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MANHATTAN DISTRICT HISTORY

BOOK I, GENERAL - VOLUME 4, AUXILIARY ACTIVITIES

CHAPTER 6, INVESTIGATION OF THE AFTER EFFECTS OF THE BOMBING IN JAPAN

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MANHATTAN DISTRICT HISTORY

Book 1, Volume 4, Chapter 6

Investigation of the After Effects of the Bombing in Japan

1. Inception of the Mission.

The first combat atomic bomb was dropped on Hiroshima at 8:15 a.m., Japanese time, on 6 August 1945; the second was dropped on Nagasaki three days later, at 11:02 a.m. on 9 August 1945. It was realized that the surrender of Japan might come at any hour and that preparatory action should be instituted at once, in order that advantage could be taken of the earliest possible opportunity to survey the damage on the ground and to gather such other data, useful to the Manhattan District, as might be available in Japan. It was also realized that our troops, entering the enemy's homeland for military occupation, might be subjected to damage from radioactivity if they were permitted to go into Hiroshima and Nagasaki before investigations had been made of the intensity of residual contamination in those areas.

Accordingly, on 11 August 1945, two days after the bombing of Nagasaki, Major General L. R. Groves issued instructions for the organization of a series of special Manhattan Project Atomic Bomb Investigating Groups. On that day he sent a message to Brigadier General Thomas F. Farrell, his deputy in command of the Manhattan Project in the Pacific, instructing him to organize and command the mission there; on the same day General Groves also telephoned to Colonel K. D. Nichols, the District Engineer of the Manhattan District, at Oak Ridge. He requested Colonel Nichols to assemble survey parties, to be composed principally of medical and scientific personnel from the District, for the purpose of monitoring the affected areas

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and surveying the personnel damage. These survey parties were to be sent out to the Pacific, equipped with all necessary instruments, to be incorporated in General Farrell's organization. (Appendix, References 1,4.)

On 12 August 1945, the Chief of Staff sent the following message to the Theater Commander:

"FOR MACARTHUR, SIGNED MARSHALL:

"GROVES HAS ORDERED FARRELL AT TINIAN TO ORGANIZE A SCIENTIFIC GROUP OF THREE SECTIONS FOR POTENTIAL USE IN JAPAN IF SUCH USE SHOULD BE DESIRED. THE FIRST GROUP IS FOR HIROSHIMA, THE SECOND FOR NAGASAKI, AND THE THIRD FOR THE PURPOSE OF SECURING INFORMATION CONCERNING GENERAL JAPANESE ACTIVITIES IN THE FIELD OF ATOMIC WEAPONS. THE GROUPS FOR HIROSHIMA AND NAGASAKI SHOULD ENTER THOSE CITIES WITH THE FIRST AMERICAN TROOPS IN ORDER THAT THESE TROOPS SHALL NOT BE SUBJECTED TO ANY POSSIBLE TOXIC EFFECTS ALTHOUGH WE HAVE NO REASON TO BELIEVE THAT ANY SUCH EFFECTS ACTUALLY EXIST. FARRELL AND HIS ORGANIZATION HAVE ALL AVAILABLE INFORMATION ON THIS SUBJECT."

(Reference 1.)

2. Purposes of the Mission.

The message of the Chief of Staff, quoted above, outlined the three groups of which the organization planned by General Groves was to be composed: a first group for Hiroshima; a second group for Nagasaki; and a third group to secure information concerning general activities of the Japanese in the field of atomic weapons.

The primary purposes of the first two of these groups, which were to accompany the first American troops entering Hiroshima and Nagasaki, were:

a. To investigate the areas of the bombed cities and make certain that no unusual hazards were present which might endanger the troops;

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b. To obtain all possible information concerning the effects, both structural and medical, of the bombing of each of the two cities.

This chapter of the Manhattan District History is not concerned with the investigations carried out by the third group, whose purpose was to determine what progress had been made by the Japanese in atomic research and in the development of atomic weapons and what, if any, pertinent metallurgical resources could be found in Japan. Suffice it to say here that these investigations showed that the Japanese scientists had at the end of hostilities made even less progress than the Germans and had come nowhere near the attainment of an atomic bomb. As Dr. James Phinney Baxter wrote in his history of the Office of Scientific Research and Development, "Japan's organization of science for war was even more faulty than Germany's ... in short, if we had planned the Japanese system for research on new weapons, we could scarcely have devised one better calculated to promote our interests." ("Scientists against Time", pp.9,11).

3. Organization in the United States. Colonel Stafford L. Warren, Chief of the Medical Section of the Manhattan District, was appointed head of the medical personnel taking part in the mission. On 11 August 1946, Colonel Warren was on his way to Los Alamos and could not be reached, and Colonel Nichols placed Lt. Colonel H. L. Friedell in charge of the preliminary planning for the expedition (in Oak Ridge) with the help of Lt. J. W. Howland. Colonel Warren was consulted in Los Alamos by telephone and Colonel Friedell conferred with General Groves in Washington, and suggestions from both were incorporated in the plans for the expedition.

The party which was finally organized was composed of Manhattan District personnel from Oak Ridge, Chicago, Los Alamos, Dayton and Rochester,

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and included the following medical officers: Colonel Warren, Lt. Colonel Friedell, Captains H. L. Barnett, P. O. Hageman and H. O. Whipple, and Lieutenants J. H. Allen, B. M. Brundage, J. W. Howland and B. S. Wolf. Five engineer officers were also members of the party collected in the United States: Captains N. Varley and W. C. Youngs, Jr., and Lieutenants D. C. Collins, G. E. Goring and R. A. Tybout. Twelve enlisted men, trained in first aid and in radiation measurements, completed the party: Seymour Block, R. M. Brownell, Joel Greene, A. T. Greenwood, Nathaniel Hill, Carl Hornberger, Thuron Hamphries, Robert Leonard, Phil Levine, Wendell C. Miller, Robert J. Smith and Frank Sowa. Instruments were obtained from Los Alamos, Rochester and Chicago. The personnel assembled at Hamilton Field, California, on 12 August 1945, and were there joined by Lt. Colonel Clyde Matthews, press relations officer. The entire group, composed of fifteen officers and twelve enlisted men, took off from Hamilton Field on 13 August, in a special ATC plane, a C-54, and arrived on Tinian 16 August 1945, after stop-overs at Hickam Field and Kwajalein. (References 4, 5, 6, 8.)

