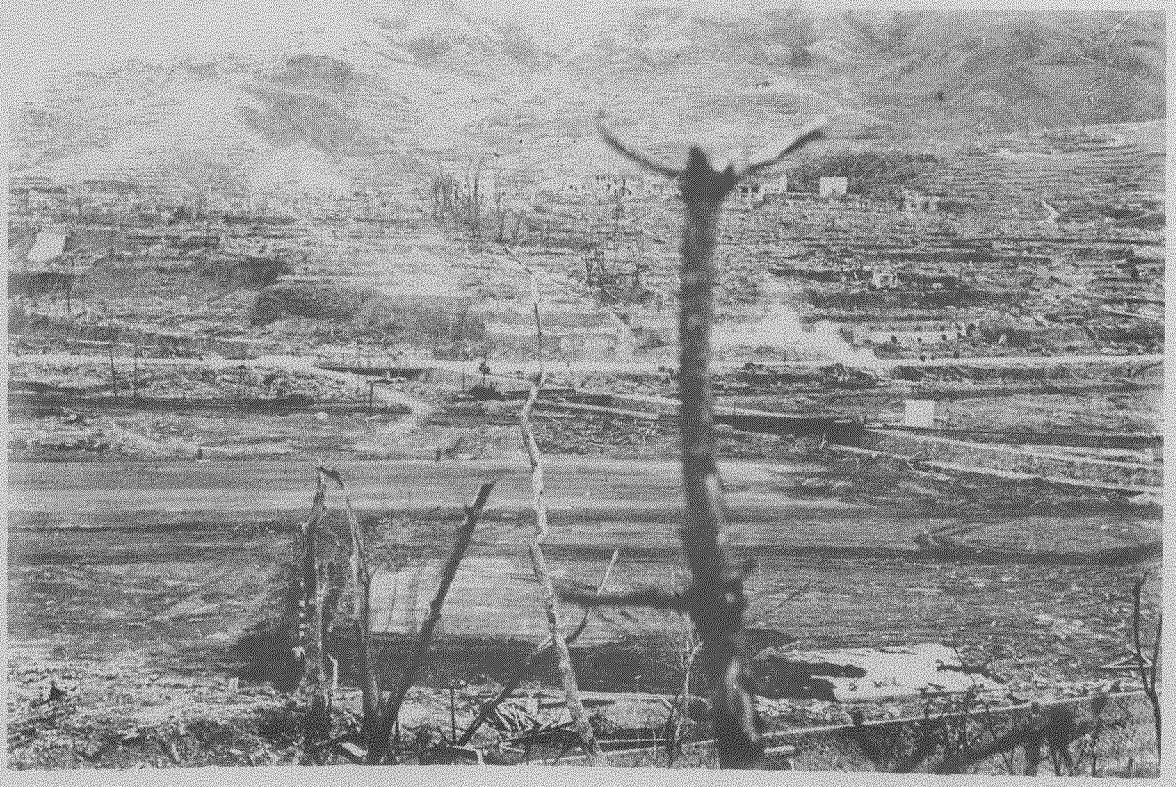


Fig. 19--(3H). "Mass distortion" of a steel-framed factory shed (600 meters). The entire building leans away from the center of the explosion. The metal sides have been crushed against the frame like paper blowing in the wind. (Photo File # HB 415.)

Fig. 20--(3H). Houses destroyed at Higashi-ura, Dunbara (2,000 meters). This area was partly protected from blast by Mount Hiji. The collapsed structures in the foreground represent the appearance of the city after the blast and before it was reached by the flames. The heavy tree beams were responsible for trapping many persons who were subsequently burned to death by the uncontrollable fires. (Photo File # HB 451.)

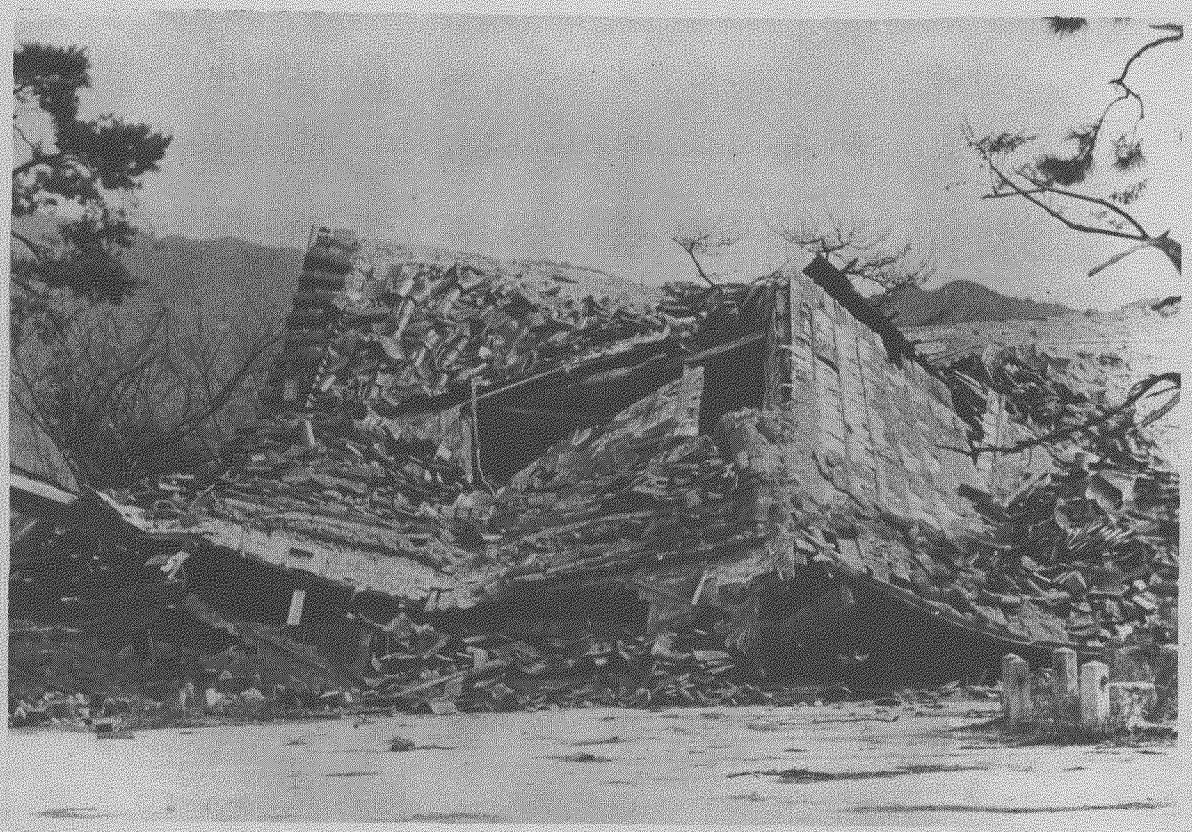


Fig. 21--(3H). A typical Japanese building at Hijiyama (1800 meters). The great longitudinal tree beam that supported the roof can be seen. The heavy pantiles are also visible. (Photo File # HG 411.)

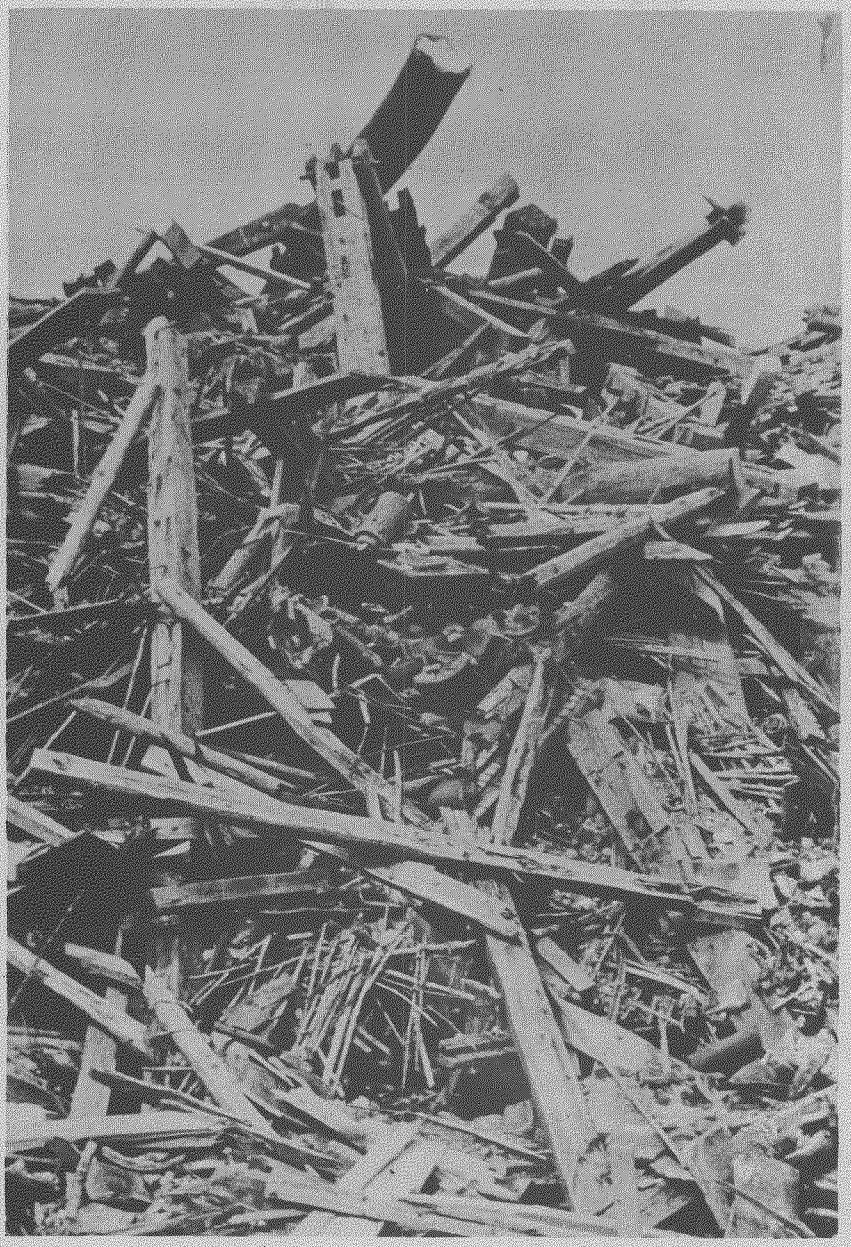


Fig. 22--(3H). Ruins of Hiroshima Castle (900 meters). Appearance of a large building of native construction, collapsed by blast but spared from fire. (Photo File # HB 414.)

Fig. 23--(3H). The Hiroshima Gas Company Building (200 meters). Collapse of brick-faced, reinforced concrete wall. Columns still stand. (Photo File # HB 421.)

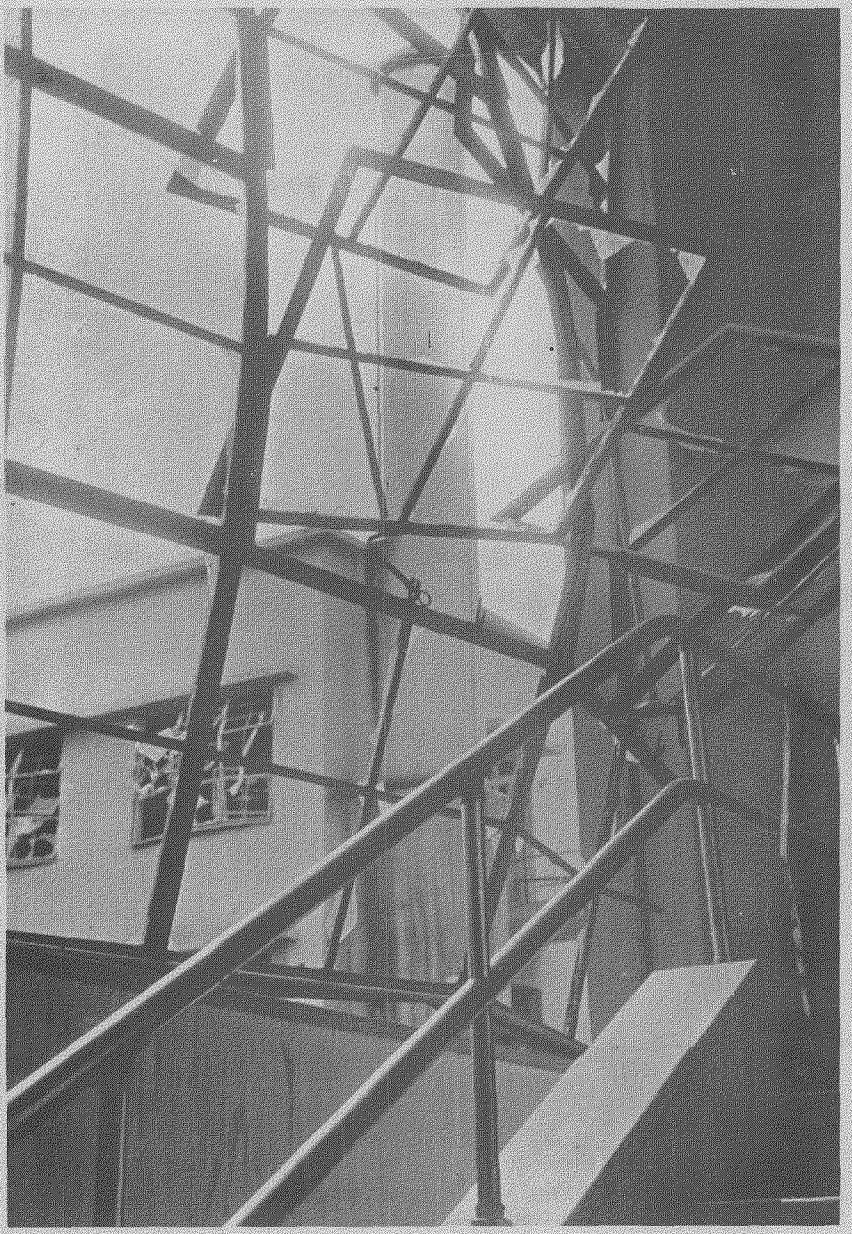


Fig. 24--(3H). Broken window frames at the Japan Red-Cross Hospital, Hiroshima (1600 meters). Direction of pressure wave indicated by bulging of the window frames. Note jagged fragments of glass that produced many of the injuries, particularly in these concrete buildings. (Photo File # HH 109.)

Fig. 25--(3H). Brick building with load-bearing walls. Shima Hospital. This structure was within 50 meters of the point above which the bomb exploded. Note the huge lethal fragments in which the building has collapsed. There were no survivors. (Photo File # HB 424.)

Fig. 26--(3H). An air raid shelter of excavated, timber-supported, board-roofed, and dirt-covered construction remains intact amid the surrounding devastation (1100 meters). These shelters were almost deserted at the moment of explosion. After the bombing they served as temporary housing. (Photo File # HH 157.)

Fig. 27--(3H). Red Cross Hospital (1600 meters). Damage to sterilizing equipment. (Photo File # HH 237.)

Fig. 28--(3H). Asano Park, a famous garden of Hiroshima. Many took refuge here after the bombing. (See Father Siemes eye-witness account in Appendix 1, this section.) (Photo File # HH 228.)

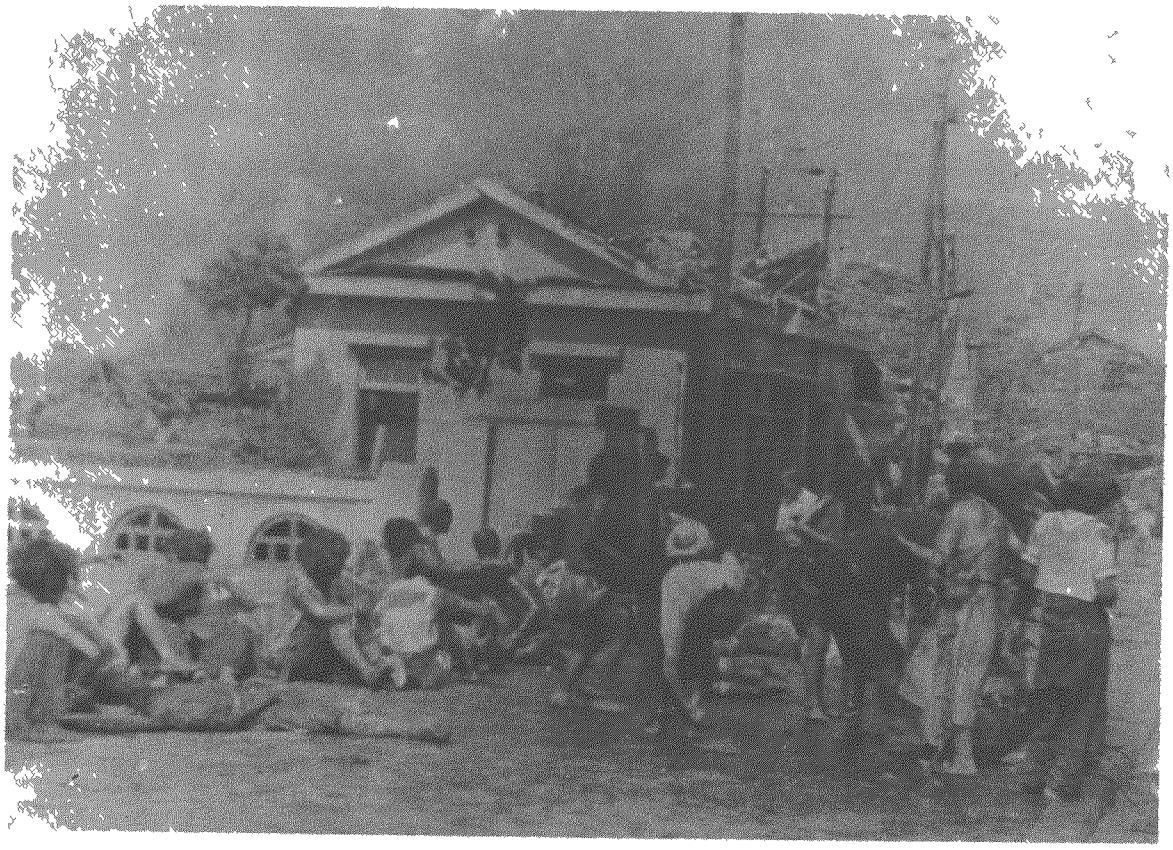


Fig. 29a--(3H). The injured awaiting first aid treatment in Hiroshima soon after the bombing. (Photo File # HH 100.)

Fig. 29b--(3H). Ruins of First Army Hospital (500 meters) after the blast and fire. (Photo File # HH 186.)

Fig. 30--(3H). Ninoshima Island (8000 meters). Many patients were ferried across the bay and treated at the Quarantine Station here. (Photo File # HH 250.)

Fig. 31--(3H). Ninoshima Hospital and Quarantine Station. (Photo File # HH 254.)

Fig. 32--(3H). Ninoshima Quarantine Station - general view. (Photo File # HH 252.)

Fig. 33--(3H). Grave posts of the dead, buried near the Quarantine Station on Ninoshima Island. More than 1,000 persons died here and were buried on the island. (Photo File # HH 256.)

Fig. 34--(3H). Surgical Treatment Room, Department of Communications, Post Office Hospital. (Photo File # HH 194.)

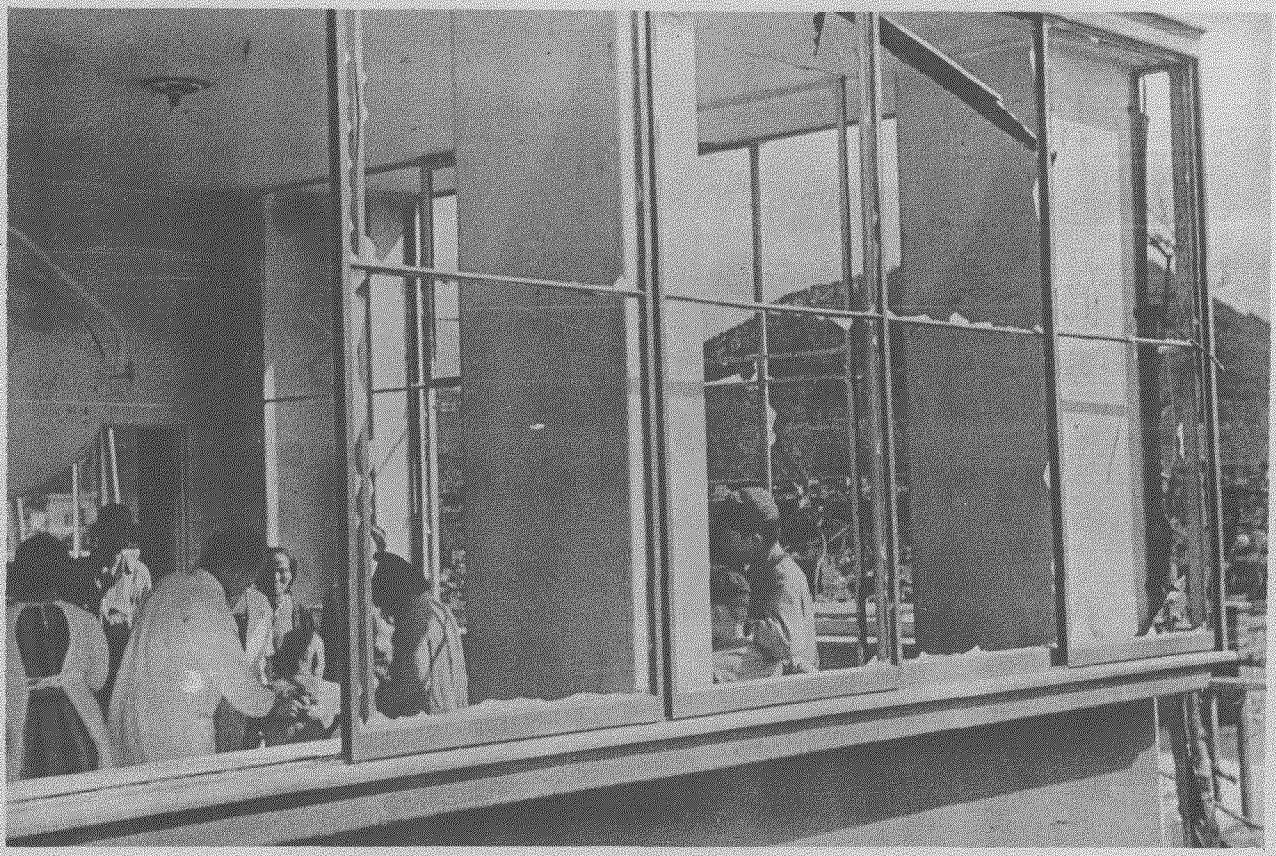


Fig. 35--(3H). The Operating Room of the Communications Department Hospital. The room is practically out-of-doors. The fixtures are non-functional. This room could be used only as a dressing station for many weeks. (Photo File # HH 192.)

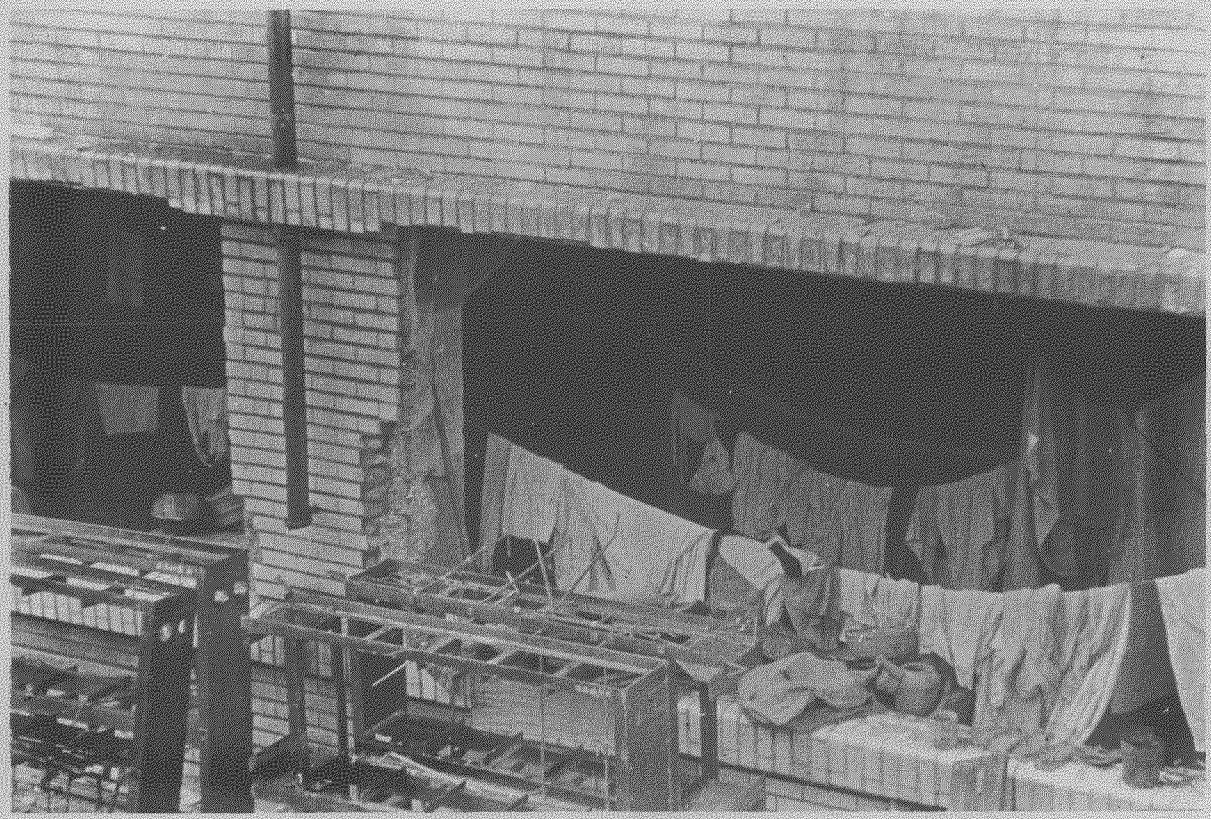


Fig. 36--(3H). Department of Communications Building. Cooking utensils are brought into the hospital with the patient. Cooking and feeding are done by his family. (Photo File # HH 190.)

Fig. 37--(3H). Communications Department Hospital. Temporary morgue constructed out of scrap material by Assistant Professor Tamagawa of Okayama University. (Photo File # HH 203.)

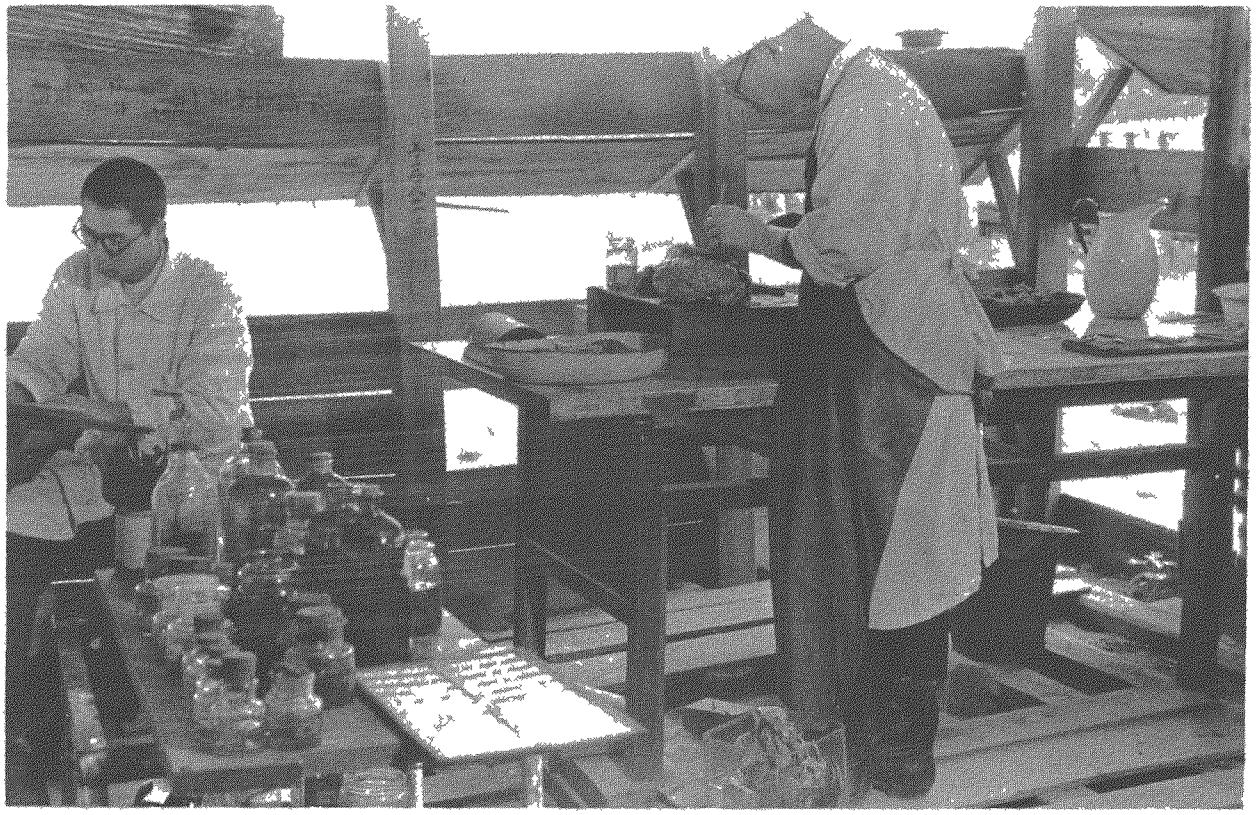


Fig. 38--(3H). Communications Department Hospital Morgue. Professor Tamagawa performed the first necropsy on a patient from this hospital here on 29 August 1945. (Photo File # HH 204.)

Fig. 39--(3H). The Japan Red Cross Hospital, Hiroshima (1600 meters). (Photo File # HH 104.)

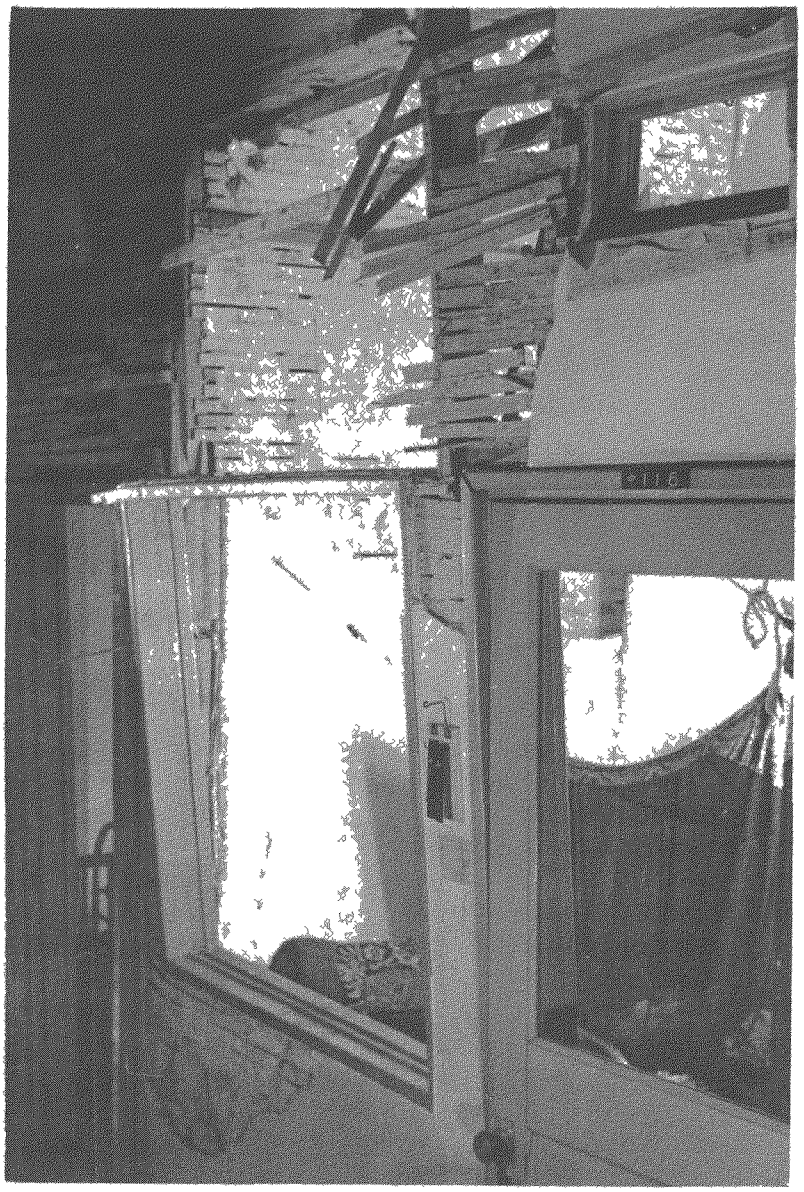


Fig. 40--(3H). Sick-room of the Japan Red Cross Hospital. Damage to windows and partitions. Note the highly inflammable lathwork used in the "fire-proof" building. (Photo File #HH 110.)

Fig. 41--(3H). Red Cross Hospital, Treatment Room. (Photo File #HH 122.)

Fig. 42--(3H). Red Cross Hospital, Surgical Treatment Room. (Photo File # HH 124.)

Fig. 43--(3H). Osiba Relief Hospital (2500 meters), formerly a Primary School. (Photo File # HH 214.)

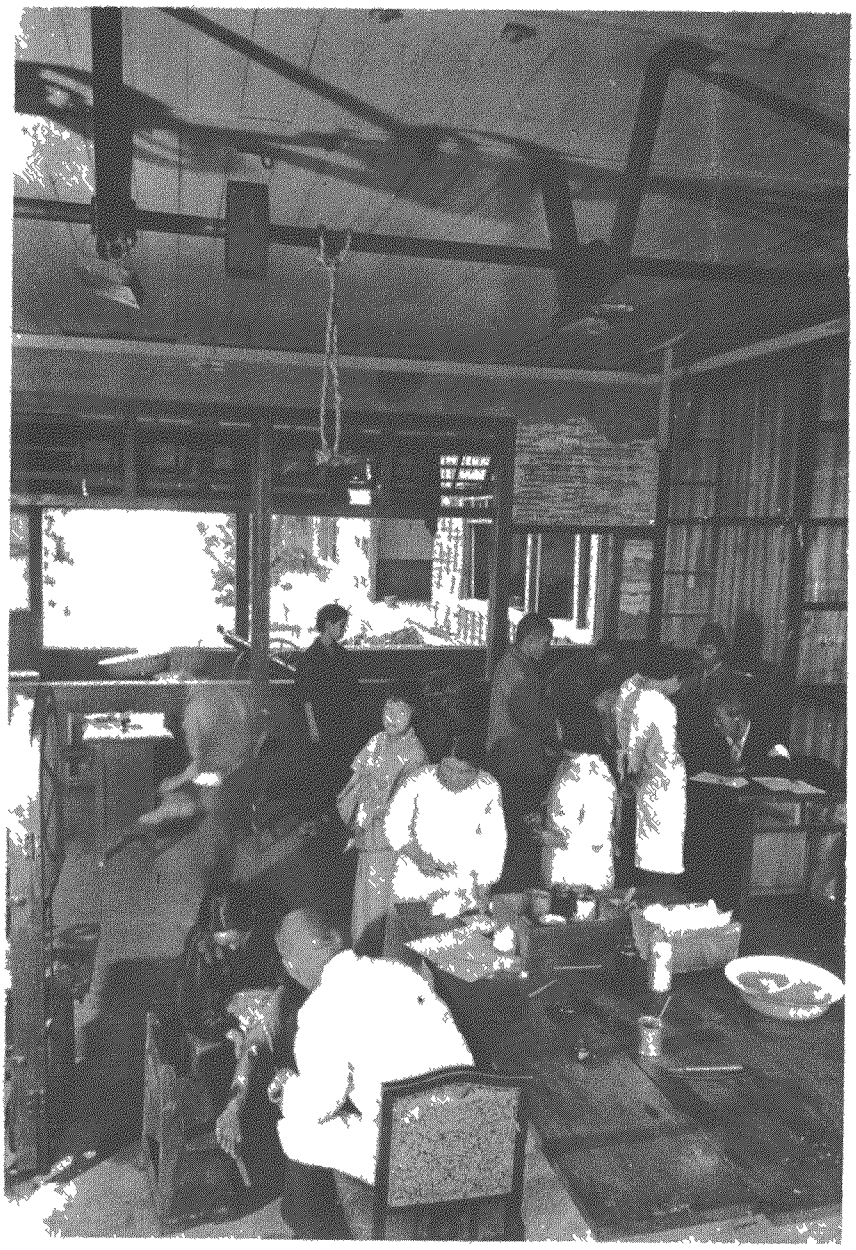


Fig. 44--(3H). Osiba Relief Hospital. Treatment Room. (Photo File # HH 216.)

Fig. 45--(3H). Patient's room. The two patients in the foreground are mother and daughter. A member of the family and a nurse are present. Much of the nursing care was administered by the patients' families who stayed with the patients. (Photo File # 217.)

Fig. 46--(3H). Osiba Primary School Relief Hospital. Patient brought to relief station by hand cart. Many of these conveyances were used to transport the injured immediately following the explosion and thereafter. (Photo File # HH 221.)

Fig. 47--(3H). Fukuromachi School (700 meters). This building, not far from the center of the explosion, was one of the few left standing in the area. It was put to immediate use as an aid station. Note mats used for shelter. (Photo File # HH 207.)