4. Organization in the Pacific.

In addition to the personnel described above the investigating groups under the command of General Farrell included: an additional medical officer, Captain James F. Nolan; civilian scientists, including Dr. Philip Morrison and Dr. R. Serber; and an intelligence unit under the command of Colonel Peer deSilva, including Major William L. Uanna, Captain Henry I. McClenahan, Master Sergeants Andrew A. Walker and F. J. Driscoll, and Tech Sergeant Nathan C. Safferstein.

There were also assigned to the expedition: Brigadier General James B. Newman, Jr., who came from Washington to serve as General

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Farrell's deputy; Colonels Wilson and Doubleday, Air Force bomb damage assessment officers; Major Robert Furman, Engineer Officer, of the Manhattan District, who was chosen to head the group which was detailed to investigate progress of atomic research, etc., in Japan; Lieutenant Schaeffer, and two Air Force enlisted men from the 509th Group; and two Nisei interpreters.

While on Tinian, the force as a whole was divided into three parts. The first group, composed of Generals Farrell and Newman, Captain Nolan, and the intelligence and metallurgy officers, flew to Okinawa to await transportation into Japan at the earliest opportunity. Of the other two groups, which were approximately equal in size and composed mainly of the medical officers, one group, under Colonel Friedell, stayed on Tinian, to make entry into Hiroshima with the landing forces assigned to that target. The other group, under Colonel Warren, shipped with the landing forces which were assigned to Nagasaki as their target. (Reference 5.)

5. Itinerary of Colonel Warren and the Nagasaki Group.

The Nagasaki group, comprised of 15 members headed by Colonel Warren, was flown to Guam on the evening of 17 August and the following morning boarded the LSV-5 (USS Monitor) which was heading toward Tokyo to evacuate prisoners of war. On 20 August, the LSV-5 joined the 3rd Fleet at Point Look, about 100 miles out of Tokyo harbor. There the party was deflected and trans-shipped by breeches buoy to destroyers 394 and 396 (USS Lansdown and USS Buchanan) and taken to Okinawa, where they arrived on 23 August. The party as a whole remained there, at Buckner Bay, until 17 September, but Colonel Warren left to enter Japan some days ahead of them.

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On 5 September the first group described in paragraph 4 above, including Generals Farrell and Newman, landed at Atsugi airport and went to Yokohama. On 6 September, General Farrell was able to arrange for Colonel Warren to join him, to serve as expert consultant to evaluate all casualties which had been transported to Tokyo. Through an arrangement worked out by Captain Nolan and Captain DeSilva an opportunity came to get to Hiroshima. A number of interested persons and groups, in addition to the two Generals, Colonel Warren, Captain Nolan and Captain DeSilva, were incorporated in the entry into that city, by plane: Dr. Junod of the (Swiss) International Red Cross; Colonel A. W. Oughterson (MC), who had just arrived under orders from General Denit; Dr. M. Tsuzuki (ex-Admiral), who obtained the "protection of the Emperor" for the party and made many personal arrangements for the party's safety, transportation and housing; Dr. Tsuzuki's aide, Dr. M. Motohashi (ex-Major); Colonel Webster (MC), of General MacArthur's staff, who assisted in clearing up the red tape for formal permission to go in before troops had entered; Captain John Flick (MC), an ophthalmologist from General MacArthur's staff; and Corporal Kasner, a photographer from the Signal Corps.

The party was preceded by one day by a wild cat flight of a group of newspaper men and by a Russian plane carrying two Russian observers, believed to be engineers. Both planes left the area as the official survey party landed, and the conclusions of the Russians were never ascertained.

The official survey party was flown to Hiroshima on 8 September 1945. From a base at Miashima, the party made a preliminary survey of the city, finding no significant or dangerous amounts of radioactivity. On 10 September, Generals Farrell and Newman left by air. Colonel Warren,

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Captain Nolan, Corporal Kasner and Dr. M. Tsusuki remained behind to finish the preliminary survey, and then left for Tokyo, returning by train because of inclement weather; after an arduous trip they arrived in Tokyo to find that Generals Farrell and Newman had already been in Nagasaki and that the remainder of Colonel Warren's original group had been transported from Okinawa to Nagasaki. Colonel Warren, with his party, accompanied by Colonel Oughterson, who in the meantime had been designated to represent the Surgeon General's official investigating party, flew into Nagasaki the next day, joined his group, and directed their investigations.

The original Nagasaki group, which Colonel Warren had left on Okinawa when he went to Guam on 15 August, flew to Omura, an airport near Nagasaki, on 17 September 1945. Thence they were transported by charcoal-burning Japanese automobiles the 28 miles into the city, arriving just about six weeks after the bombing. The group remained in Nagasaki and (later) at Omura Naval Hospital, the former Naval Tuberculosis Sanitarium, where the greater percentage of the living severely injured casualties were held, until their departure on 6 October. During this time also Captain Flick and Lieutenant Howland made a trip to the Kyusu Imperial University, where a number of survivors from Hiroshima were seen, autopsies were obtained and all available records were filmed. The investigations at the Omura Hospital were performed by Captains Barnett and Whipple and Lieutenants Brundage and Howland. When the Manhattan District group left they were relieved by a new detail of Army Medical Officers under the command of Colonel DeCoursey (MC), through arrangements made by Colonel Oughterson with the Surgeon General's office.

On 6 October the entire group of medical officers, engineers and enlisted technicians were flown from Omura to Tokyo. On 13 October all of

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the group except Lt. Collins left Tokyo by air for the United States, arriving at Hamilton Field, California, at 3:00 p.m. on 15 October 1945, after stopovers at Tinian, Kwajalein and Hickam Field, Honolulu.

(References 4, 5, 6.)

6. Itinerary of the Hiroshima Group.

The group headed by Lt. Colonel H. L. Friedell was transferred from Tinian to Guam and thence to Zamboanga in the Philippines, where they awaited transportation by air to Japan. The group was delayed by a series of typhoons and did not enter Hiroshima until about 26 September 1945 (about ten days before the date of departure).

This group spent about one week in Hiroshima and then returned to Tokyo by train, after considerable hardship; there they joined the Nagasaki group and returned with them to the United States.

(Reference 5.)

7. Physical Damage in Hiroshima and Nagasaki.

a. Survey Methods. The surveys of physical damage were made in both cities by the Army Engineers and civilian physicists, who made observations, took photographs and collected specimens and statistics.

The scientists used various ingenious methods to calculate the peak pressures exerted by the atomic blasts at different points, from evidence which was still available. The peak pressures were calculated by Dr. W. G. Penney (British scientist from Los Alamos), from crushed empty vessels, such as oil drums or gasoline cans; from the bending of flag poles, or lightning conductors, away from the blast; and from overturned memorial stones. These pressures were checked against theoretical predictions and further checked against the readings obtained by the measuring instruments which were dropped by parachute at each atomic attack. From these pressure calculations, the

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equivalent T.N.T. tonnage of the atomic bombs was estimated. The generally accepted result is that which was announced by the President after the Hiroshima attack: the explosive energy of each atomic bomb was equivalent to about 20,000 tons of T.N.T. (References 1, 3.)

b. General Effects. The damage to structures and other inanimate objects was of the same general character in both cities and was in general the result of the following effects of the explosions:

(1) Blast, or pressure wave, similar to that of normal explosions but on a vast scale.

(2) Primary fires - those fires started instantaneously by the heat radiated from the atomic explosion.

(3) Secondary fires - those fires resulting from the collapse of buildings, damage to electrical systems, overturning of stoves, and other primary effects of the blast.

(4) Spread of the primary and secondary fires to other structures.

(Reference 1.)

c. Summary of Specific Effects. In both cities the blast totally destroyed almost everything within a radius of about 1 mile from the center of explosion. The only surviving objects of any consequence in these areas were the frames of a small number of reinforced concrete buildings which were not collapsed; most of these buildings suffered extensive damage from interior fires and had their roofs smashed, their windows, doors, and partitions knocked out, and all other fixtures which were not integral parts of the reinforced concrete frames burned or blown away. Because only portions of these areas, particularly in Nagasaki, had been built up, the areas of almost total destruction were less than the total areas of the enclosing

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circles; it was estimated that 5.2 square miles had been thus devastated in Hiroshima, and 3.1 square miles in Nagasaki. (See Maps in Ref. 1 and Ref. 3) The uniform levelling of a large part of the devastated area, the consumption of almost all combustibles by fire, and the obscuration of details by typhoon rains tended to make accurate estimates very difficult in both cities.

In Hiroshima, nearly everything was heavily damaged up to a radius of about 2 miles from the blast; at distances of 2 to 3 miles, everything was about half destroyed, and beyond 3 miles comparatively light damage extended for several more miles. Glass was broken up to 12 miles from the center of explosion. (References 1, 9.)

In Nagasaki, the severely damaged area - described as, "severe fire damage and moderate blast damage" - extended irregularly to variable distances, reaching an overall length of 3 miles in a general north and south direction. The hillsides up to a radius of about 1½ miles were scorched, giving the vegetation an autumnal appearance. The area of partial damage (from "blast and/or fire") extended in some directions more than 4 miles from the center of explosion. (References 1, 9.)

The following table gives an informative summary of the damage to buildings in Nagasaki, as compiled from a ground survey by Nagasaki Municipality (References 1, 3):

Destruction of Buildings and Houses in Nagasaki

	<u>Number</u>	<u>Percent</u>	<u>Number</u>	<u>Percent</u>
Total in Nagasaki			<u>50,000</u>	<u>100</u>
Blasted (not burned)	2,652	5.3		
Blasted and burned	11,494	23.0		
Partially burned or blasted	<u>5,441</u>	<u>10.9</u>		
Total buildings and houses destroyed or damaged			19,587	39.2
Undamaged (except minor roof and window breakage)			<u>30,413</u>	<u>60.8</u>
			50,000	100.0

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For further details of the physical damage caused by the bombs, reference is made to the printed report, by the Manhattan Engineer District, entitled "The Atomic Bombings of Hiroshima and Nagasaki", with its accompanying maps and photographs, released 30 June 1946 (References 1, 2), and the "Preliminary Medical Report, Hiroshima - Nagasaki Bombings", by S. L. Warren, Colonel, MC, 27 November 1945, with its accompanying maps (Reference 3).

B. Medical Findings in Hiroshima and Nagasaki.

a. Survey Methods. In endeavoring to determine the effects of the atomic bombs on the people of Hiroshima and Nagasaki, how these effects were produced, and how many people were killed or injured, most of the data were derived from the following lines of investigation:

- (1) Examination of patients still living.
- (2) Analysis of records of patients who had died or were not available for examination for other reasons.
- (3) Autopsy material.
- (4) Tabulations of data and opinions of Japanese investigators who had studied the earlier patients.

The survey mission was seriously handicapped in its efforts not only by the length of time which had elapsed since the bombing of the cities, but also by the almost complete absence of precise data in the possession of the Japanese. As Colonel Warren said in his testimony at the hearings of the Senate Special Committee on Atomic Energy, on 15 February 1946 (App. 10, p. 509): "The Japanesedid not know what the population of either city was beforehand. They had very little way of telling how many people had survived or had returned to the city". The extensive destruction of civil installations - fire and police departments, government agencies, hospitals, etc., - and the state of utter confusion immediately following

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and for a long time after the explosion, as well as the uncertainty regarding the actual population before the bombing, contributed to the difficulties in obtaining reliable information.

b. Estimates of Total Casualties.