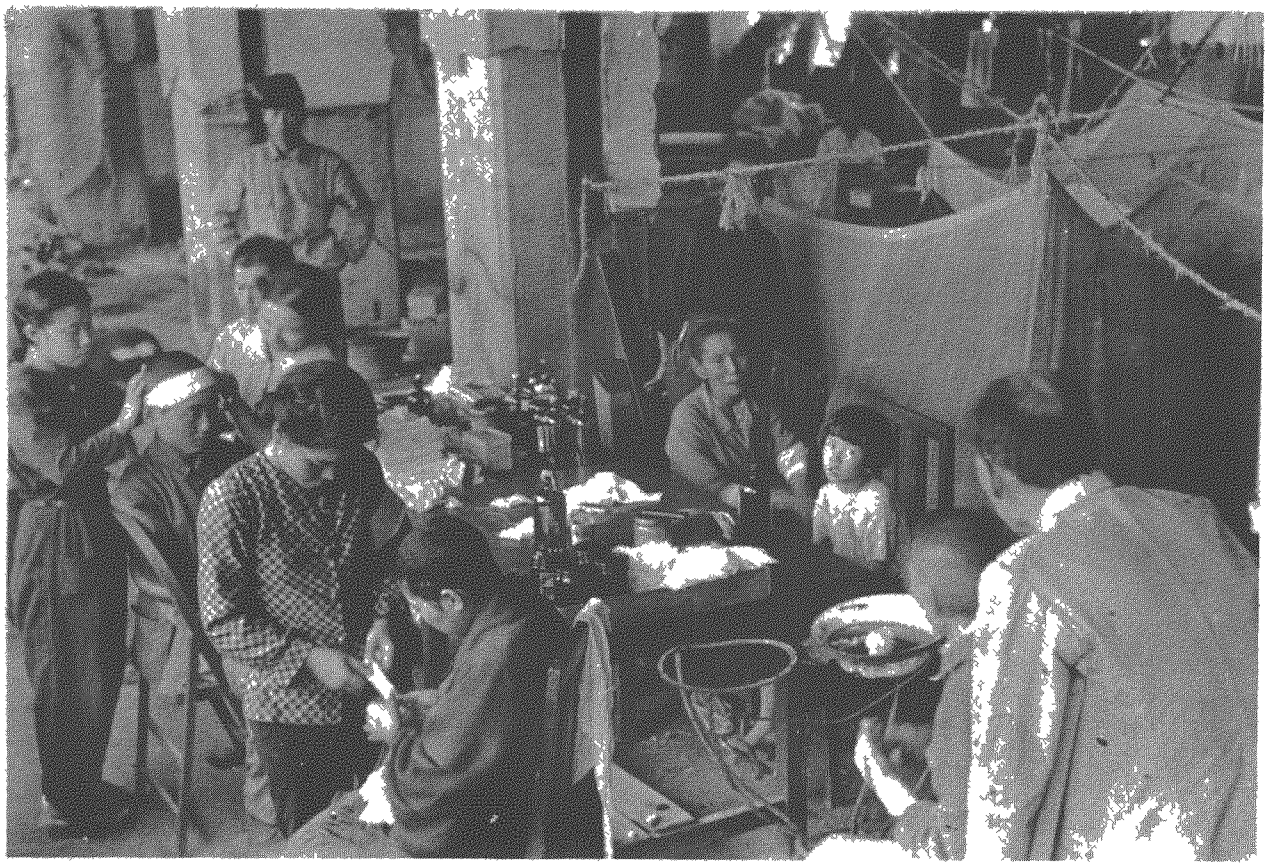


Fig. 48--(3H). Fukuromachi Relief Station. Outpatients' Clinic in fore ground. At rear are inpatients' quarters under mosquito netting. (Photo File # HH 210.)

Fig. 49--(3H). Kusatsu Primary School, Temporary Hospital (5000 meters). Necropsy Room was formerly storeroom in corner of the school grounds. The first necropsy was performed here 8 October 1945. (Photo File # HH 222.)

Fig. 50--(3H). Professor Araki of Kyoto Prefectural Hospital performing necropsy upon patient Kuma Udagamwa, age 78. (Key #80 in U. S. Army Institute of Pathology Series). 13 October 1945. (Photo File # HH 223.)

Fig. 51--(3H). Second Hiroshima Military Hospital. This hospital was set up by the 2nd Provisional Fukuoka Army Hospital which was despatched into the city. Appalling conditions of crowding prevail. A nurse is ministering to the injured. Mask dressings have been applied to burned faces. There is no evidence of intravenous fluid therapy. (Photo File # HH 138.)

Fig. 52--(3H). Second Hiroshima Military Hospital (see preceding Figure 51). The man in the foreground has sustained burns of the face and hands. Clothing apparently protected the remainder. Simple dressings have been applied to the face and hands. (Photo File # HH 137.)

Fig. 53--(3H). Sign reads: "Moxa Cautery for treatment of A-Bomb symptoms--Kawano Cauterizers." This resin-like material was burned on the skin for its "tonic" effect. (Photo File # HH 240.)

Fig. 54--(3H). Bulletins written on walls of the Fukuromachi Relief Hospital. (Photo File # HH 241.)

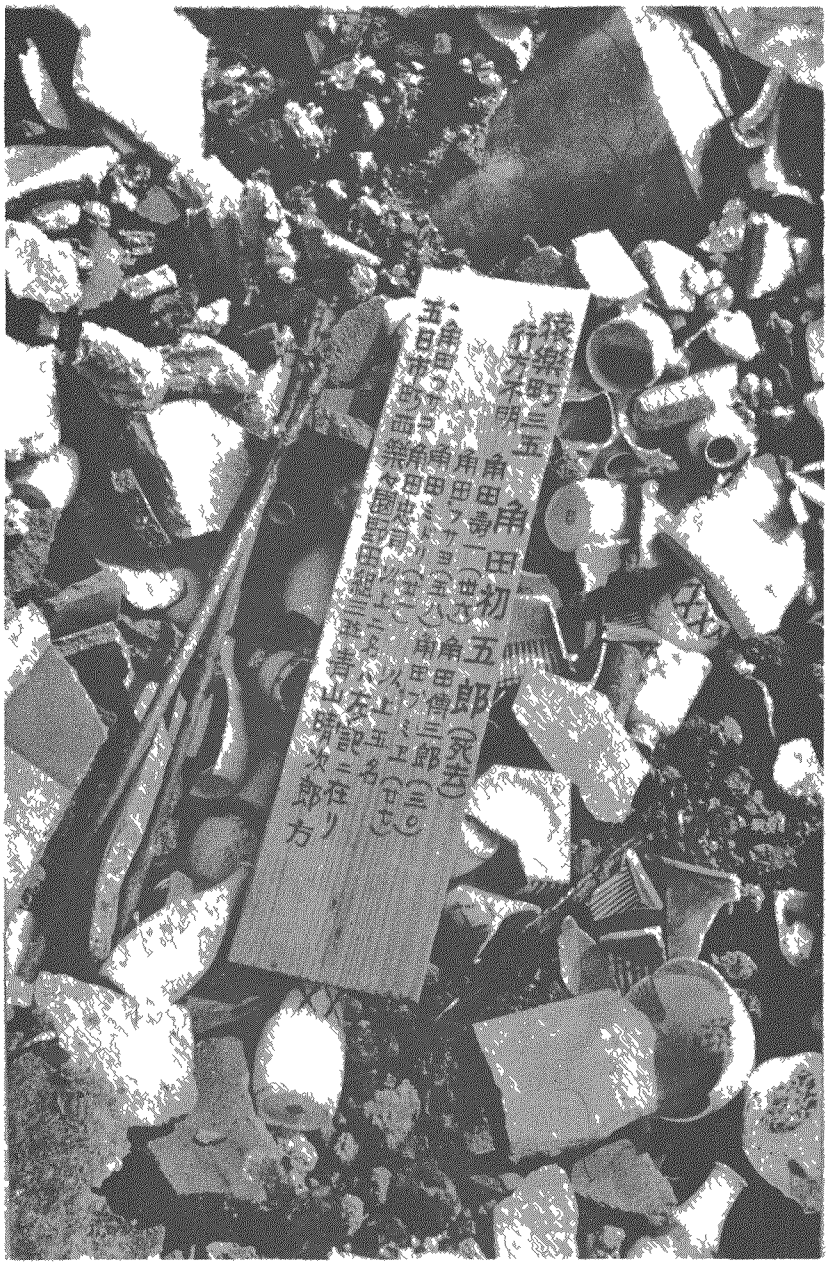


Fig. 55--(3H). Messages in vicinity of explosion telling of missing or dead. These planks were left by the relatives or friends. Contacts, even with one's own family, were difficult to re-establish and such means were commonly employed. (Photo File # HH 173.)

Fig. 56--(3H). Messages on wall near center of explosion. (Photo File # HH 172.)

Fig. 57--(3H). Shacks at Kusumachi, Yokogawa (approximately 1700 meters). Such temporary dwellings were built from scraps on the site of each man's former dwelling or shop. The central section of the city remained relatively deserted, for here the casualties had been highest. (Photo File # HH 136.)

Section 3N

NAGASAKI CITY

Prepared by George V. LeRoy, Lt. Col., MC

General: Terrain. Industries, Buildings, etc.

Nagasaki, the seat of government of Nagasaki Prefecture, is located on a fine harbor between the promontories Nomo and Kozaki, which with Shimbara form the western portion of Kyushu Island (see figure 1). The harbor extends from southwest to northeast and is approximately 4000 meters* long and 1100 meters wide, as an average. The harbor (figure 2) is joined at its northern end by the Valley of the Urakami River and by the somewhat narrower one of the Nakashima River to the northeast. Between these comparatively broad valleys and around them are the spectacular irregular hills rising abruptly to heights of 900 to 1300 feet, which give the city its characteristic appearance. The residential and industrial areas occupy these valleys and smaller ones leading to the harbor as well as the lower parts of the slopes of the hills (figure 3a,b).

The metropolitan area of Nagasaki is officially reported as approximately 35 square miles in extent, but the built up portion was crowded into an area of about 5.5** square miles. Of this, 15% was occupied by industrial installations. In the congested remainder there were no wide streets or pleasant

*Throughout the Report, linear distances are expressed in meters. The approximate equivalents are:
1 Kilometer, 1000 meters equals, 1100 yards, 3300 feet.
1 Mile, 5,280 feet equal 1600 meters.
Measurements of area are given in square miles, or acres.

**This figure is at variance with that cited in the report of the USSBS. However, it is felt that this area is more nearly correct and is based on a close knowledge of the city.

parkways (figure 4). The houses were built so close together that there was little space for yards or gardens (figure 5). Here lived a population of about 200,000 (see below), so that the general population density in the residential section can be estimated as about 56 per acre.

During the war the industrial activities of the city controlled chiefly by Mitsubishi Corporation, had been expanded markedly, necessitating the use of buildings, schools, tunnels, etc. The permanent industrial installations were the shipbuilding facilities, the electrical equipment shops, the steel and arms works, and the ordnance shops. The shipways, the dockyards, the marine engine works, and the electrical equipment factories were situated on the west bank of the harbor (see appendix, map 1). The open hearth furnaces, casting plants, soaking pits, rolling mills, and shops of the steel and arms works extended for nearly 1500 meters along the east bank of the Urakami River. One and one-half kilometers further up this valley was another industrial group composed of the municipal gas works and the ordnance factories with shops for the manufacture and assembly of torpedoes, artillery shells and parravanes. It has been estimated that these war industries employed approximately 90% of the total labor force of the city. This labor force comprised the usual group of skilled and unskilled workmen, school children of all grades, prisoners of war, and to a certain extent on a part time basis men, women and children working at home, who were otherwise employed.

Between and around these industrial installations was a congested residential and tenement section located on a series of terraces cut into the lower slopes of the hills (figure 6). On the east side of the northern end of the harbor were the docks and the commercial and residential section. Here, too, the streets were narrow and crooked, and the houses and

stores crowded together. This central portion extends northeast for about 1500 meters to where the Nakashima Valley divides into two portions. One continues to the north-northeast and becomes narrower until the Nishiyama reservoir is reached. The other extends eastward along the main motor road from Nagasaki to the rest of the peninsula. This valley terminates in the hills at the Hongochi reservoirs and filtration plant. On the sides of the hills beyond the main residential sections are small farms and homesteads usually associated with rice paddies, sweet potato patches, and orchards. A major portion of the Nakashima Valley, and all of the Nishiyama Valley, lies almost directly behind hills which vary in height to 1200 feet, so that the residents of the floor, and of the west side of the valley were well screened from the explosion of the atom bomb. (See Section).

The residential buildings and most of the stores and many of the temporary factory buildings were of frame construction, usually in the typical Japanese style with flimsy panels, frequently containing glazed sections, and thin walls. Such structures invariably had over-heavy roofs supported by slender joists. Many of the buildings consisted of only one story and Japanesetype buildings higher than two stories were not common. Few of these buildings had full cellars, but the threat of air raids had led to the construction of covered trenches inside the houses. These shelters were usually arranged so that the sole entrance was indoors. Most of the Japanese-style buildings had roofs covered by ornate rounded tiles, embedded in thick mud or plaster. The majority of the factory buildings were of steel construction usually of the "north light" gantry type. They were sheathed either with galvanized iron sheeting or asbestos composition panels. The schools (figure 7) and many of the public buildings were of modern heavy, reinforced-concrete,

earthquake-proof construction. One such group of buildings housed the Hospital of the Nagasaki Medical College. These fine modern structures were located on the eastern side of the Urakami Valley, approximately midway between the steel works and the ordnance plants. There were only a few western style brick buildings with load-bearing walls in Nagasaki. Several of these were large Roman Catholic churches, and also the buildings of the Medical College.

The external railway communications of Nagasaki were provided by a double track of narrow gauge. This line was laid down the valley of the Urakami River and ended at a large station and freight yard at the north end of the harbor. In the city there was a small electric trolley system with 115 employees, approximately 25 cars, and double-tracked trolley lines on six of the main thoroughfares.

The People.

It is warm in the summer in Nagasaki and the people of the city wore lightly clothed. The typical costume of working-class men consisted of a short-sleeved or sleeveless shirt (often removed if the work was heavy and the day hot), baggy trousers, gaiters or spiral leggings, and a military type fatigue cap. The women as a rule wore "monpei", a sort of overall, open at the neck, with three-quarter length, wide sleeves, and baggy trousers, which were usually fastened at the ankles. Those working in the fields and the rice paddies, rolled up their sleeves and trouser legs, and wore, usually, a towel or a shawl as a head cloth. Sandals of straw or wood were the commonest foot gear for both sexes, and socks or "tabis" were seldom worn during the working hours. The children of school age were dressed in uniform suits. The boys wore short pants and a long sleeved coat like an Eton Jacket. The girls were dressed in short skirts or "monpei" and middy blouses. All school children

had small tags sewed to their coats or blouses inscribed with name, age, and school year. In the farmyard and around their houses in the city, the children of pre-school age were mostly naked, or wore only little shifts or loin cloths. The children who were not barefoot had on straw or wooden sandals and no socks. The clothing of all these people was fashioned from cheap, coarse cloth made of cotton, or rayon mixtures. The colors were drab and most of the garments were shabby and threadbare.

The Air Raid Warnings, 9 August 1945.

On 9 August 1945, an "air raid alert" was sounded at 0750 hours. It was concelled at 0830 hours and the city remained in a state of "warning alert". As a result of this, most of the school children remained at their homes instead of proceeding to work. The majority of the school children were incorporated in the labor force, some wroking in shops established in the schools, and others working in various factories and municipal offices throughout the city. The fact that the school children remained at home was in accordance with the normal routine for warning alerts in Nagasaki. At about 1100 hours, another "air raid signal" was given but by the time the atomic bomb exploded at about 1102 hours, "not more than 400 people had taken cover in the city's tunnel shelter system." ** This series of shelters was said to be extensive enough to accommodate about 30% of the population. Many of the people en route

*A detailed consideration of the characteristics of the buildings and the effect of the explosion of the atom bomb is to be found in the comprehensive report of the United States Strategic Bomb Survey, entitled..."The effects of atomic bombs on Hiroshima and Nagasaki"30 June 1946.

**This is a quotation from a report by the Prefect, and in incorrect. Actually, at least 2000 people are estimated to have been in some sort of underground shelter.

to the shelters stopped to watch the two B-29 aircraft. Their attention apparently was attracted by the three parachutes that fell at the same time as the bomb. Some hesitated to take cover because only two heavy bombers were visible. Thus, many people were in the open looking toward the sky when the atomic bomb exploded. Others, unimpressed by the air raid warnings continued their habitual occupations at home and at work.

The Immediate Result of the Explosion

The exact sequence of events after the explosion of the atomic bomb has been difficult to ascertain. Many eyewitness accounts were written by the more intelligent survivors at the request of the commission. In general, these records lack precise details.* However, the accounts agree roughly on the following points: (figure 8)

a. Most of the subjects heard the peculiar motors and immediately afterwards were aware of an intense flash of light.

b. The light was described as resembling that from the magnesium powder used by photographers and its color was said to have been white or blue-white.

c. Coincident with this there was a loud sound which was variously reported. Some described a single sharp blast; others likened the sound to a steady roar such as one hears in a train passing through a tunnel.

d. In this same instant the surroundings became as dark as night. What followed then depended on the location of the witness. All felt a concussion wave at an appreciable interval of time after the flash of light, and the development of the following darkness. Those who were outdoors within a radius of about 1,000 meters, were thrown to the ground and in many cases their clothing was torn or stripped from them. Nearly everyone outdoors or indoors, whose position was within sight of the exploding bomb was momentarily

aware of a sensation of heat of varying intensity. Those who were inside of buildings also were thrown to the floor but their major recollection was of the collapse of all, or part of the building. Splintered fragments of window cane, pieces of wood from partitions, roof tiles, and any detachable portions of the building or the furnishings were thrown violently in all directions, forming dangerous and often lethal missiles. The collapse of buildings was so sudden that many were pinned under the beams or the walls. The air was filled with dust, dirt and sand raised by the violent wind which accompanied the blast. The duration of one explosion was of such length that many of the witnesses described the sensation of a "great wind" of brief duration. The ones who did not see the flash of light in the sky were nearly unanimous in supposing that the blast was due to a very "near miss" of a high explosive bomb.

The Damage to the City.

Within a few minutes after the explosion, the witnesses described the cessation of the darkness as resembling a sunrise; and in about 10 minutes the atmosphere had cleared enough to reveal a scene of devastation. (figure 9) In an area of approximately 1.5 square miles (3000 acres) whose center was directly under the bomb there was total destruction of all structures except the most solidly built reinforced concrete buildings. (figure 10). This totally destroyed zone extended for about 1400 meters north of the center and for about 1800 meters to the south. The width of it varied from 500-1600 meters. In fact, every building in the Urakami valley and at the northeastern end of the harbor was either destroyed or badly damaged. Adjacent to this region was an area of approximately 2.5 square miles in which the majority of the buildings were damaged to some extent. The blast effect was quite

*Transcripts of some of these accounts may be found in Appendix. 4 N.

irregular in this zone because of terrain features, as well as the recognized capricious behavior of shock waves. Windows were broken, and roof tiles were blown off nearly every building in the city.

The most severely damaged part of the city was known as the Urakami area. The following important industries, schools, shrines, churches and municipal institutions, which were situated there, were destroyed:

Industries:

Mitsubishi Arsenal (2 plants for torpedoes) (figure 11)

Mitsubishi Electrical Machine Works (1 plant)

Ship Model Laboratory of the Mitshubishi Shipyard (the largest in Japan)

Mitsubishi Shipyard (2 plants)

Mitsubishi Steel Foundry (5 plants; rolling mill, electric furnace, casting plant, machine shop (figure 12)

Sumitomo Carbon Factory (figure 13)

Western Gas Company (2 plants) (figure 14)

Transformer Stations and Generator of the Kyushu Power Distribution Company

Auxiliary Factories (i.e., to the foregoing - 85 plants)

Schools:

Nagasaki Medical College and its Hospital

Nagasaki Normal School

Tamaura (Prefectural) Middle School

Industrial (Prefectural) Middle School

Prefectural School for Blind and Deaf (figure 15)

Commercial (Municipal) School

Mitsubishi Industrial (Private) School (figure 16 a, b)

Chin$_2$ei (Private) Middle School (figure 17 a, b)

Junshin (Private) Girls' Middle School

Schools (continued)

Joshei (Private) Girls Domestic Science Middle School

Theological (Private) School

St. Maria (Private) Institute

Yamazato, Shiroyama, Nishiurakami, Nishizaka, Zenza and Fuchi National Schools

Shrines and Temples:

Fuchi and Sanno Shrines (Prefectural) (figure 17c)

Shotokuji, Shoenji and Anakubo Temples

Urakami Roman Catholic Church

Municipal Institutions:

Urakami Railway Station

Quarantine Hospital

Crematory

Tuberculosis Sanitorium

Prison

Nursery, etc.

Reinforced concrete (RC) buildings withstood the blast very well, in general. (figure 17a, b) The one closest to the bomb was the Chinzei Middle School, which was situated on a small hill, 80 feet in elevation, and 500 meters southwest of the center. The RC portion of the school was a four-story building that faced eastward. All of the fourth floor and the north portion of the third floor which faced the explosion collapsed. The remainder was badly damaged by blast and by secondary fires. The next closest building was the Shiroyama National School (See 11 N), which was 550 meters west of the center. The eastern end of one wing of this building collapsed from the explosion, and the structure generally was heavily damaged. The

other RC buildings were farther away and although the roof slabs of some were depressed by the blast, there was no other case of extensive collapse. In such structures, the doors and windows were blown out; and the interior trim of plaster, etc., was stripped from the walls and ceilings. Fires which originated in the buildings or spread to them, added to the destruction in many instances. The RC buildings (figure 18 a, b) of the hospital of the Nagasaki Medical College were located at an average distance of 800 meters. The framework of these buildings withstood the blast, but the interiors were unusable because of the extensive stripping away of the trim; and because of the fires.

The factory buildings in the central area were of many types, but the north light gantry type of construction was the most frequent. Other buildings had various types of steel framework. A number of materials were used for the outer walls: sheet iron, asbestos, composition panels, boards, or thin concrete over lathes. Such structures were demolished within a radius of 1100 meters. General "mass shifting" (see figure 11) or displacement of all or a part of this type of building occurred at distances as great as 1500 meters. The appearance of the wrecked steel framed buildings and shops was unusual, for they looked simply as if they had been pushed over and crushed to the ground. The girders were stripped of their sheathing and were bent and twisted away from the center of the blast. To many observers, the factories seemed to have been blown down by a tremendous hurricane. The equipment of the factories and the machine tools were damaged to a serious extent, usually due to the shifting of the building, to overturning, to debris or to fire. All machinery was further damaged by weathering and estimates of the amount which could be salvaged varied according to the type

of building. In steel framed shops, damage occurred within a radius of about 300 meters; while in timber framed buildings, similar damage was observed at distances of 1100-1400 meters.

Buildings with load-bearing walls were not common in Nagasaki. The majority were one-story shops with timber framework and board walls. Some of the public school buildings and all but 6 of the Medical College buildings had wooden frames and brick walls. The largest brick building was the Urakami Roman Catholic Church (figure 19a, b). This type of construction collapsed at distances of 900-1800 meters. Serious structural damage without collapse occurred as far from the center as 2500 meters. The large amount of wood in these buildings made them vulnerable to fire, and within 2100 meters most of them were burned out. The buildings of the Medical College, (figure 20a, b) which were of this type, were located at an elevation of about 100 feet, and at an average distance of 700 meters. Of the 30-odd buildings, all except the RC library and five laboratory buildings were demolished and their wreckage burst into flames. The prison, located at 250 meters, was of similar construction and was completely destroyed.

Japanese-type wooden buildings were the commonest type exposed to the bomb. The majority of the homes were of this sort, and it is estimated that there were about 40,000 such buildings in Nagasaki. The peculiarities of this construction make these buildings very susceptible to blast effect, and complete collapse occurred within a radius of 2500 meters (figure 21a, b). (See also figure 15). Severe structural damage without collapse occurred at distances up to 3000 meters. In addition to the blast damage, the wooden construction and inflammable contents increased the fire hazard considerably. Such buildings were damaged by fire at distances as great as 3200 meters from

the center. According to the police report, 14,000 of these structures were completely destroyed and 5,000 were seriously damaged.

The extent of the damage to all types of buildings has been summarized: (See table 1, page 5)

The public utilities were disrupted to a variable extent by the explosion of the atomic bomb:

a. Everywhere in Nagasaki the electricity failed immediately. Four of the six large transformer substations were put out of operation or destroyed. 1500 poles carrying electric lines were thrown down; and approximately 480 of the small transformers were damaged. The telephone system suffered to a comparable extent.

b. The two gas works, in Ochashi and in Yachiyomachi (see figures 13, 14) were destroyed. The large accumulator of the former plant is located 950 meters north of the center. It was caved in by the blast and was beyond repair. The two smaller tanks of the other plant were located 2000 meters to the south. The tops of these were [illegible] by the blast, but they could be repaired. The gas generators were destroyed; but the underground mains were not damaged.

c. The water supplies of the city were three reservoirs, all remote from GZ. There were a few breaks in the mains chiefly where they were carried across rivers; and there was [illegible] some of the joints which had become loosened. There was apparently very little earth shock associated with the explosion. This would explain the lack of damage to water and gas mains.

d. There was no sewerage system in Nagasaki.

e. The electric street railway system lost most of its cars due to blast and fire. (See figure 4). Many of the trolley wires were pulled

TABLE 1

Extent of Damage to Buildings

Type of Building and Damage	Estimated Radius of Effect - Distance From Center
REINFORCED CONCRETE	
Structural Damage	600
STEEL-FRAMED INDUSTRIAL	
Demolished or Collapsed	1100
Serious Structural Damage ("Mass Effect", shifted members, etc. - no collapse)	1500
Structural Damage	1800
LOAD BEARING WALLS	
(Timber framed, brick or wooden trim)	
Demolished or collapsed	900-1800
Serious structural damage	2500
WOODEN JAPANESE STYLE	
Demolished	2500
Serious Structural Damage (No collapse)	2700
Serious Non-structural Damage (i.e., loss of tiles, windows, panels, etc.)	2800
Fire Damage (to any extent)	2500 - 3200

Source: Report of British Mission to Japan and USSBS Report on Japan.

down by the falling poles. The tracks suffered little damage except where they crossed over bridges, which had been shifted by the blast.

f. The railroad line was damaged by fire. The cross ties were ignited either primarily or by burning debris, and the heat warped the rails. The two stations in the city were badly damaged by blast and fire; and much of the rolling stock in the yards was destroyed. In spite of the damage, it was possible to run a train as far as the Urakami station on 9 August to evacuate casualties. (figure 23).

Fire: - As soon as the air had cleared, a small number of fires were observed. These are reported to have spread slowly, and it was several hours before the devastated area was generally aflame. Efficient fire breaks, and a series of heavy showers during the afternoon of 9 August, kept the fires from spreading beyond the Urakami Valley to any serious extent. The burned-over area is difficult to estimate, but it is doubtful if it exceeded 3.0 square miles. The intense heat of the explosion of the bomb started a number of small fires in the woods on the hills surrounding the city; but only on the western side of the valley in a rather small area where the forest fires were serious. There is no clear record of how long the fires continued to burn; but judging from the amount of charred timber in the city, they stopped or were rained out rather quickly, so that by the evening of 11 August, only a few regions were still in flames.

Many of the farms on the hillsides overlooking the Urakami Valley were exposed to the force of the explosion. Of the unknown number of farm houses within range of the bomb, 750 were burned down; and 350 were demolished. The agricultural crops were affected by the blast of heat which seared everything exposed to it within a range of at least 3500 meters. A writer visited Nagasaki

at the end of August described the surrounding fields and woods as brown in color "like late autumn". A Prefectural Goverment report, dated 1 September 1945, submitted estimates of the extent of the damage to crops. This data is reproduced in table 2.

TABLE 2

Extent of Damage to Crops

Crop	Percent of Crop Damaged and Acreage Involved 80%	50%	30%
Rice (paddy)	94	65	151
Sweet Potato	163	36	84
Vegetables	84	24	48
	341	125	283

Total Acres Damaged: 749 = 1.2 square miles

The Nature and Extent of the Casualties.

It is very difficult to gain a clear picture of casualties from the eye-witness accounts*. Each person was obviously terrified by the magnitude of the damage to the building or region where he happened to be when the atomic bomb exploded. As the smoke cleared away and the vast area of devastation could be seen, his terror increased and if he was able, he started for the hills or some place where he hoped he would be safe. Everywhere he turned were burned and wounded people, who were also struggling toward safety. Others were trapped under collapsed buildings, and as the wreckage caught fire their situation became hopeless. (Figure 24). Because of the fires in the region of the center, the first movement of casualties seems to have been into the nearby hills; and in the case of those at the southern end of the

*Appendix 3 N

Urakami area, into the less damaged parts of the city. The large RC school buildings which were comparatively intact, were refuges to which the more severely wounded struggled or were carried.

The total number of casualties, and the manner in which the number was ascertained will be discussed in detail later. (See Section 10N). The population of the Urakami area, the central damaged region, was about 40,000, and about three-quarters of these were killed or wounded. For the whole city it will be sufficient to state at this point that on 9 August, approximately 65,000 people were killed or injured. The number who were killed instantly, by blast, or crushed to death under collapsed buildings, or burned to death by the bomb's flash, or cremated while trapped under burning buildings, can never be known precisely. A resonable estimate is 10,000. In addition, to this number, there was a group who were injured only by the gamma radiation; and who did not become casualties in the sense that they needed medical care, for a week or longer. A reasonable estimate of the number in this group is 5,000 to 10,000. Subtracting these two groups from the total casualties, leaves a minimum number of 50,000 people who required medical care at once. These patients has sustained every type of burn and traumatic wound. The most frequent injury was a second degree "flash burn" of the parts of the body exposed to the bomb-burst. (see figure 25). The severity of the burns depended primarily on the propinquity of the victim to the air burst; and secondarily on the degree of protection that was supplied by his clothing or objects between him and the bomb. The next most common injury was multiple lacerations due to glass fragments and other debris. Some of these wounds were very deep and until the causal agents could be removed, they bled freely and were quiet painful. In the eyewitness accounts such patients were

described frequently; and many appeared to the writers to have been dipped in blood. In addition to the wounds and the burns, all the survivors were covered with grime and dust which had been raised by violent winds, and their skin and clothing were blackened by the soot and smoke from the fires. The relative frequency of the various types of casualty is difficult to determine because of the incomplete records. Some idea of the preponderance of burns may be gained from the following data: Of the patients who reached hospitals, one-half to two-thirds were burned; of the hospital deaths during the first week, nearly three-fourths were due to burns. After 14 August, symptoms of injury by gamma radiation were recognized in the wounded and the dying. This made a determination of the cause of death more complicated. At about the same time, patients were seen in aid stations and hospitals who had survived the bombing unscathed. After a few days of apparent good health, the typical syndrome due to over-exposure to gamma radiation developed.

The Management of the Casualties

The provision of medical care for this large number of casualties, and the rescue of those trapped in the wreckage was a greater problem than any Air Raid Defense System could hope to solve adequately. The organization of the relief activities was taken over by the Governor of the Nagasaki Prefecture. The troops in the Nagasaki Fortress, police and rescue groups in the city were mobilized at once and despatched into the damaged area. The medical aid groups went to the schools and large municipal buildings where the walking wounded had sought refuge, and to which the more seriously injured were being carried. The greatest immediate need was for doctors and nurses. (figure 26, 27). Many of the physicians and nurses in the Hospital of the Nagasaki Medical College were killed, and nearly all the survivors were injured. Throughout the entire city,

nearly one-half of the medical practitioners were killed or seriously injured. Urgent calls for assistance were sent to the Governor-General of the Kyushu District, the Chief of the Western Army Command Area, and the Commandant of the Sasebo Naval Base. The responses of these officials seems to have been prompt. The Army authorities sent relief trains which were able to get as far into the city as Urakami Station, just south of the center at about 1600 hours on 9 August. Approximately 1000 casualties were evacuated on that day in these trains to Ishahaye Naval Hospital and Omura Naval Hospital. Subsequently, other trains in the next few days evacuated about 1000 more casualties to Naval hospitals in the vicinity. The Commanding Officers of the military hospitals in the Sasebo district sent the first rescue and aid parties which appeared. Other groups arrived during the next few days by rail and truck from the towns of Nagasaki, Saga and Fukuoka Prefectures. Approximately 1500 relief and rescue workers were despatched to the city during the first week after the bombing.

During the first few days after the bombing, the casualties were cared for in 15 aid stations in the city. After 13 August, these were closed one by one, with the exception of the one established in the Shinkozen Primary School. Because many of the wounded fled from the city it was necessary for the surrounding towns to establish aid stations for the refugees. In the latter part of August, a tentative report on the activities of aid stations and hospitals was submitted by the Prefectural Government. It is reproduced here as table 3.

On 16 August the 216th Army Field Hospital (temporary) began accepting patients; and at the end of August this unit, and the Shinkozen Medical Aid Hospital (the Primary School), were caring for the majority of the hospitalized

TABLE 3

Aid Station and Hospitals Caring for Casualties from Nagasaki Late in August, 1945

Name	Number of Patients Treated	Number who Died
Shinkozen Medical Aid Hosp.	2500	256
Nagasaki Economics College (later 216th Field Hosp.)	1260	156
Tenshudo 1st Hospital	2240	250
Irabayashi National School	1290	266
Takagi Hospital	1465	64
Katsuyama National School	3500	243
Oura First Aid Station	1650	27
Tamaya National School	650	14
Nagasaki Branch, Japanese Red Cross	2080	-
Nagasaki Medical College	2500	-
Mitsubishi Plants, Aid Station	2500	-
Inasa National School	3370	248
Yamazato National School	800	142
Shiroyama Temporary Aid Station	1900	4
Tomachi First Aid Station	210	1
Totals in City	28,215	1,682
Mogi Village	60	2
Tagami Sanitarium	350	-
Tokitsu Village	1750	386
Nagayo Village	980	203
Ishahaye City	1230	-
Omura City	1030	-
Kashima National School, Saga	1060	-
Other places in Prefecture	2260	-
Totals in Prefecture Aid Stations	7,890	591
Omura Naval Hospital	740	125
Ureshino Naval Hospital	176	24
Ishahaye Branch Hospital	521	156
Kawatana Naval Hospital	245	54
Omura Auxiliary Hospital	92	8
Sasebo Auxiliary Hospital	65	26
Reinforcement Rescue Corps Hospital	441	127
Totals, Naval Hospitals	2,280	520

Table 3-continued	Number of Patients Treated	Number who Died (2793
Dead reported from Police Stations (i.e. for whom certificates were issued)		15,153
Missing (reported by relatives)*		1,927
GRAND TOTAL	38,385	19,873

*These are assumed to represent individuals known to have been in areas which were so throughly destroyed that no trace of a body could be found.

casualties left in the city. The large Naval Hospitals at Omura, Ishahaye Ureshino and Kawatana; and civilian and University hospitals throughout Kyushu and Honshu were caring for the remainder.

In none of the contemporary reports is there any mention of serious shortages of such elementary supplies as bandages, oil for the burns and simple drugs. Apparently the medical supply depots in the large Naval hospitals were equal to the demand. There is no way of judging the adequacy of the medical care which was rendered in the aid stations. The best of them, at Shinkozen, lacked nearly everything necessary for the comfort of patients. There were functioning latrines and running water; but there were no cooking or laundry facilities; no large sterilizers and no satisfactory surgical theatres. The patients were placed on straw mats on the bare floor, and were covered with such blankets and quilts as friends and relatives could provide. The tedious and painful changing of the dressings of wounds and burns was done in the wards. With all the windows blasted out there was no means of keeping flies and dust and dirt from the wounds.

Judging from the records which were available, the casualties who were evacuated to military hospitals received adequate minimal care. The burns were dressed with gauze soaked in a medicated fish oil, and then covered lightly with a few layers of gauze or muslin. The larger lacerations were cleansed and sutured in most cases. Fractures of the long bones were treated by immobilization in blankets or other simple splints. In some cases ruptured viscera were diagnosed and surgical intervention was attempted. Shock was not generally diagnosed as such, and the treatment administered to obviously shocked patients consisted of intravenous infusions of Ringer's solution, and the injection of camphor, caffein, and "cardiotonic" drugs. The supply of

Ringer's solution was inadequate for the demand in most of the hospitals. Blood substitutes, like plasma, serum, or colloidal solutions, were not available so far as could be determined. None of the hospitals had a blood bank; and transfusions were given to only a few patients in the emergency period of the first 3 - 4 days. These transfusions were given by the multiple syringe method, using freshly typed blood from a volunteer donor. Even in the large hospitals the stocks of sulfanilamide were inadequate, and only the severely wounded received the drug. Sulfapyridine and sulfathiazole were even scarcer, and sulfadiazine had not been manufactured in Japan. There was no Penicillin. When the manifestations of injury by gamma radiation appeared, treatment with vitamins and liver extract was seriously limited by shortages of these drugs.

The only adequate description of the appearance of the casualties which confronted the doctors was written by a naval surgeon, Lt. Masao SHIOTSUKI, and a portion of it is worth quoting here:

"About 600 wounded patients were sent to the Omura Naval hospital between 2000, 9 August, and about 0100, 10 August. These were transported to Omura Railroad station by train, and from there to the hospital by trucks. The appearance of the patients on that night was horrifying. Their hair was burned, their clothes torn to pieces and stained by blood, and the naked parts were all burned and inflamed. Their wounds were contaminated by filth. Many among them had numerous pieces of glass and wood projecting from the skin of the face and back. Many were in such a state that they were with difficulty recognized as human beings.

As can be imagined, it was an appalling scene of confusion. Nearly ten hours had passed since the injuries had been received, and in spite of their severe injuries, the majority of the patients were quiet as though in a collapsed state. Many were covered with black blobs, which we at first thought

to be coagulated blood from their wounds, mixed with smoke from the train. Later, however, we learned that after the explosion there had been a "Black rain" throughout the city. The patients were given routine burn treatment and we finished about 1500, 10 August '45."

The death rate during the first six days was very high; and it has been estimated that 20,000 deaths occurred in that period. This is about one-half of the total mortality. How much of the mortality was due to deficiencies in medical care can only be guessed, but it seems apparent that many essential items were lacking. The military and civilian doctors, and the Red Cross nurses, however, seem to have worked unbelievably hard in an attempt to cope with the casualties.

Appendix I (3N)

EYE WITNESS ACCOUNTS, NUMBERS 13 - 21 INCLUSIVE

NAGASAKI CITY

Prepared by George V. LeRoy, Lt. Col., MC

Collected and Edited by Verne R. Mason, Col., MC

13. Eyewitness Account of Bombing of Nagasaki by Nagasaki Railroad Employee.

Tagawa, Aiko, female, single, age 20, baggage worker at the Urakami R. R. Station, Nagasaki, 1050 meters from bomb center.