(1) The best available figures for the estimated total casualties in each city, as compiled by the Manhattan District, are as follows:

	<u>Total Casualties</u>			
	<u>Hiroshima</u>		<u>Nagasaki</u>	
	<u>Number</u>	<u>Percent</u>	<u>Number</u>	<u>Percent</u>
Pre-raid Population	<u>255,000</u>	<u>100</u>	<u>195,000</u>	<u>100</u>
Dead	66,000	26	39,000	20
Injured	<u>69,000</u>	<u>27</u>	<u>25,000</u>	<u>13</u>
Total Casualties	135,000	53	64,000	33

(The estimates of the Medical Division of the U. S. Strategic Bombing Survey are higher: In Hiroshima, 80,000 dead and 80,000-100,000 injured; in Nagasaki, 45,000 dead and 50,000-60,000 injured. Reference 13.)

It is generally believed that the energy of the Nagasaki explosion was greater than the energy of the Hiroshima explosion, yet the above figures show that the effects in terms of total casualties were considerably greater in Hiroshima. This was caused not only by the topography and the physical layout of the two cities, but also by unexpected chance circumstances: just previous to the bombing of Hiroshima plans were being made for the evacuation of unnecessary persons, and on the day of the bombing approximately 40,000 extra people had been brought into the center of the town for instructions on these evacuation plans; in Nagasaki, on the other hand, similar evacuation

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plans had been carried out a week before the bombing, and the population in the bombed areas had been reduced. Also, many of the families of those working in the mills and plants lived outside of the bombed area. It may be noted that in Nagasaki particularly the numbers of the dead were determined by the numbers of bodies actually incinerated by the clean-up squads and did not include the great number burned in the buildings, whose skeletons were mixed up with the ashes and ruins; nor was there any good count of those refugees who died in the suburbs, particularly in the first few weeks.

(References 1, 3.)

(2) The relation of total casualties to the distance from the center of explosion (the point referred to as "X"), in Nagasaki, is shown in the following estimates, based on the casualty figures first obtained by the Manhattan District (Reference 1):

Relation of Total Casualties to Distance from "X".

<u>Distance from "X", feet</u>	<u>Killed</u>	<u>Injured</u>	<u>Missing</u>	<u>Total Casualties</u>	<u>Killed per Square Mile</u>
0-1,640	7,505	960	1,127	9,592	24,700
1,640-3,300	3,688	1,478	1,799	6,965	4,040
3,300-4,900	8,678	17,137	3,597	29,412	5,710
4,900-6,550	221	11,958	28	12,207	125
6,550-9,850	112	9,460	17	9,589	20

(The summation of total casualties in this table, 67,765, was revised by later estimates to 64,000).

(3) There is no way of transposing these figures mathematically to percentages of mortality, because no data have been obtained to show the pre-raid population at the various distances from "X".

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A calculation made by the British Mission to Japan, however, based on a preliminary analysis of the study of the Joint Medical Atomic Bomb Investigating Commission, gives the estimated percentages of mortality at other distances, as follows:

Percent Mortality at Various Distances

<u>Distance from "X"</u> <u>in yards</u>	<u>Percent Mortality</u>
500	93%
1,000	66
1,500	37
2,000	18
2,500	6
3,000	1
3,500	0

(From curve, "in Japan", on diagram headed "The More Important Effects of Atomic Bombs on People and Their Homes", in Report of the British Mission to Japan, "The Effects of the Atomic Bombs at Hiroshima and Nagasaki", 1946, page 21.)

Plotting these distances and percentages to suitable scales produces a smooth curve and it is probable that this curve would not be very seriously at variance with the curve which could be produced from the actual facts, if the necessary population figures were available and if proper allowance were made for the layout and topography of the cities and for the large element of chance which inevitably influences the results produced by all explosives. It is common knowledge that freakish results are sometimes the rule rather than the exception in high explosive detonations.

Because of the peculiar psychology of the Japanese who wanted to please the interrogator, one must view with suspicion a good deal of the information gathered by subsequent parties on the location of survivors at the time of the explosion, for the number of unscathed survivors from the center increased with time. Actually the shock of the experience frequently

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caused an amnesia in survivors and very few near zero escaped lethal gamma ray exposure.

(4) It was probably inevitable that the great majority of total fatalities should have occurred immediately after the bombing. The causes of many of the deaths could not be definitely determined, and of course many persons near the center of explosion suffered fatal injuries from more than one of the bomb effects. The possible causes of the immediate deaths were, principally, in order of importance: burns, mechanical injury, and gamma radiation, but it seems unlikely that radiation alone would be immediately fatal. Early estimates of the Japanese, for what they may be worth, are shown in the following table (Reference 1):

Causes of Immediate Deaths

<u>City</u>	<u>Cause of Death</u>	<u>Percent of Total</u>
Hiroshima	Burns	60%
	Falling debris	30
	Other	10
Nagasaki	Burns	95%
	Falling debris	9
	Flying glass	7
	Other	7

It is obvious that the percentage figures for Nagasaki include duplications, because the percentages add up to 118, whereas there are no duplications in the figures for Hiroshima. This may account, to some extent, for the wide divergence of the results as estimated for each city, but it is probable that more important reasons for these differences are the variations to local conditions, and the human equation. Different estimators would certainly reach different results in interpreting the evidence for theoretical evaluations of this kind.

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c. Types of Injuries.

Injuries to persons resulting from the atomic explosions were of the following types (corresponding in part to the principal causes of death which have been previously described):

- (1) Burns from (a) Fires started by the explosions.
(b) Flash radiation of heat.
- (2) Mechanical injuries from collapse of buildings, flying debris, etc.
- (3) Direct effects of the high blast pressure.
- (4) Radiation injuries, from the instantaneous emission of gamma rays and neutrons.

It has not been possible to estimate with any degree of accuracy the percentages of casualties attributable to each of these types of injury, but it seems certain that the majority of the casualties resulted from burns and mechanical injuries, and it is believed that not more than roughly 10% of the deaths resulted from radiation injury alone, in persons not otherwise injured; a very large proportion of all of those who died might well have died from radiation injury alone if blast and fire and mechanical injury had been lacking entirely. The greatest single factor influencing the occurrence of casualties was the distance of the person involved from the center of explosion. Burns were suffered at considerably greater distances from "X" than injuries of any other type since fires were not restricted to the blasted area, and a small percentage of mechanical injuries occurred farther out than radiation effects. (References 1, 13.)

d. Burns.