On the morning of the bomb explosion, I was working in the baggage room, a one-story building with wood walls, glass windows and standard tile roof. The all-clear signal had sounded about half an hour previously. Suddenly the room was lighted up very intensely, and the whole building crashed down. I was cut by broken glass on the right elbow, right hip and thigh. The baggage master was killed by falling debris where he sat. I felt no heat, nor was I burned. The room became dark with dust, dirt, and soot. I walked and ran north along the railroad tracks as far as the end of the Mitsubishi Steel Works, then turned west to cross the bridge over the river and escape into the hills. By this time I saw many fires all around. The bridge was down, so I waded across the river.

I do not recall seeing any dead people along the route. At the river, many were jumping into the water to get relief from burns. Most of them wore clothing that was torn into shreds; I did not see any clothes burning, nor do I know whether the clothes had been burning previously.

Toward evening, my father found me and brought me to our home in Michino. At that time, I saw dead people in the streets. I think they died from burns, but cannot say for sure. Their bodies, including their faces, were swollen. Some of the faces were black from soot. Their eyes were not prominent.

My wounds suppurated, and healing is very slow, not being healed yet (3 months later.) My hair began to fall out 2 weeks after the explosion and I was completely bald until recently, when the hair began to grow in again. I had no purpura nor petechiae at any time, no loss of weight, no loss of strength, and no obvious anemia.

My menses began at the age of 17, were very regular, every 30 days, until the explosion. My last period was August 1 to 6; then I had a scant flow for one day on November 1st. I have had no headaches.

WBC on 5 November, 10,800 per cubic millimeter by Japanese doctors.

235 Kodamachi, Nagayo Village, Nishinonogi-gun, Nagasaki Ken.

14. Eyewitness Account of Bombing of Nagasaki by Ueno, Toragoro, age 44, Mechanic of Imayomachi, 28.

I worked at the Mitsubishi Steel Works. Early in the morning, about 9:30 or before 10, an air raid alarm had been sounded and we, a group of steel workers headed by myself, put on our steel helmets and went to the air raid shelter up on a wooded hillside west of the plant. About a quarter of eleven, I saw the all-clear flag on the pole at the plant, and our group began to walk back through the woods along the path about 2 feet wide with trees lining both sides. I was ahead, wearing a steel helmet over a wool liner, white cotton shirt with short sleeves and no markings, full-length cotton trousers, pale green in color, and leather shoes.

The path led slightly north of east directly in line with the bomb center and about 1600 meters away. My first experience was noting an intense light, the color of which I cannot r call, and then I heard a loud noise. I quickly threw myself on the ground and then felt a terrific blast which blew off my helmet. I lay there for about 2 or 3 minutes fully conscious. A yellowish dust and smoke was thick all around. I noted burning pieces of dry leaves and paper and clothing in the road, but no fires in the woods. Several minutes later, I saw flames among the houses down in the open part of town.

At the time of the flash, I felt no heat on the face or body, but in a short time my skin showed burns and blisters - in fact, the reaction was immediate. I ran toward the factory, and on coming by the stream, I saw many people jumping into the water to relieve burns. Near the Fuchi School, I saw many people with clothing so scorched that it fell into shreads. I do not recall seeing any dead people about me.

After 20 or 30 minutes, the dust cleared up to be followed in another 20 or 30 minutes by smoke coming from burning houses.

I ran to my home nearby and found the house collapsed in ruins. There were small fires of flaming wood in several spots. Some black and khaki colored clothes hanging on bamboo poles were burning, although not near any fire to be ignited by it.

I had no epilation of any part of the body (I wore a steel helmet) I saw no purpuric spots, but I did have definite petechial hemorrhages, rice-size, from about the 5th to 12th of September, on the forearms, hips, buttocks, and sides of thighs. They disappeared gradually. At the same time, I had conjunctivitis and edema of the left eye. For several weeks I had difficulty in hearing with the left ear, but recovery is now complete. I was pale and had severe malaise for many weeks, but am recovering.

15. Eyewitness Account of Bombing of Nagasaki.

Fukahori Kikuo, a 47 year old workman of Kawanami Koyagijima Shipyard tells his experience of the atomic bomb as follows:

While working in Koyagijima which was 6 to 7 killometers from the bombed area, he heard a loud noise. His first thought was that the explosion was right over his workshop. Getting out of the shop, he noticed the sky over the Mitsubishi Shipyards as red and bright as a sunset. As there were hills between his place and the bomb, he could see only the sky and no smoke on the low surface.

Taking the 2 o'clock boat, he got off and started to climb the hills in order to get back to his house in Okamachi (that was near the bomb center.) As he reached the top he found it difficult to get down to his home because of the fires which had started. He saw the church which was ablaze, hiding the area from him, because of the black smoke from it.

At about 5 P.M. he came down to the place where his home had stood, but found nothing but ashes. He then went to the cave in the prison hill, near the main street, to try and find his family. That day he found none of his family. But on the following morning he found nothing but bones which were the remains of his 21 year old daughter and 4 other children on the ground where his house had stood. He imagined they had been pinned under the fallen house and burned.

On the morning of 11 August, he went to the cave again to see if his wife was there. Upon arriving he saw 5 bodies at the mouth of the cave, which were naked and browned, and looking as if they were drowned. Their eyes and tongues were out and his wife's body was one of them. As he looked about 6 feet deeper into the cave he noted some more bodies which appeared much like the ones at the mouth, except that they were not as black.

Later, he heard from a woman who survived in the cave that she experienced a sensation of a strong gust of wind, followed by the odor of smoke, but she did not know of the explosion.

16. Eyewitness Account of Bombing of Nagasaki by Fukahori, Taeko, a girl, aged 16 years.

This girl was working with about 60 other men and women in a cave pumping the water out when the bomb exploded. She was about 60 feet inside this cave which was situated near the hill by the prison and about 100 or 150 meters from the bomb center. Around this hill many cave trenches had been built, and she was in the one nearest to the main street on the north side of the hill, facing west. The clothes she was wearing at the time were a blue short-sleeved shirt with red and white dots and blue trousers.

When the bomb exploded she felt the blast and was knocked down but not unconscious, apparently dazed. The electric light was blown out and the cave became dark, and as she ran out of the cave she did not see the locations or the conditions of the others in it, but she did hear some cries for help and thought the people were alive.

It was about 5 minutes after she got out of the cave that she noticed burns on her shoulders, hip and legs. Later, she was told by another survivor that the others in the cave were mostly wounded on their legs. She took shelter under a bridge where she saw many people suffering from burns.

Her wounds became infected later and took 6 weeks to heal, but she did not show any other symptoms of injury or malaise. She had her menstrual period on 12 August, normally, but missed it in September and October.

17. Eyewitness Account of the Bombing of Nagasaki by Kawauchi, Fusa, a woman, aged 49 years.

She was sitting sideways in a cave about 40 to 50 feet from entrance with the right side of her face toward the entrance, yet she was burned on the left side of the face, and the outer aspect of her left arm showed 3rd degree burns. She claims her clothing was torn into shreads and the skin peeled off her left arm. Her clothing did not burn, nor was there a fire to cause flame burns. She did not see a flash of light. Her first strange experience was hearing a rushing noise of air in the cave, as though machinery were working. She was crouching, holding onto a hose emptying water from the inside of the cave; she held on tighter, and does not recall whether there was enough pressure of suction to force her one way or the other. She kept her eyes closed for several minutes, or so it seemed to her. Upon opening her eyes she looked at the girl working opposite to her at that time and she was also conscious. They remarked that each other's face was covered with black, sooty material. They saw fire outside the cave and made their way out. On the way out they passed several prone bodies in the cave, most of them moaning and crying for help.

Once outside, this woman made her way to a cave higher on the hillside to avoid the fires of the houses toward the main road. The fires were very intense. The other girl was led to the highway by a young man, who did not work in the cave and in unknown to them. He has come from higher on the hill. Later on, 2 or 3 other women joined her in the cave higher up on the hillside. On the way to this cave, she passed several dead or dying people in the rubble of collapsed houses, some of which were on fire. She thinks this was about 10 minutes after the explosion.

Of about 20 people in the cave, men, women, and children some being there before and some arriving after her entrance, most of them died of burns in the two days she remained; all died without food or water during that time. On the second day her daughter found her and took her to safety.

The faces and bodies of the burned individuals in the cave were quite markedly swollen.

She wore a black silk shirt and mompe at the time of the explosion. This was torn, not burned.

18. Eyewitness Account of the Bombing of Nagasaki by Hasegawa, Takatashi, a man, aged 44 years.

Location when bomb exploded - in a 2 story concrete building on the second floor facing the bomb center, about 4.5 meters away from a window, the glass of which had been blown away.

The bomb explosion threw me on my abdomen. I could not see momentarily, although I remained fully conscious. On the return of visibility, I walked to my home in a valley on the other side of a hill nearby. I was bleeding from a cut over the right eye which was difficult to control. On going to bed, I began to feel pain from cuts over the back, the left arm, and right side of head. Six days later I was examined by Dr. Shirabe, who said I had an incised wound of glabella about 1 cubic millimeter long, laceration of the right mastoid process, scalp, left forearm, multiple small incised wounds of the back, subluxation of the right first metatarso-phalangeal joint, general malaise, weakness from shock, and contusions.

I soon began to lose weight, which became quite marked in about a week. My skin became pale, dry, dark, and wrinkled. My eyes were sunken, my cheek bones prominent. Perspiration practically ceased, even on the hottest days, except on exertion. Appetite remained good for a time. Aside from dryness of the mouth on awaking, there was no change in the mucous membranes. At times I had a miserable feeling like a "hang-over". There was mild constipation. There were no changes in the special senses.

Two days after receiving my wounds, they became purulent, and my temperature, rose to 39.2'C. It soon returned to normal. Three weeks later, I had a chill with fever of 38.3'C, the temperature remaining slightly above 37'C for about 2 weeks. During all that time I felt cold and miserable. A high-pitched ringing noise affected the left ear, but hearing was not disturbed. Eyesight was good. My appetite became bad, I had insomia. My skin became even drier and rougher. My throat was sore, although the tonsils did not swell.

Small, purplish spots appeared on the limbs and chest. The stools were either too dry or watery, and at times bloody. Urine seemed normal. All these symptoms disappeared about 7 weeks after injury, and now, 13 weeks later, my health is rapidly returning to normal. I am still mildly anemic, tire readily and have ringing in the left ear.

Treatment was dietary and not medicinal. When purpura appeared, I received injections of vitamins B and C for several days, and ate a high caloric diet, forcing myself to eat when the appetite was poor.

My wounds were very slow in healing, the only treatment consisting in maintaining cleanliness when iodoform seemed to be without effect. With return of health, healing was rapid. There seems to be an exaggerated growth of hair about the wound on the arm. My stay at hot-springs region with hot baths caused marked improvement in health.

19. Eyewitness Account of Bombing of Nagaski by Koga, Tatsuya, a man aged 25.

At the time of the bomb explosion, I was in the isolation ward of Nagasaki Medical Hospital which was about 700 to 800 meters southeast of the bomb center. The building is made of concrete, two stories high. I was at the north end of the hall. On the east side of the floor is the hall; on the north, west, and south are sickrooms. I was, therefore, sheltered from the bomb by the walls of the building and of the rooms. I wore a white, long-sleeved shirt, white sport trousers, putties, and a white gown over all.

As I was walking through the hall, I heard what shounded like a dive bomber. I was about to make for a shelter when I was thrown to the floor, striking my head. I did not see a flash, nor do I recall hearing the noise of the explosion. The concussion caused unconsciousness for probably a minute. When I opened my eyes with return of consciousness, everything appeared black before me. Believing I had become blind and unable to escape, I sat still for several minutes. But then the dust and black smoke began to clear and I was able to see the surroundings. I could not smell the smoke, nor did it affect my eyes.

Blood from a wound in my scalp was dripping down my cheeks onto my gown and trousers. The backs of my hands were scratched. The hall was filled waist-high with broken glass and plaster. I ran down the broken staircase out of the building and saw that the nurses' dormitory, a 2 floored wooden structure, was completely destroyed. I now realized an atomic bomb had exploded. With 4 other doctors and with some nurses and patients, we took shelter on the hillside at the back of the hospital. On leaving the grounds, about 15 minutes after the explosion, we noticed that all the houses in sight had been destroyed and that smoke was rising from some spots. I applied iodine to my scalp wound and dressed it with a compression bandage.

About 3 in the afternoon I felt nauseated and vomited bile 3 times. The mucosa of the left eye became hyperemic, edamatous and painful, as though a foreign particle was present. My mouth was dry. An overwhelming lethargy came over me, and I lay down in the field. At 6 P.M. I awoke and walked to the center of town, which was now nothing but a ruins from the fire. I drank water several times but vomited all immediately.

After a good night's sleep, I felt refreshed. The pain in the eye had left. I worked among the wounded till the 15th. On the 16th the conjunctivitis reappeared, and the pain and swelling became so marked that I went to my home in Kumamoto on the 17th of August. I then developed fatigue, anorexia, fever, diarrhea, and sore throat. After 2 days in bed, everything disappeared but the sore throat, but that left in 2 more days. Fatigue and anorexia lasted 2 more weeks. A kerato-conjunctivitis with severe signs and symptoms developed. Treatment with zinc sulfate and a chromic preparation caused improvement. After 3 weeks at home, healing was complete. On 27 September, WBC was 3,600. I have had no epilation, no gingivitis, no purpura, and no bleeding.

20. Eyewitness Account of the Bombing of Nagasaki by Koyano, Kohei, a Professor at the Nagasaki Medical School.

I was in good health at the time the atomic bomb was dropped at Nagasaki. I can distinctly remember that the weather was fine, too. At 8 o'clock in the morning I started for the college and on the way I heard the warning signal. Later came the air raid alarm, at which time I had been making my rounds of the hospital patients. I stopped making my rounds and waited in my office. At about 11 o'clock the all-clear signal was given and I went into the surgical outpatient consulting room, in the front part of the main building and there began polyclinic work.

The building I was in was 3 story concrete structure with a basement. On each floor was a hall through the center of the building, almost from east to west. On either side of the hallways were rooms for various hospital and educational purposes. My consulting room was on the south side. Under these conditions the room I was in at the time of the explosion was sheltered from radiant energy by the roof, ceiling, and floor above; and from the south side by the three walls which divided the room from the hall and the other room. There was a table a little to the west from the center of the room, and a consulting table a little east from the center. I was sitting between these 2 tables with the south windows behind me and facing north.

Around me were a few students, doctors, nurses, and patients. For some time after the bombing I could not find out what happened to these people, but later I was assured that all of them survived without serious injuries.

I had been quite absorbed in my work and had not noticed any sound of a plane. At about 11:30 that morning I felt a strange flash like a magnesium flash from the windows behind me, and about the same time with an ear-rendering noise the whole place turned to darkness. The earth from the walls, window glass, and instruments were broken to bits and poured around me like a shower while a hot wind with a strange smell (like exploded firecrackers) attached itself and made me choke for a while. This must have been for about 10 seconds, I was not sure, but I was quite concious at the time. In a little while I saw a dim, round light before my eyes which gradually broadened. "If you have ever been on a train with no top on it, and suddenly rushed into a tunnel, you would have felt the hot smoke from the engine all over you in the dark, and as the train neared the exit of the tunnel, you would then see first the dim light which would gradually grow wider and stronger." It could be explained something like that, even to the broadening of the light.

I had heard that there were unnumbered cases of patients with burns in Hiroshima, a couple of days previously, and I just thought of covering myself, head and all, with the white calico gown I was wearing. Doing so I quickly crouched on the floor. Just as soon as it cleared from the darkness to twilight I stepped out to the hall, but found that I could hardly walk on it. So I went out into the yard through the window. Then for the first time I noticed I was bleeding from my forehead and bruised about the left elbow. As these injuries did not disturb my bodily motion I left them as they were and tried to look around. There stood a pillar of brown smoke and the sun in the sky looked bloody because of the smoke, which appeared as if you were looking

toward the setting sun in Manchuria through the yellow sands.

There were students and nurses with some strange injuries, like burns on the exposed parts of their bodies. (I had not quite realized this to be an atomic bomb as yet.) Some were wounded and bloody all over and they were all crying for help. The whole scene looked like "Hell" itself. I turned around the main building and came near the location where my office and operating room were, there I saw flames shooting out from the north room where there had been no windows at all since the bombing of 1 August. (During this time not more than 5 minutes had elapsed.)

I was afraid of being surrounded by the flames which had suddenly enveloped me and escaped to a hill 500 meters on the east side. Others say that about this time we had a shower, but I do not remember it.

Some of the wounded dropped on the way to the hill. Many knowing I was a surgeon swarmed around me for aid. I saw burns of wide areas on most of them and they cried from thirst. When we came up to the hilltop an assistant with no outward-appearing injury began to vomit and now was unable to walk. (He got better once but died after 5 weeks). Now we came over the hill to the town and I gave some directions to the people. I climbed to the hilltop again at night to sleep there. The next morning I went down to the college, knowing that the president was seriously injured, and I had to take up his responsibilities.

My home was about 0.9 kilometers northwest from the hospital and about 0.5 kilometers from the bomb center. The house had burned and collapsed but the trench underneath it was still in good condition. For a week after the bomb I slept in the trench at night and worked in the college during the day. After a week I moved away to a part of the city about 4 kilometers from the college and walked every day back and forth under the midsummer's sun.

My wife had been wounded on her head, chest, and limbs but had been getting better. But about two weeks after the injury her temperature went up to 40 degrees C, and she became hemorrhagic and her condition was quite serious. I gave her 250 cubic centimeters of my own blood, but in those days of heavy responsibilities I did not seem to feel tired. One day at the beginning of September after walking in the rain to the hospital and back home again, for the first time I felt quite feverish. My temperature at the highest was about 38.5 degrees C, and while in bed from 36.9 to 37.5 degrees C, (normal temperature is 36.4 degrees C) for a period of 10 days. My gums became dark purple and there was slight hemorrhage. My blood test at that time showed 4,950 leukocytes, and the urine was normal. Actually I was in bed 6 days and injected vitamins A&C, liver preparation, and calcium, and ate as many summer oranges as I could get which proved especially effective. During the time I was ill, on both cubital fossae where I had intravenous injections thrombi appeared, but they neither developed into necrotic or suppurative lesions and disappeared in 10 days with the removal of fever.

Since then, though, with a slight feeling of weakness I have been able to stand the physical and mental strain of my new situation as temporary president of the college, and since the middle of October my skin has begun to look normal and well-nourished.

For a while I had lost all my sexual appetite, since after 2 months it has come back but it's not quite normal.

To conclude all this, though I was within 0.8 kilometers from the bomb center I was protected by 3 concrete walls from the radiation and effects were slight, but I have had some of the symptoms, the slight hemorrhagic gingivitis, the thrombosis of the veins after injection, and fever for 10 days which appeared 4 weeks after the atomic bomb.

I must make a notation here that I stayed for a week right after the explosion, about 800 meters from the bomb's center, and that under the circumstances I was not able to take care of myself or keep myself quiet, but had to be working much harder than before and yet until the beginning of September I felt no discomforts at all.

21. Eyewitness Accounts of the Bombing of Nagasaki.

The following interviews were given to a member of the Atomic Bomb Commission at Nagasaki.

a. Eyewitness Account by 5 Japanese Sailors.