Burns from fires started by the explosion were fire burns of the usual type. The so-called flash burns, however, which were seen in

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large numbers of cases, were distinctive in several respects; and it was concluded that they were due to infra-red rays for the following reasons:

(1) Clinically they were more superficial and healed more quickly than ordinary fire burns.

(2) They were apt to be sharply delineated by lines representing the borders of bare skin areas, and they were limited to those areas which were facing the center of the explosion; for example, a patient who had been walking in a direction at right angles to a line drawn between him and the explosion, and whose arms were swinging, might have burns only on the outside of the arm nearer the center and the inside of the other arm; or he might have burns below the cap and above the shirt line on the side of the head toward the explosion.

(3) Patients who had on white and black striped clothing, might have burns of the skin only in those areas which were under the black stripes. Flash burns also tended to involve areas where the clothes were tightly drawn over the skin, such as the elbows and the shoulders.

(4) Many patients who had worn shorts or a breech clout recovered after as much as two-thirds of the total skin area had been so burned, which would be most unlikely with ordinary burns if they were deeper than first degree.

Most of these burns were classified as first and second degree. They healed slowly, but without sloughing and without many instances of secondary infection. Most of the patients showing flash burns were near the center, but, with decreasing frequency and severity, their locations seemed to extend more than 13,000 feet (about 4 km.). At Nagasaki, patients with burns were observed who were said to have been out to the remarkable distance

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of 13,800 feet. Sometimes, however, a case of this kind may have been recorded through error on the patient's part, for he may have passed by a burning building and had in effect a flash burn. Those close in had gamma radiation effects and died later. There was ample evidence of similar flash burning of physical objects. (A striking example of this evidence is found in a photograph of a bridge in Hiroshima located about 0.6 mile from "X" and broadside to the blast; the pavement of the bridge roadway is shown darkened by flash burns except where it was shielded by the posts and railings at the side toward the blast (See Reference 2, figure 33). Other striking examples are found in photographs in the report of the British Mission, as one (No. 21) which shows the "shadows" of persons preserved on the flash-burned surface of some polished granite).

(References 1, 3.)

e. Mechanical Injuries.

Mechanical injuries resulting from collapse of buildings, flying debris, etc., included fractures, lacerations, contusions, and similar effects, such as would be expected. There were evidences of such injuries as far out as 12,200 feet from the center. The tremendous drag of the blast wind, even as far as 1 mile from "X", must have resulted in many deaths.

(References 1, 3.)

f. Direct Blast Effects.

It is the general feeling of the medical authorities that the direct blast effects were not great, although the actual pressures necessary to kill humans is unknown. The pressures developed were sufficient probably to kill only those people who were within a few hundred feet of the center of explosion, and the recorded injuries attributable primarily to the squeeze of the direct blast were likewise relatively few. For example, very few

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cases of ruptured ear drums were noted. Many of the Japanese reports which purported to describe extreme immediate effects of the blast on human bodies are believed to have been false or grossly exaggerated or due to other causes. Observations on blast may have been nullified on three scores: (1) death or recovery usually occurred within 24 hours; (2) those close enough to suffer ruptured ear drums may have received high lethal doses of gamma radiation and died before the drum rupture was noted, or they may have been unable to get out of the fire and so perished without being counted; or, (3) the period of the blast wave may have been long enough to enable the drum to adjust itself without rupturing.

g. Radiation Injuries.

(1) Evidence Against Persistent Radioactivity. The radiations from the explosions which caused injuries to persons were primarily those experienced during the first few seconds or minutes after the explosion. Radiation from scattered fission products and induced radioactivity from objects near the center did not cause any casualties, as the following evidence showed:

(a) Theoretical predictions indicated that the height above the ground at which the bomb was detonated would not produce any dangerous amounts of neutron induced persistent radioactivity; nor was it likely that contamination by fission products would result, since the "ball of fire" containing them would not come near the ground.

(b) The amount of radioactivity on the ground determined at the time of the survey was very small and well below physiological limits, and it was not sufficient to account for any harmful amounts having been present since the explosion. (See paragraph 9, hereinafter, for further discussion of this matter.)

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(c) No persons coming into the areas after the explosion were found who showed any signs or symptoms of radiation effects. (Further discussion of this matter also will be found in paragraph 9.)

The same reasoning and findings apply to any effects from radioactive particles scattered along the path of the cloud.

(References 1, 3.)

(2) Symptoms.

The radiation injury is the result of total body exposure and the symptoms are the result in general of the collapse from disintegration of a vital organ. The timing of death varies with the intensity of the exposure and the fact that as the body recovers from the destruction of one organ, the failure of another appears. The destruction of the bone marrow, which also occurs, furnishes an analogous example: after destruction it cannot replace the blood cells as they are worn out in daily use. Late effects are due to atrophy and failure of function from faulty repair.

The symptoms of the radiation injuries began after a latent period varying from 3 to 30 days. The important symptoms and physical findings were epilation (loss of hair), severe ulcerative lesions of the mouth and throat, hemorrhagic manifestations including petechiae (bleeding into the skin), severe gastrointestinal symptoms (death within the first ten days), and rapid and extreme emaciation. Epilation was one of the most spectacular and obvious findings. The appearance of the epilated patient was typical. The crown of the head was involved more than the sides, and, curiously, epilation other than of the scalp was extremely unusual. In extreme cases the hair was totally lost. In some cases, regrowth of hair had begun by the time the patients were seen, 35 days after the bombing.

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Loss of hair was unimportant of itself except that it indicated radiation exposure which, if severe, subsequently resulted in death.

Petechiae and other hemorrhagic manifestations began usually with bleeding from the gums, and in the more seriously affected were soon evident from almost every possible source. Petechiae (small black bleeding spots) appeared on the limbs and on pressure points. Large ecchymoses (hemorrhages under the skin) developed about needle punctures, and wounds partially healed broke down and bled freely. The bleeding time and the coagulation time were greatly prolonged. This clinical picture began about two weeks after the explosion and stopped almost simultaneously in each city six weeks afterward.

Deaths occurred throughout a period extending from one week to two months after the explosion, with a great number occurring about one month after, when the survey parties first visited both cities, and then occurred less frequently.

The important laboratory findings related primarily to disturbances in the hematopoietic function manifested by leucopenia (low white blood cell count), and thrombocytopenia (few or no platelets and no clot formation). The most striking findings at autopsy were ulcerative lesions of the colon and rectum, in the earlier period, together with destruction of the bone marrow and the lymphatics, and, later, signs of hemorrhage throughout the viscera.

The earlier deaths correspond to animal experiments in which it is proven that the breakdown (ulcerations) of the intestinal mucosa results in an intoxication and death. The only difference is that in the animal it is the small intestine while in the Japanese the colon and rectum seem to have had the most marked injury. While such bodies had lost almost

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all their blood forming cells in the bone marrow and spleen, the circulating blood cells would have been able to carry on for a few weeks before they wore out. When the circulating cells were not replaced, those having non-fatal intestinal injury began to have falling white blood cell counts and platelet counts, and the blood would not clot, so that hemorrhage began to occur in small amounts from ordinary motions and wear and tear, and the person died with falling hemoglobin and what amounted to exsanguination. The last day of life was usually complicated by secondary infection from bacteria commonly present which produced ulcerations of the gums, lips, throat, etc., and caused a high fever.

In general, the earlier that symptoms appeared, the more severe was the case and probably the higher the radiation dose. The progress of radiation injury and probable dosage levels (divided into three classifications for simplicity: "Most Severe", "Moderately Severe" and "Mild") are shown in the following table:

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Progress of Radiation Disease

Symptoms in Patients Showing Delayed Effects

Days after Explosion	Most Severe (Patients usually within 1.0 km of center)	Moderately Severe (Between 1.0 and 1.5 km)	Mild (1.5 to 2.5 km)	
1.	1. Nausea and vomiting after 1-2 hours lasting 1-2 days.	1. Nausea and vomiting after 1-2 hours lasting 1-2 days.		
2.				
3.				
4.	LATENT PERIOD		LATENT PERIOD	
5.	2. Bloody diarrhea and 3. Vomiting 4. Fever 5. Rapid emaciation Death (Mortality probably 100%)	2. Beginning epilation progressing until death		
6.				
7.				
8.				
9.				
10.				
11.				LATENT PERIOD
12.				
13.				
14.				
15.				
16.				
17.				
18.	3. Loss of appetite and general malaise			
19.	4. Fever			
20.	5. Severe inflammation of the mouth and throat			
21.				
22.				
23.				
24.				
25.				
26.				
27.	6. Pallor			
28.	7. Petechiae, bloody diarrhea, and nose bleeds			
29.	8. Rapid emaciation			
30.	Death			
31.				
.				
.				
.				
45.				
	(Mortality probably 100% of all showing 5 & 7. Numbers 4 to 8 may be delayed until a few days before death.)		1. Epilation 2. Loss of appetite and weakness 3. Temporary sterility 4. Pallor 5. Petechiae (rare) 6. Moderate emaciation 7. Secondary infections (Recovery unless complicated by previous poor health or superimposed injuries or infections, except that few, if any, severely epilated persons survived.)	

(References 1, 3.)

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(3) Causes of Symptoms. That these symptoms and findings were primarily due to radiation was concluded from the following:

(a) The theoretical calculations predicted an instantaneous discharge of high energy gamma rays and neutrons, below the point of detonation, expected to cause serious biological effects.

(b) The symptoms and findings were those which would have been predicted from animal experiments and from known toxic effects encountered in clinical therapeutic application of radiation.

(c) The existence of a definite latent period before the onset of symptoms and the correlation between the length of the latent period and the severity of the symptoms (as shown in the table above, headed "Progress of Radiation Disease") strongly suggested that the symptoms were due to radiation.

(d) Induced radioactivity had been detected in brass, copper, sulfur, bones and the fillings of teeth very near the center of the explosion. This could be attributed only to the effect of neutrons.

(Reference 3.)

(4) Evaluation of Symptoms. Of the symptoms and findings described, those which in themselves can be considered to be due to radiation are epilation, bleeding from the intestines in the early stages, destruction of the blood forming system, followed by low white blood count and declining hemoglobin and thrombocytopenia with its accompanying hemorrhagic manifestations. These effects are characteristic of total body exposure either to gamma radiation or neutrons. Where both are present it is assumed that their effects are additive. There is no evidence from the Japanese data to believe otherwise. The time of onset and severity of symptoms are a rough index of the dose received, although the human lethal dose is still in doubt. It is of interest

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in retrospect that the human dosage values predicted from the medical findings found individuals dying at a much greater distance than would have been possible had the calculations of the physicists on intensity been correct. After viewing the medical data, the physicists revised their formula, with a better fit to the predictions and the conditions observed at Bikini. (Reference 3.)

(5) Treatment. Treatment of the radiation injuries by the Japanese included general supportative measures such as rest and high vitamin and high caloric diets. Parenteral liver and calcium administration, thrombin preparations, and blood transfusions were used to combat hemorrhage. Parenteral vitamin preparations and pentanucleotide were used by American medical officers after their arrival. No definite effect of these measures on the course of the disease could be demonstrated. The use of sulfonamide drugs by the Japanese and of penicillin by the American physicians undoubtedly helped control superimposed infection, but delayed the exitus of the patient only a few days if at all. Any slight wound such as that made for a blood count or transfusion when petechiae were present resulted in a continuous intractable coagulation of blood. Without doubt this hastened the death of some and so fell into disfavor. (Reference 3.)