The next morning, 10 August 1945, after the bombing a number of dead were along the side of the road across from the Nagasaki Station who showed evidence of burns. It was the impression of the narrator that these people had walked from somewhere near the center of the bomb area. Buildings along the road were smoldering but not in actual flame. About 2,000 meters from the bomb center there were many dead lying along the road with evidence of burns. Their clothes were scorched The bodies showed evidence of multiple wounds about the head and extremities and burns of exposed areas. From 2,000 meters toward the center there were many dead and wounded. There are estimated 300 to 400 dead and dying from 2,000 meters to 900 meters. The numbers of dead increased as you approached the center. The dead and dying were being moved to caves along the road. A number of dead horses (about 100) were bloated and described as having no hair. As he approached the center from 900 meters the bodies appeared black, "as though they had been painted black". A few of those who were black appeared to be alive. The forest on the west was noted to be smoking and burning. The houses at 600 meters, looked as though they were blown away rather than burned. The dead were black and swollen and had no clothes. Dead animals were also noted in this area. The horses were described as hairless, bloated, and with abdominal walls ruptured. Going along the road from 500 meters toward the center there were easily 50 bodies countable. At the foot of the hill to the Medical School there were 20 or 30 dead. These bodies were naked and black, and some were swollen and had ruptured abdomens.

b. A narrator on the ship "Tsurugka Maru" saw the explosion through field glasses. He heard a loud explosion and what he thought were 4 or 5 explosions afterwards. The smoke after the explosion, which appeared to rise straight up, seemed to be bluish in color at the base and white and mushroom-shaped on top. The narrator noticed several fires in the surrounding forest; also a small boat bringing supplies to the narrator's ship caught fire and burned soon after the explosion. A black hat of one of the men on the ship was blown from his head by the blast and when found it was noted that the hat had turned brown. A number of the ship's crew suffered flash burns. One of the men who wore short sleeves had second degree burns of his arms with huge blister formation. This ship was 9000 meters from the bomb center anchored in the harbor.

c. "On 13 August 1945, bodies were being burned in the vicinity of the Nagasaki Station (2,600 meters.) At 1,800 meters bodies were seen being removed from factory sites. The entire area looked deadly brown, nothing was green. There was a strange, horrible odor everywhere. A building at 1,400 meters was still smoking. The hills to the west of the city had many smoking areas. There were a number of bodies along the road from this point, 1,200 meters, on toward the center."

The narrator was unable to see these bodies because they had been

covered. "At 600 meters north of the center there were about 6 bodies which were swollen, faces yellow, eyes were entirely out of their sockets, tongues were protruding, and abdomens were ruptured on the left with intestines outside the abdominal wall. A number of blind horses were straying about the area; their eyes appeared to have been burned. The entire area was brown, nothing green was visible."

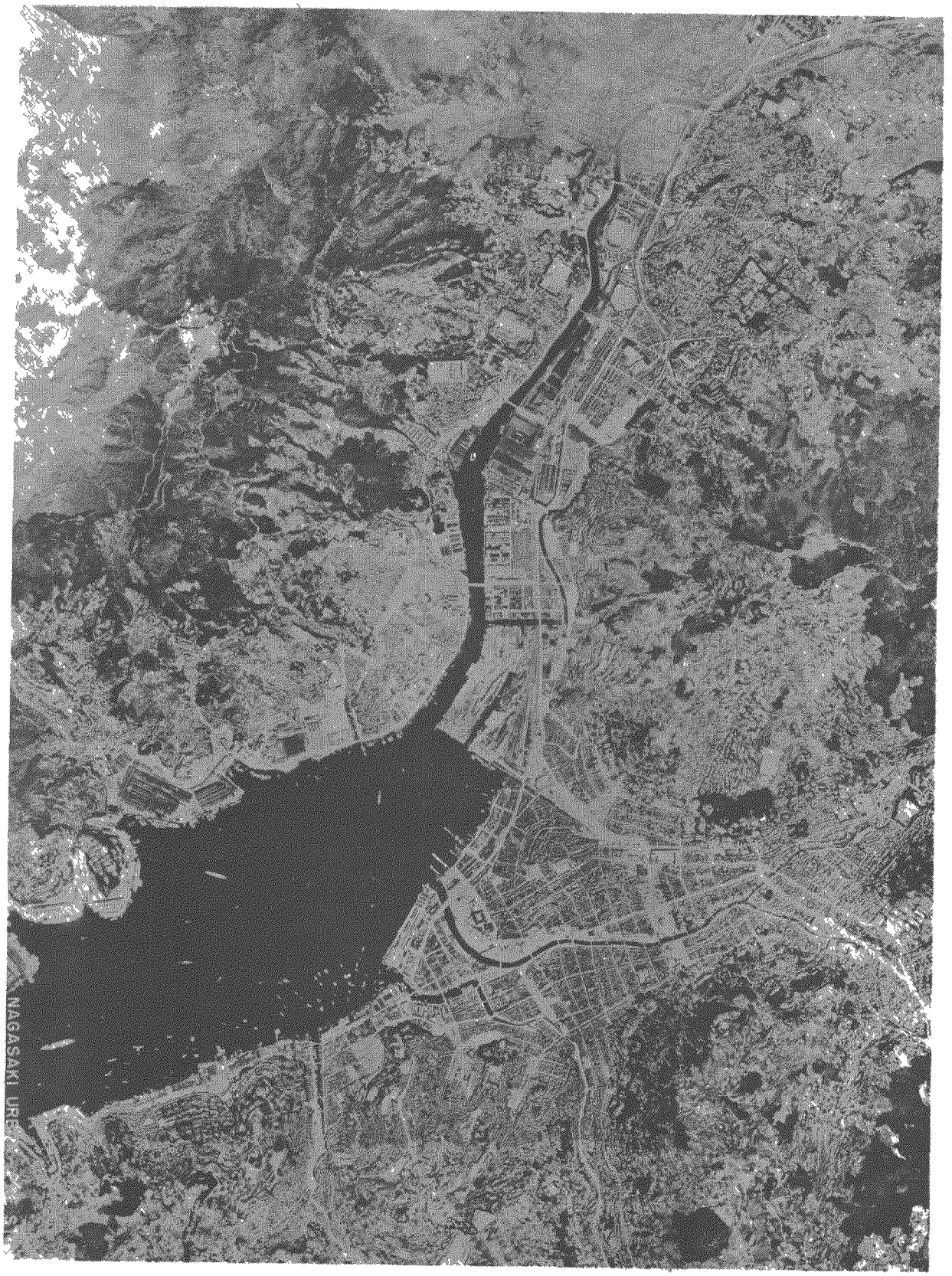


Fig. 1--(3N). Aerial photograph of city made before the raid by AAF reconaisance planes. (Photo File #NG 214.)

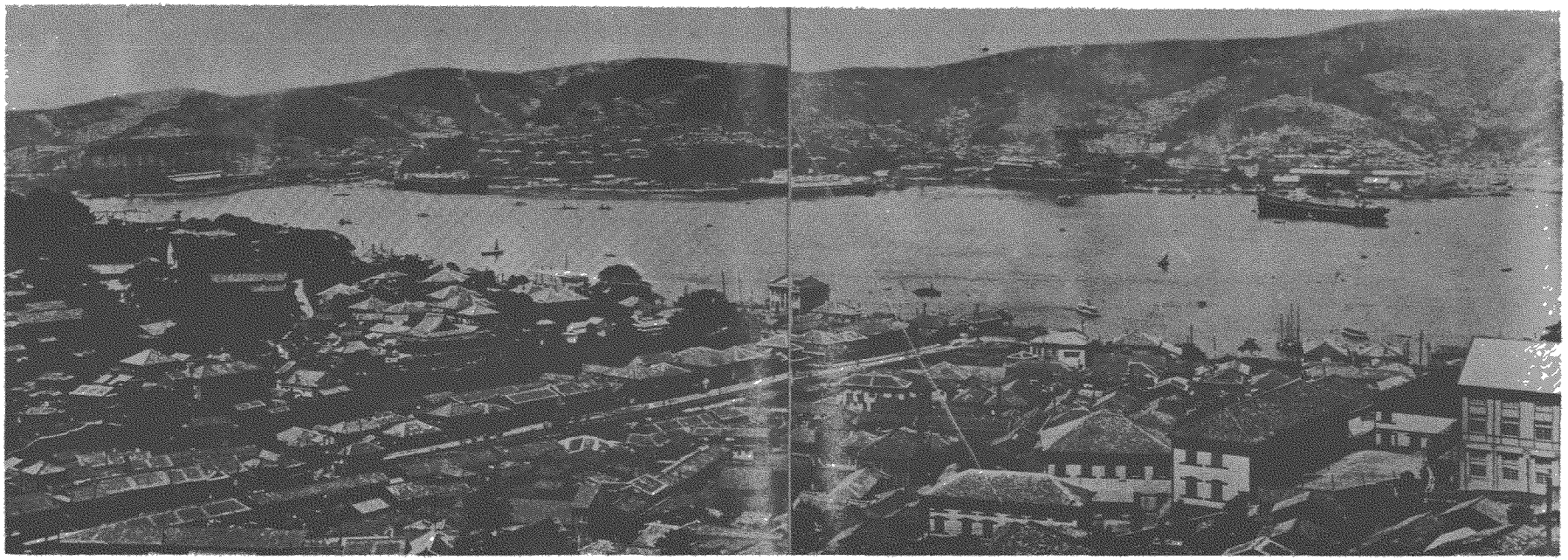


Fig. 2--(3). General view of the Nagasaki city and harbor,looking west. (Photo File #NB 123 a, b.)

Fig. 3a--(3N). General view of Nagasaki city and harbor, looking south. (Photo File #NB 126.)

Fig. 3b--(3N). General view of Nagasaki city, looking toward the Oura school district. (Photo File #NB 125.)

Fig. 4--(3N). Street scene in undestroyed section of Nagasaki, showing the narrow thoroughfare and the type of building. (Photo File #NG 101.)

Fig. 5--(3N). General view of an undestroyed portion of the city showing the congested arrangement of the houses. (Photo File #NG 103.)

Fig. 6--(3N). General view of a tenement section. This scene was taken after the bombing, but was typical of much of the area exposed. (Photo File #NB 121b.)

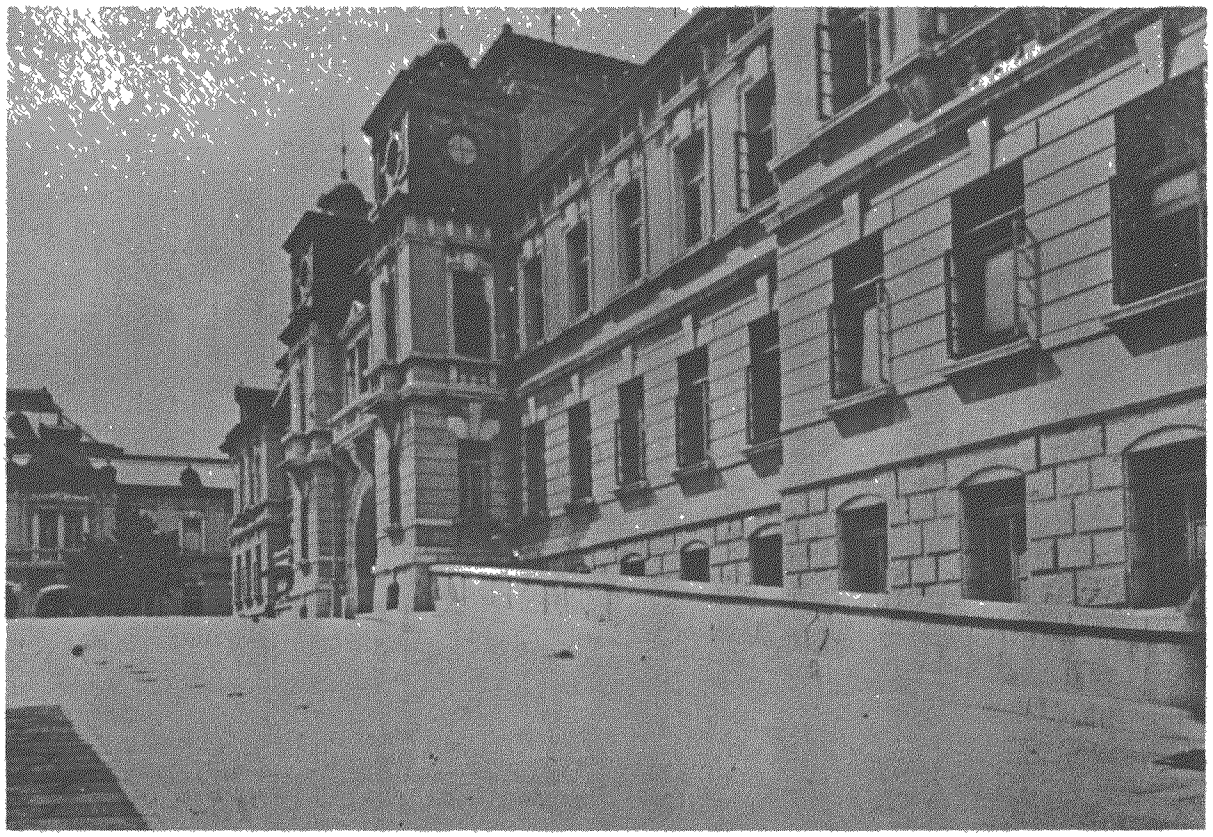


Fig. 7--(3N). The Nagasaki Prefectural Office. (Photo File #NB 119.)

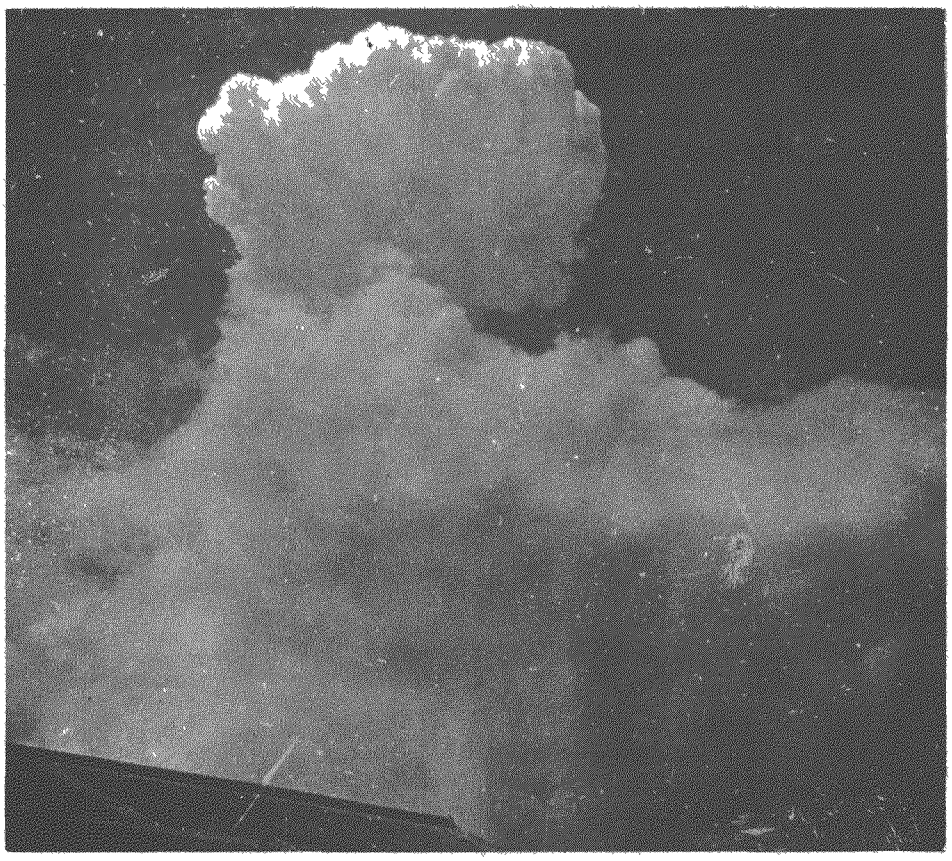


Fig. 8--(3N). The "cloud" created by the explosion of the atomic bomb. This photograph was taken at Omura Naval Hospital, 28 Km. from Nagasaki City. (Photo File #NG 110.)

Fig. 9--(3N). Aerial photograph of the city made after the bombing by A.A.F.

Fig. 10--(3N). Panoramic view of the destruction in the Urakami Valley. The camera was located near the Shiroyama school and the angle of view is 260°, looking from the west. (Photo File #NG 133-139, inc.)

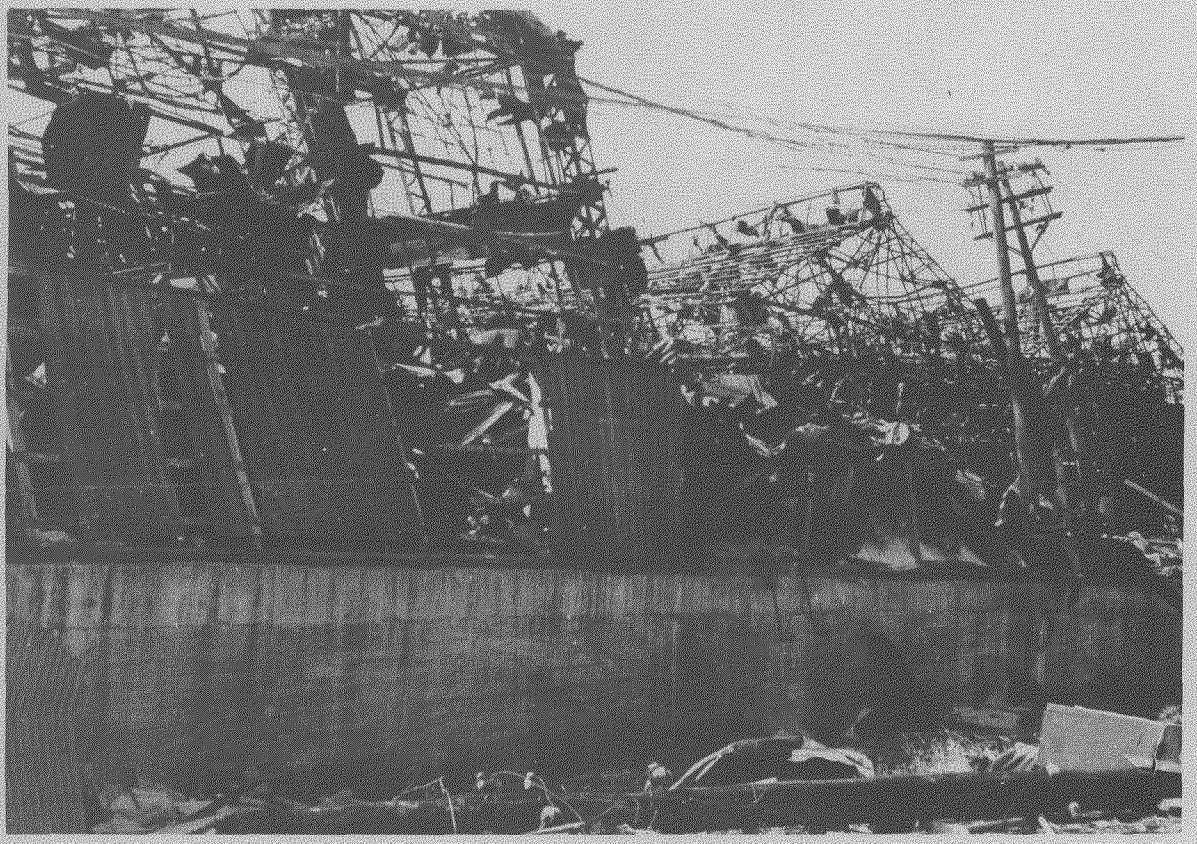


Fig. 11--(3N). The Mitsubishi Steel and Arms Factory (Arsenal-Morimachi Works). These buildings were approximately 1300 meters south of the center. (Photo File #NG 147.)