(6) Radiation Casualty Statistics. The total number of patients who showed radiation effects and the percentage of those who died were even more difficult to estimate than the numbers of casualties from all causes. An inherent defect in the situation, which could never be overcome, was the fact that many patients were killed immediately or died from other injuries before they had time to develop symptoms due to radiation. Records were not kept on the majority of the patients and many of those which were available were incomplete. This was particularly true of the records of

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patients admitted to the hospitals who were discharged after their burns and wounds were healing, but before they developed symptoms due to radiation. Attempts to compare the amount of radiation received were made particularly difficult by the inability to estimate the amount of effective shielding in individual cases and this differed in general in the two cities. With all these qualifications, and considering only those patients admitted to the better supervised emergency hospitals in the two cities, it was estimated that of approximately 4000 patients admitted to hospitals, 1300, or 33%, showed effects of radiation and of this number, approximately one-half died within the eight weeks covered by the data. It is not unlikely that most of the balance of the 1300 died subsequently and also that many others had undiagnosed radiation injury and died later. Only a small percentage, probably 10% or less, of those examined, however, showed solely gamma radiation injury and no other injury. The large proportion of survivors received multiple injuries including radiation injury. These other injuries were often credited for the death and there was no way of properly evaluating the exact cause or the summation of causes. Except for the few shielded in heavy concrete buildings, it is rather likely, however, that almost everybody within 1000 feet of the hypocenter would have died from ionizing radiation injury had they not died of burns or mechanical injury. Within this distance they literally had many shots against them, any one of which was fatal. (References 1, 3.)

9. Intensity of Radioactivity Found in and Around Hiroshima and Nagasaki.

One of the most important tasks assigned to the mission which investigated the effects of the bombing was that of determining whether the radiation effects were all due to the instantaneous discharges at the time of the explosion, or whether people were being harmed in addition from persistent radioactivity.

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Two methods of approach were used in determining this question: investigation by direct measurements of persistent radioactivity; and investigation to determine whether any persons not in the city at the time of the explosion, but coming in immediately afterward, exhibited any symptoms or findings which might have been due to persistent radioactivity.

(Reference 3.)

a. Investigation by Direct Measurements.

(1) Methods. To measure the presence of residual activity in and around the two cities, portable counters of the Geiger-Müller type, with earphone attachments, were found to be the most practicable instruments. Landsverk and Kollan electroscopes were also used. Direct reading ionization chamber instruments were available but were not sensitive enough to detect the low intensity radiation present. The instruments were calibrated and recalibrated against known radium sources brought for the purpose. Monitoring parties composed of physicians and technicians trained in this work explored on foot the rubble of the bombed cities, and along roads into the environs. Readings were made by all in a prescribed manner and recorded. Instrumentation problems were a constant handicap in the frequent rains all during the survey. Water sheds and places of habitation in the vicinities of the cities were investigated.

(Reference 3.)

(2) Results. The readings were plotted on maps of the cities, and lines of equal intensity were drawn. These maps accompany Colonel Warren's Preliminary Report of 27 November 1945 (Reference 3). They show that in each of the two cities there were two distinct areas of radiation, both of low intensity: one in a restricted area beneath the point of detonation, and the other separated from the first by several kilometers and traceable in a wide

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trail, in the case of Nagasaki as much as fifty miles along available roads. These areas were correlated with the wind directions reported directly after each bombing.

Although the intensity of radiation was low, it was measurable with the very sensitive instruments which were used. From these measurements and from dirt samples brought back to the United States, simple calculations determined the highest radiation intensities which were present at any time after the bombings, and also the total amount of radiation which could have been absorbed by any person during the entire period following the bombings. The measured highest intensity of gamma radiation in Hiroshima was found, at the center of explosion to be 0.4 milliroentgens per hour, two months after the bombing. The corresponding integrated dose from one hour until about six weeks after the explosion would be somewhere between 6 and 24 roentgens. The measured highest intensity in the Nagasaki area was found in a small area in the Nishiyama Reservoir district, about one mile northeast of the city, where there had evidently been a fall-out of radioactive materials made up of induced radioactive material and of fission fragments; the highest measurement here was 1.8 milliroentgens per hour, corresponding to an integrated dose of 27 to 110 roentgens. The radioactivity in the center of town was only 1/10 as high as that in the Nishiyama Reservoir area.

The above figures represent the highest dosages which a person could have received if he remained at the point of highest radioactivity continuously for a period of 61 days in the case of Hiroshima (from 6 August to 6 October 1945) or for a period of 48 days in the case of Nagasaki (from 9 August to 26 September 1945). It is hardly likely that anyone could have done this even in the Reservoir area of Nagasaki.

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Considering the intensities of radioactivity from a physiological standpoint, it is quite obvious that the residual radiation alone could not have been detrimental to the health of persons entering or living in the bombed areas after the explosions. (As previously stated, in paragraph 8g above, the amount of radioactivity on the ground determined at the time of the survey was very small and was not sufficient to account for any harmful amounts having been present since the explosion.) Further evidence to support this conclusion, of a negative nature, is described in a following paragraph.

The measurements were performed mainly for gamma rays, which are the most penetrating and the most important type from the standpoint of general bodily reactions. Measurements of beta rays were also made, but these were not calibrated because of technical difficulties and inaccuracy in evaluating the readings. Alpha ray measurements in the field are almost impossible to obtain for the same reasons, and in any case their biological importance was practically nil in these investigations. No alpha radiation was found with the preliminary measurements. Therefore, after spot checks for beta radiation, which were found within the expected limits, reliance was placed on the gamma radiation, as the most practical measurement from the technical and physiological viewpoints.

(References 1, 3.)

(3) Other Analytical Investigations.

Neutron intensities were calculated from the induced radioactivity of phosphorus and calcium in bones and various metals picked up in the Japanese cities. In both Hiroshima and Nagasaki, neutron intensities exceeded by a factor of at least 10 the maximum theoretical values. Figures obtained from the most reliable Japanese report on induced radioactivity exceeded the maximum theoretical values by a factor of 7 in the center of Hiroshima.

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Soil and metallic samples were analyzed later to account in detail for the residual radioactivity. Fission products were quantitatively separated from two of the soil samples. The residual radioactivity at Nagasaki, even in the area directly below the bomb explosion, seems to have originated almost entirely from deposited fission fragments rather than from elements normally present made artificially radioactive.