Fig. 12--(3N). Mitsubishi Steel and Arms Factory. Scene in one building where billets of steel for shells and guns were treated. This site is approximately 700 meters from the center. (Photo File #NB 437.)

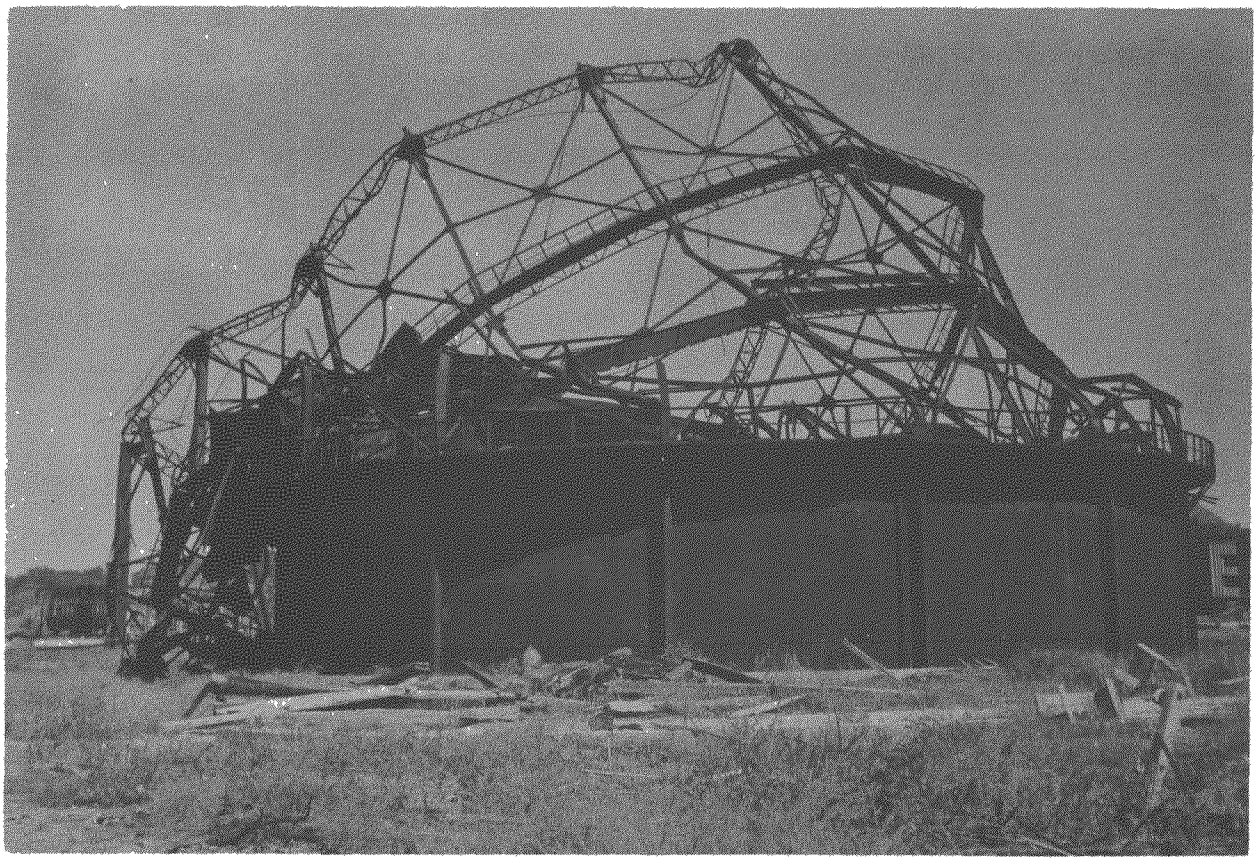


Fig. 13--(3N). Storage tank, Urakami Gas Works. This tank was located 1,000 meters north of the center. (Photo File #NE 107.)

Fig. 14--(3N). One of two storage tanks of Urakami Gas Works, located 2,000 meters south of the center. The top is "dished" in by the blast but it is otherwise intact. (Photo File #NE 106.)

Fig. 15--(3N). Prefectural school for Blind and Deaf and Tamaura Middle School, located 800 meters N.E. of center. (Photo File #NG 169.)

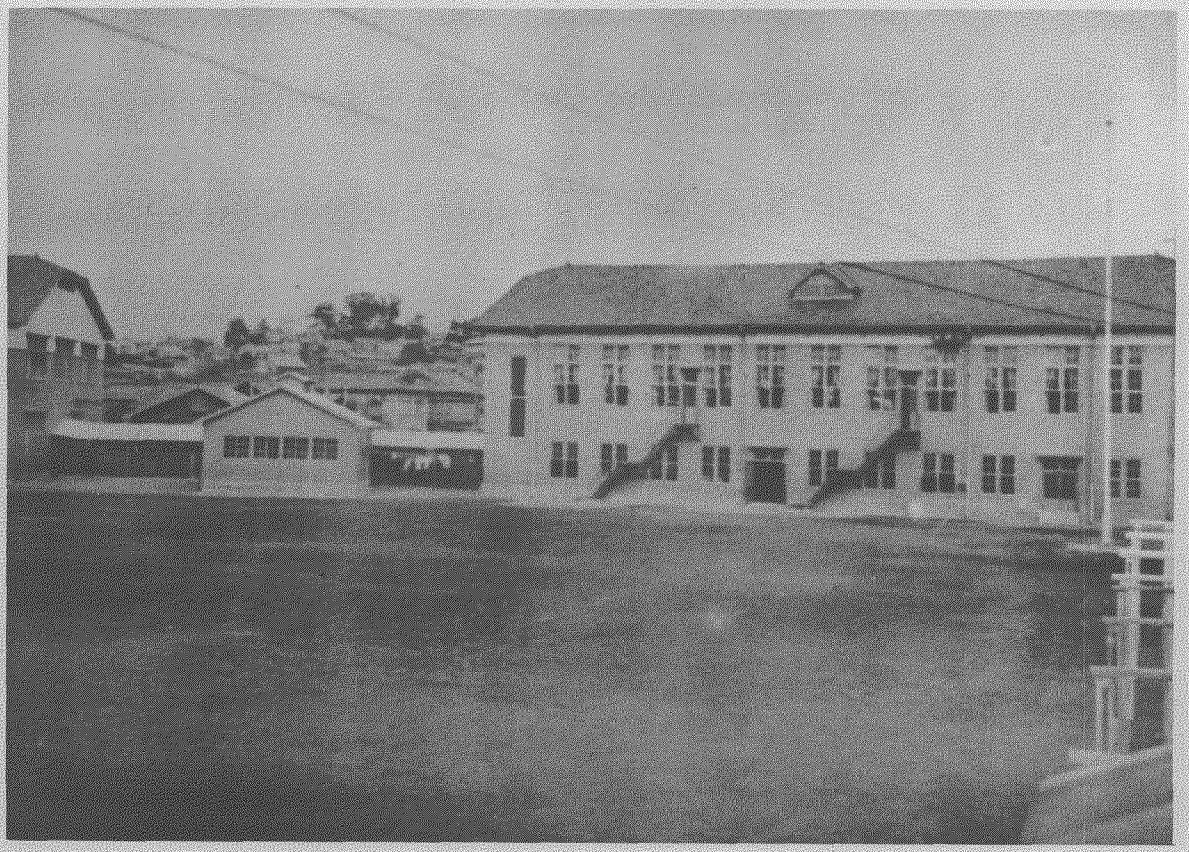


Fig. 16a--(3N). Mitsubishi Industrial School before the explosion. The buildings were located 900 meters south of the center. (See Figure 16b (3N).) (Photo File #NB 109a.)

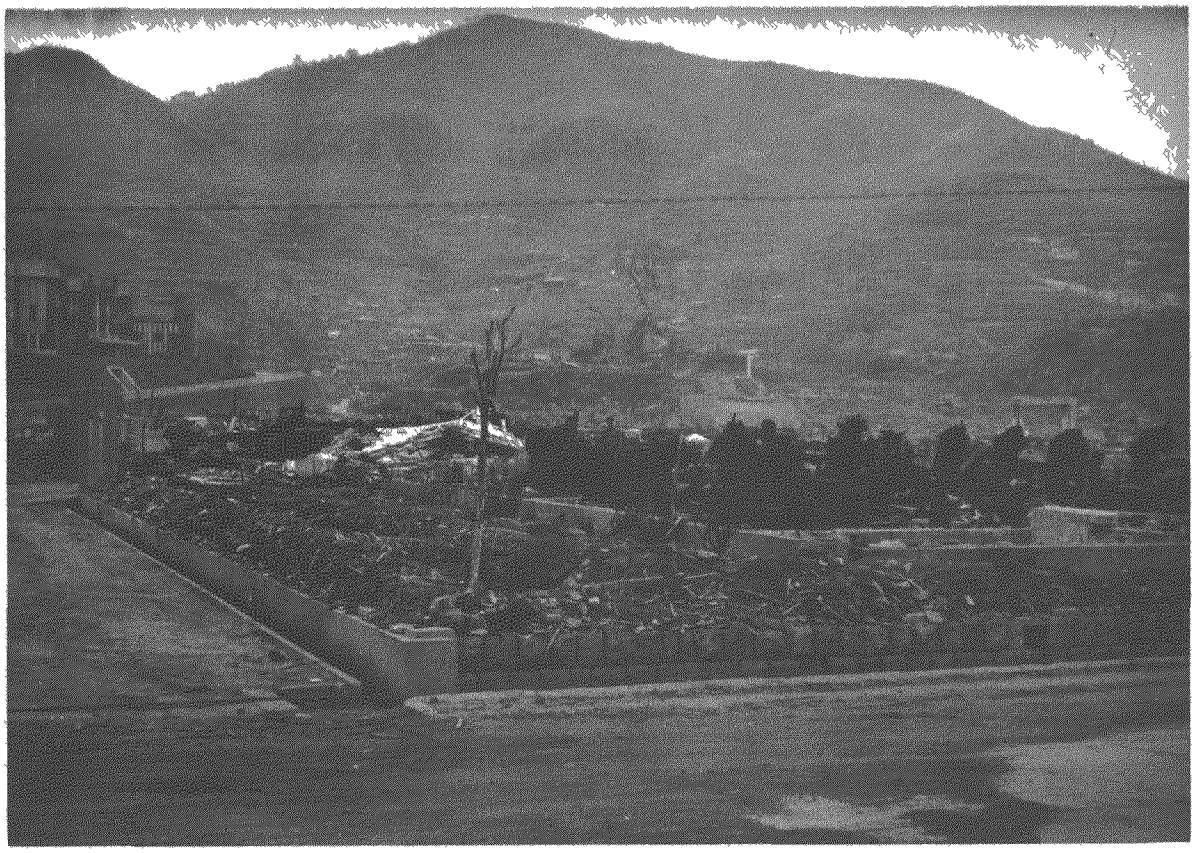


Fig. 16b--(3N). Mitsubishi Industrial School after the bombing. (Photo File #NB 109c.)

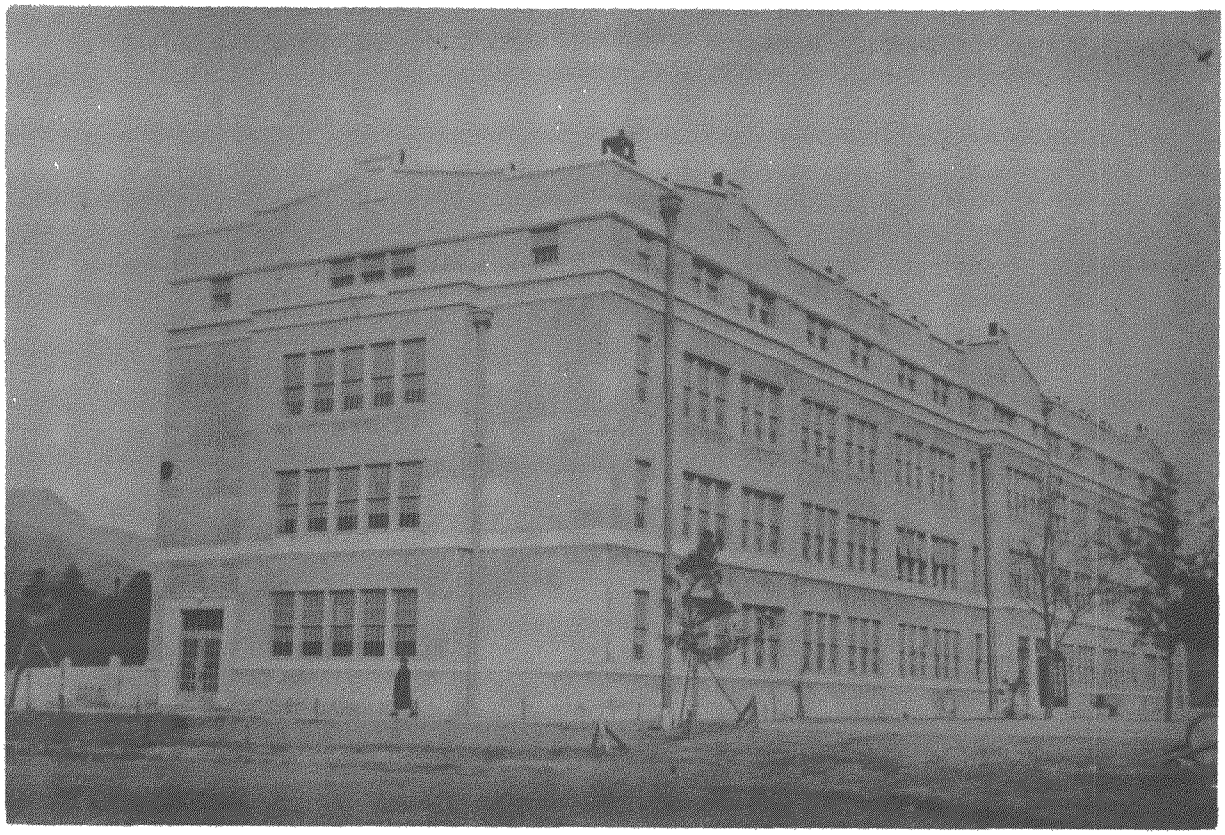


Fig. 17a--(3N). Chinzei Middle School before the explosion. See also Section 11. (Photo File #NB 113a.)

Fig. 17b--(3N). Chinzei Middle School after the explosion. This building was 500 meters from the center. (Photo File #NB 113c.)

Fig. 17c--(3N). Sanno Shrine after the bombing. The shrine was 1,000 meters N.E. of the center. Note that the torii is broken in half. (Photo File #NG 194.)

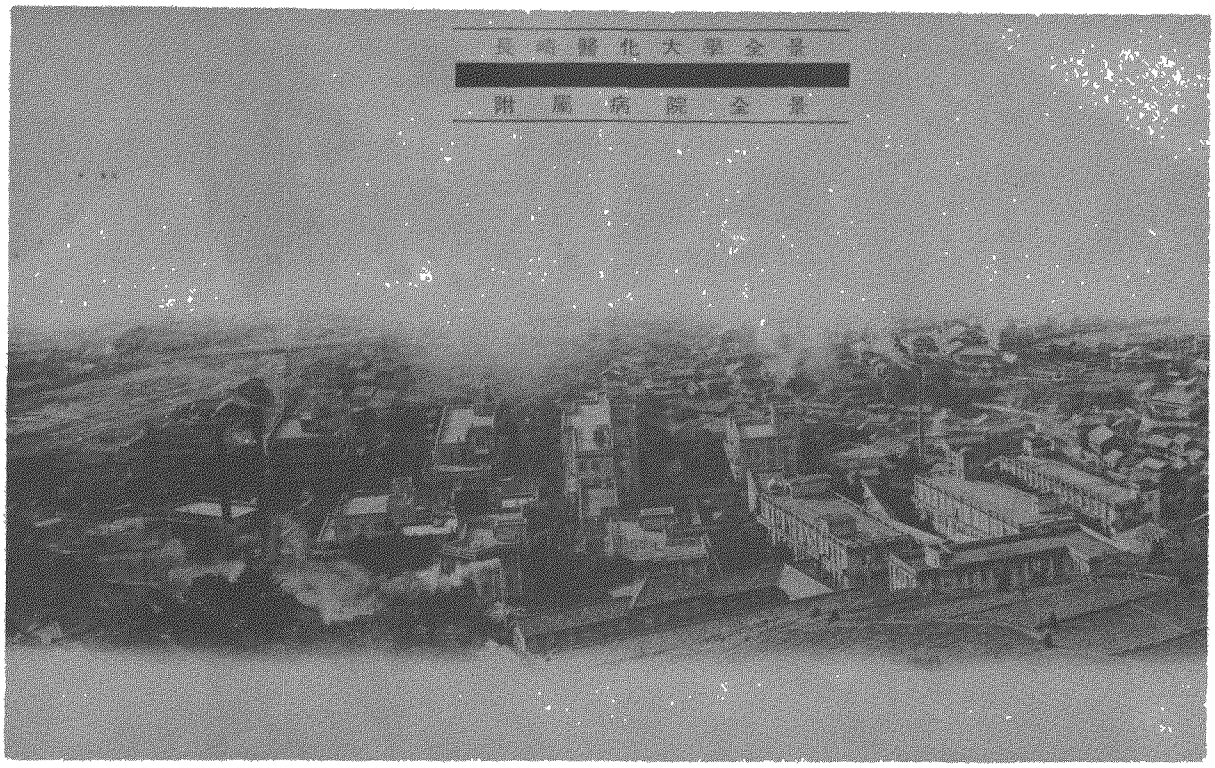


Fig. 18a--(3N). The Hospital of the Nagasaki Medical College before the bombing. The group is located 800 meters S.E. of the center. (Photo File #NB 105 a.)

Fig. 18b--(3N). The Hospital of the Nagasaki Medical College after the bombing. Only the reinforced concrete buildings remain. (Photo File #NB 105b.)

Fig. 19a--(3N). Urakami Roman Catholic church before the bombing, located 800 meters E. of the center. (Photo File #NB 100a.)

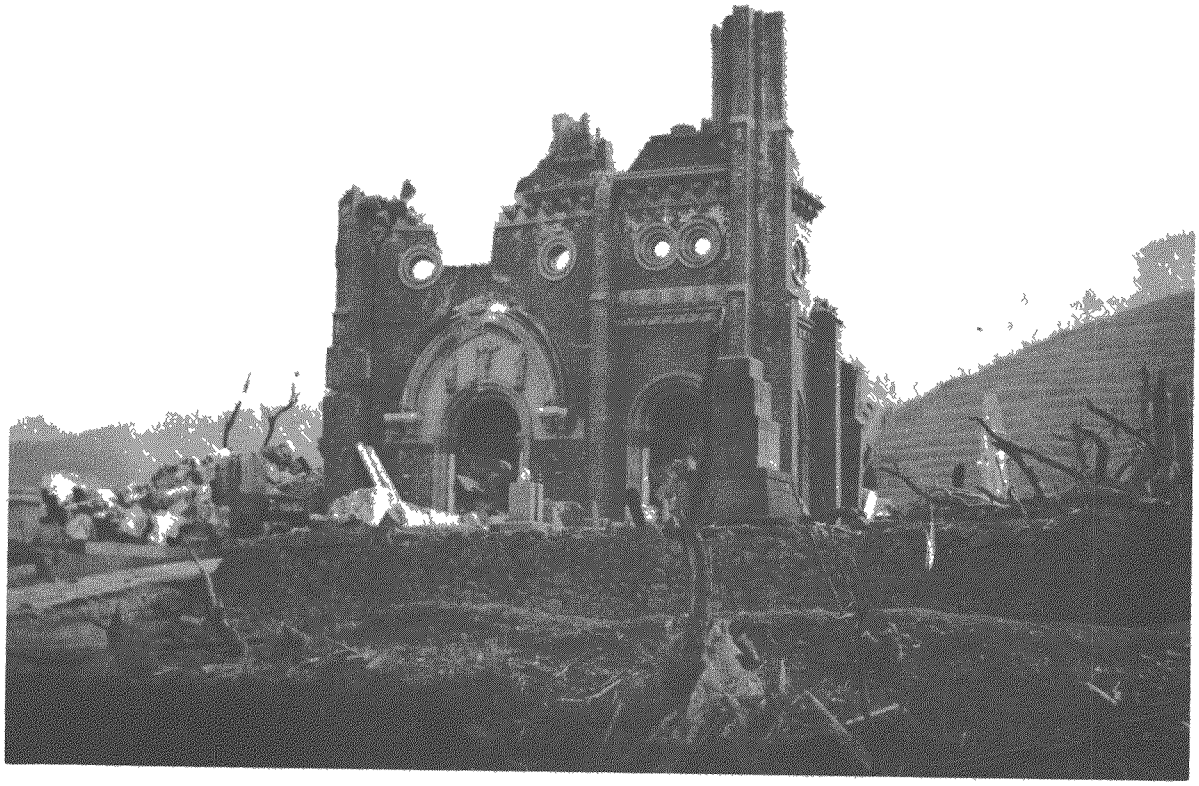


Fig. 19b--(3N). Urakami Roman Catholic church after the bombing. (Photo File #NB 100c.)

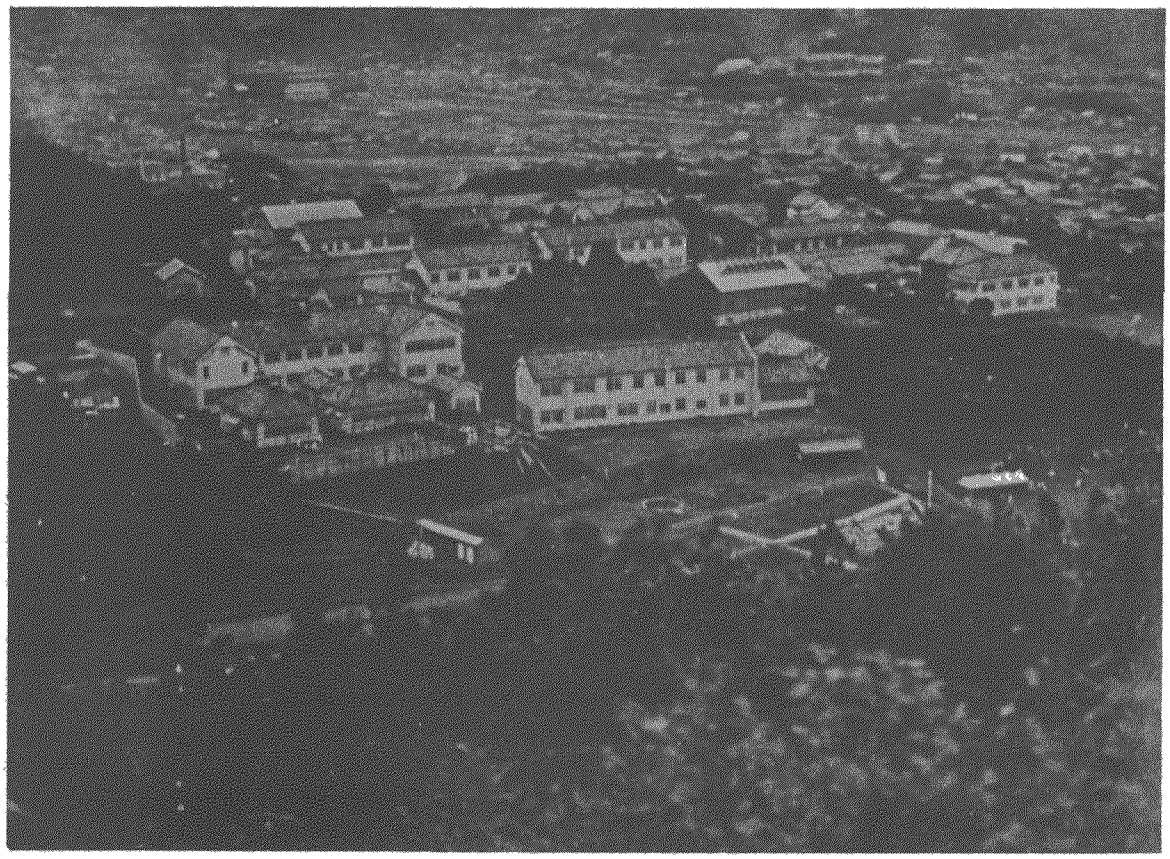


Fig. 20a--(3N). The building of the Nagasaki Medical College, and Pharmaceutical College before the bombing; located 700 meters S.E. of the center. (Photo File #NB 108a.)

Fig. 20b--(3N). The buildings of the Nagasaki Medical College after the bombing. Only the reinforced concrete structures remain. (Photo File #NB 108c.)

Fig. 21a--(3N). Sofuku (Christian) Church and a typical residential district of wooden houses before the bombing. The church is located 2,700 meters south of the center. (Photo File #NB 122a.)

Fig. 21b--(3N). Sofuku Church and residential district after the bombing. (Photo File #NB 122b.)

Fig. 22--(3N). Street car terminal, near the center of the explosion. The Shiroyama National School is in the background. (Photo File #NG 202.)

Fig. 23--(3N). Scene along main railroad track near center of explosion. A train was blown off the track, and the wreckage of one of the cars and several cadavers are shown. (Photo File #NH 124.)

Fig. 24--(3N). Cremated cadavers trapped in the debris of a Japanese house. (Photo File #NH 122.)

Fig. 25--(3N). Yamaguchi, 17, male, distance unknown. 2nd degree flash burn in the early stage, from Japanese sources. Omura Naval Hospital, August, 1945. (Photo File #NP 144.)

Fig. 26--(3N). Survivors and rescue workers on the main road from the Urakami Valley. The child being carried, in the foreground, has his face burned black by the flash. This photograph was taken within the first few days after the explosion. (Photo File #NH 112.)

Fig. 27--(3N). A scene in a first aid station. (Photo File #NH 127.)

JAPAN CITY PLANS 1:12,500

TYPE C-AMS 1

NAGASAKI

For use by War and Navy Department Agencies only
Not for sale or distribution

NAGASAKI
NAGASAKI PREFECTURE, KYUSHU, JAPAN

Scale 1:12,500

½ 0 ½ Mile
500 0 500 Meters
500 0 500 Yards

CONTOUR INTERVAL 10 METERS

POLYCONIC PROJECTION
ONE THOUSAND YARD WORLD POLYCONIC GRID BAND IIIn, ZONE "C"
THE LAST THREE DIGITS OF THE GRID NUMBERS ARE OMITTED

INDEX TO BOUNDARIES

NAGASAKI-KEN
1. NAGASAKI-SHI
2. NISHI-SONOGI-GUN
a. FUKUDA-MURA
b. MOGI-MACHI
Political boundaries as of November 1943.

Prepared under the direction of the Chief of Engineers by the Army Map Service (AMS), U. S. Army, Washington, D. C. Compiled in 1945 from aerial photography dated August, October and November, 1944, and March, 1945, by stereo-photogrammetric methods and by reference to Japanese Hydrographic Chart 197, 1:12,000, 1935; Controlled Intelligence Data, 1:16,000, 1943; Nagasaki Prefecture, ed. 1. Kusuka, inset, Nagasaki, 1:35,000, 1937; City of Nagasaki, 1:11,000, 1921; Japan 1:200,000, Japanese Imperial Land Survey, Nagasaki, 1909; United States Hydrographic Chart 1270, 1:12,000, 1933 cor. 41; Japanese Hydrographic Chart 197, 1:12,000, 1906; British Admiralty Hydrographic Chart 2815, 1:12,000, 1901; Japanese Hydrographic Chart 203, 1:75,000, 1928 cor. 30; British Admiralty Hydrographic Chart 2415, 1:25,000, 1913 cor. 40; Japan 1:200,000, Imperial Geological Survey, Nagasaki, 1912; Guide to Japan, Imperial Railways, Nagasaki, 1:16,000, 1926; Nagasaki City, ed. K. Katsura, 1:10,000, 1924. Additional information from intelligence data. Place names transcribed according to the modified Hepburn (Romaji) System.

COVERAGE DIAGRAM

COMPILATION METHODS

PHOTO STEREO		PHOTO PLANIMETRIC
6°-Vertical (high)	Intensified	
Long focal length	6°-Oblique (reliable)	MAP
6°-Oblique (sketchy)		

A. U.S.H.O. Chart 1270, 1:12,000, 1933, cor. 1941 (Reliability good).
1. Sortie 5M75 6°V, 1945.
2. Sortie 4M69 6°LV, RV, TV, 1944.
3. Sortie MJ 6°V, 1944.
4. Sortie 4MR22 24°V, 1944.

APPROXIMATE MEAN DECLINATION 1945 FOR CENTER OF SHEET
ANNUAL MAGNETIC CHANGE 1' WESTERLY

Use diagram only to obtain numerical values. To determine magnetic north line, connect the pivot point "P" on the south edge of the map with the value of the angle between GRID NORTH and MAGNETIC NORTH, as plotted on the degree scale at the north edge of the map.

GLOSSARY

-bashi	bridge
-chō	precinct
-gawa, -kawa	river
-gun	county
-hana, -bana	point
-ji, -dera	temple
-jinsha, -jinja	shrine
-ken	prefecture
-ko	port
-machi	township
-machi	precinct
-mura	township
-saki, -zaki, -mizaki	cape
-shi	municipality
-shima	island
-sone, -se	reef, shoal
-take, -dake	mountain
-ura	inlet
-yama, -san, -zan	mountain

LEGEND

Built-up area	Fence, Cemetery
Road, Track or trail	Temple, Shrine, Pagoda
RAILROADS	
3'6" gauge, single track	Dike or wall: Masonry, earth
3'6" gauge, double track	Masonry retaining wall, Revetment
4'8½" gauge, single track	Soundings in fathoms
4'8½" gauge, double track	Limiting danger line
Narrow gauge or light, single track	Rocks bare at low tide
Narrow gauge or light, double track	Rock awash
In street or road	Sunken rocks, Principal navigational light
High tension line	Woods-Brushwood
Waterwheel or Mill, Anchorage, Chimney	Brushwood
BOUNDARIES	Orchard
Prefectural	Bamboo
Gun or Shi	Paddy field
Machi or Mura	

Paddy fields are generally subject to inundation, however they may be seasonally dry.

HYDROGRAPHIC DATUM: NEARLY LOWEST LOW WATER
HEIGHTS IN METERS—DEPTHS IN FATHOMS
SEE BACKUP FOR INDEX TO ADMINISTRATIVE UNITS

CONVERSION GRAPH
NOT at the scale of the map.

Meters	Feet
3,000	10,000
2,500	9,000
	8,000
	7,000
2,000	6,000
1,500	5,000
	4,000
1,000	3,000
500	2,000
	1,000
0	0

A.M.S. L902
Type C (AMS 1), 1945.

NOTE: OFFICERS USING THIS MAP WILL MARK HEREON CORRECTIONS AND ADDITIONS WHICH COME TO THEIR ATTENTION AND MAIL DIRECT TO THE CHIEF OF ENGINEERS, WASHINGTON, D. C.

ARMY MAP SERVICE, U.S. ARMY, WASHINGTON, D.C., 138353
1945
8-45

NAGASAKI, JAPAN
N3242-E12950/6x5

INDEX TO ADMINISTRATIVE UNITS FOR NAGASAKI

CAUTION: THIS MAP FOR USE ONLY AS ADMINISTRATIVE LISTING REFERENCE

Military Grid references give the location of the southwest corner of the 1,000 yard square within which the unit lies.

Administrative names and locations are correct to July 1945.

ADMINISTRATIVE LISTING

KEYING NUMBER	NAME	MILITARY GRID REFERENCE
1	Nagasaki	9464
2	Nishigō	9367
3	Motoharachō	9467
4	Takaomachi	9466
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JAPAN CITY PLANS 1:12,500

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HIROSHIMA

HIROSHIMA PREFECTURE, HONSHŪ, JAPAN

Scale 1:12,500

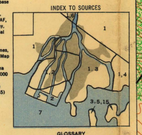
POLYCONIC PROJECTION

CONTOUR INTERVAL 10 METERS

ONE THOUSAND YARD WORLD POLYCYCLIC GRID, BAND IIIa, ZONE B
THE LAST THREE DIGITS OF THE GRID NUMBERS ARE OMITTED

Prepared under the direction of the Chief of Engineers by the Army Map Service (AMS), U. S. Army, Washington, D. C. Compiled in 1945 from: 1. Japan 1:25,000, Japanese Imperial Land Survey: Hiroshima (1930, '33), Kaidachi (1933), Gion, Fukawa (1928) (trigonometric survey-base map); 2. Vertical Aerial Photography c 1:16,000, XX USAAF, XXI BC, 3PR/SM/41/24", 32,000'/2V; 145 (April 1945) (partial coverage, clear-spot revisions); 3. Vertical Aerial Photography c 1:13,000, XX USAAF, XXI BC, 3PR/4M/1/19", 26,000'/2V; 18-28 (c. 1 July 1945) (partial coverage, cloudy-spot revisions); 4. Vertical Aerial Photography c 1:16,000, XX USAAF, 76,000'/4L and R; 18-45 (December 1944) (partial coverage, cloudy-spot revisions); 5. Vertical Aerial Photography c 1:16,000, XX USAAF, 3PR/SM/1/24", 32,000'/2V; 145 (April 1945) (partial coverage, cloudy-spot revisions); 6. Vertical Aerial Photography c 1:62,500,24 USAAF,XXI BC, 3PR/SM/63/9", 31,000'/4V; 3-7 (January 1945) (partial coverage, cloudy-spot revision); 6. Vertical Aerial Photography c 1:15,000, 32 USAAF, XXI BC, 3PR/SM/104/24", 30,000'/2V; 15 (March 1945) (partial coverage, clear-spot revisions); 7. Japanese Hydrographic Chart 231 (1/1945 Mar, No. 1), 200,871 (-) 42,833 (1938, corr. '44) (trigonometric survey-depths, added detail); 8. Nippon Annai-ki (Guide Book), pub. R-R Ministry, 1934, (Diagramatic plan-identifications); 9. Hiroshima Street Plan, pub. Kinseido Book Store, 1:15,000 (1934) (diagramatic plan-identifications); 10. Detailed Map of Residences and Industries of Japan, New District of Minasa in Hiroshima, pub. K. Hirata, c 1:3,000 (1935) (diagramatic plan-identifications); 11. Hiroshima Shi Zenzu (Complete Map of Hiroshima City), pub. Hiroshima Shi Yakusho, 1:15,000 (1935) (diagramatic plan-identifications); 12. Dai Hyakka Jiten (Encyclopedia) Hiroshima c 1:52,000 (1936) (sketch map-identifications); 14. Kokumin Hyakka Daijiten (Encyclopedia) Hiroshima c 1: 52,000 (1936) (diagrammatic plan identifications); 15. Japan 1:50,000, Japanese Imperial Land Survey, Hiroshima (1894) (trigonometric survey-contours); 16. Japanese Government Railway Timetable (1941) (railroad gauges); 17. USHO Lists of Lights (1944) (lighthouses); 18. Intelligence data (1944, '45) (identifications). Names transcribed according to the Modified Hepburn (Romaji) System.

INDEX TO SOURCES



LEGEND

Bombed Area, Completely Destroyed		Bombed Area, Partially Destroyed	
Factory		Roads generally metalled over 2 M. wide or Streets in City Areas	
Hospital		Streets in City Areas under 2 M. wide (to scale)	
Shrine		Other Roads 2-4 M. wide	
Temple		Road, Track or Trail less than 2 M. wide	
Chimney		3'6" Gauge, Single Track Railroad	
Monument		3'6" Gauge, Double Track Railroad	
School		4'8½" Gauge,Double Track Railroad	
Post Office		Railroad Station	
Depth of Water		Cutting	
Police Station		High Tension Power Line	
Theater		Woodland	
Bank		Grassland	
Cemetery		Bamboo	
Densely Built-up		Orchard	
Sparsely Built-up		Rice	
Unidentified Cultivation			

GLOSSARY

-bana (-hana)	point	-kyō (-kyō)	bridge
-bashi (-hashi)	bridge	-machi	street
-chō (-machi)	street	-mura	village
-gawa (-kawa)	river	-saki	point
-gō (-ryō)	shrine	-shima	island
-ike	pond	-shō	shrine
-kaikyō (-kaikyō)	strait	-tō	island (1)
-kawa (-gawa)	river	-tō	pagoda
-kō	harbor	-tō	lighthouse
-kōen (-kōen)	park	-wan	bay
-kuchi (-guchi)	entrance	-yama	mountain
-kumi (-gumi)	river	-yashiki	mansion
-machi (-chō)	street	-zaki	point
-mura (-son)	village		

Firelanes as represented on this map constitute temporary cultural features and are subject to rapid change.

HEIGHTS IN METERS, DEPTHS IN FATHOMS AT NEARLY LOWEST LOW WATER

APPROXIMATE MEAN DECLINATION 1945
FOR CENTER OF SHEET
ANNUAL MAGNETIC CHANGE 7' WESTERLY

Use diagram only to obtain numerical values. To determine magnetic north line, connect the pivot point "P" on the south edge of the map with the value of the angle between GRID NORTH and MAGNETIC NORTH, as plotted on the degree scale at the north edge of the map.

CONVERSION GRAPH
NOT at the scale of the map.

Meters	Feet
6,000	20,000
5,500	19,000
5,000	18,000
4,500	17,000
4,000	16,000
3,500	15,000
3,000	14,000
2,500	13,000
2,000	12,000
1,500	11,000
1,000	10,000
500	9,000
0	8,000
	7,000
	6,000
	5,000
	4,000
	3,000
	2,000
	1,000
	0

HIROSHIMA -WAN

KAITA -WAN

HIROSHIMA-KŌ (UJINA-KŌ)

HIROSHIMA AIRPORT (UNDER CONSTRUCTION)

HIGASHI DRILL FIELD AND MILITARY AIRPORT

1000 METERS

NOTE: OFFICERS USING THIS MAP WILL ADD HEREON CORRECTIONS AND ADDITIONS WHICH COME TO THEIR ATTENTION AND MAIL DIRECT TO THE ARMY MAP SERVICE, WASHINGTON, D. C.

ARMY MAP SERVICE, U. S. ARMY, WASHINGTON, D. C., 138449
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1946

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