(Reference 11.)

b. Investigation of Persons Entering the Cities after the Bombings.

Vigorous efforts were made to find any persons who had not been in the cities at the times of the explosions but came in immediately afterwards, who exhibited any symptoms or findings which might have been due to persistent radioactivity. Before the arrival of the Manhattan District investigating group several Japanese studies had been made of post-bomb entrants into the cities. None of the persons examined in these studies showed any symptoms which could be attributed to radiation, and their blood cell counts were consistently within the normal range. Throughout the period of the Manhattan District investigation, Japanese doctors and patients were repeatedly requested to bring to them any patients who they thought might be examples of persons harmed by persistent radioactivity. No such subjects were found. (Reference 1.)

This negative information tended to confirm the general conclusion reached from the investigations by direct measurements, that although a measurable quantity of induced radioactivity was present, it had not been sufficient to cause harm to persons living in the cities after the bombing. Still further confirmation was obtained from the follow-up studies which were made a year after the bombings, described hereinafter.

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10. Psychological Effects.

An account of the effects of the atomic bombings of Hiroshima and Nagasaki could not be complete without mention of the terror these bombings struck in the peoples of those cities. This terror ranked with the physical damage and the human death and injury to form the three most significant effects of the bombs. The fear and horror inspired by the bombs resulted in immediate hysterical activity and flight from the cities, and, in addition, produced a lasting effect on the survivors: those who had become accustomed to mass air raids had grown to pay little attention to single planes or small groups of planes, but after the atomic bombings the appearance of a single plane caused more terror and disruption of normal life than the appearance of many hundreds of planes had ever been able to cause before. (Reference 1.)

As Dr. Philip Morrison said in part (in the hearings before the Senate Special Committee on Atomic Energy, 6 December 1945), in describing the revolutionary character of the new weapons:

".....A Japanese official stood in the rubble and said to us: 'All this from one bomb; it is unendurable.' We learned what he meant. The cities of all Japan had been put to flame by the great flights of B-29's from the Marianas. But at least there was warning, and a sense of temporary safety. If the people in Kobe went through a night of inferno, you, living in Nagayo, were going to be all right that night. The thousand-bomber raids were not concealed; they even formed a pattern of action which the war-wise Japanese could count on. But every hour of every day above any Japanese city there might be one American plane. And one bomber could now destroy a city. The alert would be sounded day and night. Even if the raiders were over Fukuoka, you, in Sendai, a thousand miles north, must still fear death from a single plane. This is unendurable." (Reference 12.)

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11. Further Investigations in 1946.

a. Purpose.

An investigating group sent into Japan in August 1946 was instructed to obtain information concerning the medical and physical status of the atomic bomb survivors and the status of the bombed cities, one year after the atomic bombings, and to determine what studies of atomic bomb survivors had been carried out by Japanese scientists.

The mission was in effect a follow-up of the mission of the preceding year, and a part of its objective was to determine what, if any, new developments during the intervening year might tend to alter previous conclusions and findings, some of which had necessarily been regarded as tentative. (There had been a gap after Colonel DeCoursey's party left, in December 1945, during which no official American group was in the field. During this time the Japanese doctors made what observations they could with limited facilities.)

(Reference 7.)

b. Personnel.

The group to whom this mission was assigned was composed of Colonel James P. Cooney, Captain Douglas L. Wake and Lieutenant Melvin A. Block, detached from the Radiological Safety Section of Joint Task Force No. 1, at Bikini.

c. General Activities.

The group of three officers departed from Bikini on 9 August 1946 and arrived in Tokyo, Japan, on 11 August 1946. There they reported to the Office of the Chief Surgeon, Armed Forces Pacific, and then to the Public Health and Welfare Section, which was concerned with the public health of the Japanese people. Lt. (jg) Edgar Snow, USN, was assigned to accompany the group and act as interpreter and translator.

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A few days were spent in Tokyo obtaining supplies and interviewing Japanese scientists who had been engaged in studies of atomic bomb survivors. The National Research Council of Japan had formed a Special Committee for the Study of the Effects of the Atomic Bomb, and Dr. Masao Tsuzuki, Professor of Surgery at the Tokyo Imperial University School of Medicine, was the chairman of the Medical Section of this committee. Several conferences were held with Dr. Tsuzuki and other physicians in Tokyo who had engaged in work on the medical effects of the atomic bomb.

On 16 August the group, accompanied by Dr. Tsuzuki, left Tokyo for Kure, arriving there on 17 August. Kure is located about 20 miles from Hiroshima and is the location of an American Military Government Team, the American installation nearest Hiroshima. The following two days were spent in viewing Hiroshima, visiting the hospitals there, examining survivors, and interviewing Japanese physicians there.

The group departed from Kure on 18 August, arriving in Nagasaki on the following day. During the next two days the city of Nagasaki was viewed, members of the staff of the Nagasaki Medical College were interviewed, and Japanese survivors were studied. Colonel Cooney, Lieutenant Snow, and Dr. Tsuzuki then returned to Tokyo, Colonel Cooney leaving shortly thereafter for the United States. Captain Wake and Lieutenant Block then engaged in studies of groups of atomic bomb survivors, these including examinations of cutaneous areas which had sustained burns, brief physical inspections, routine blood counts, completion of a questionnaire, and taking of photographs. Various Japanese physicians, obstetricians, and midwives were interviewed. In addition, over 100 inhabitants of the Nishiyama area, the area near Nagasaki where the fall-out of radioactive products was most intense, were questioned and studied by brief physical examinations and routine blood counts and smears.

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Captain Wake and Lieutenant Block departed from Nagasaki on 27 August and returned to Kure and Hiroshima on 28 August. Additional atomic bomb survivors in Hiroshima were examined and Japanese physicians were interviewed. The two officers then returned to Tokyo on 3 September 1946.

The following week was spent in Tokyo organizing data, examining and collecting Japanese manuscripts and data, and having discussions with Japanese investigators. The two officers departed from Japan on 10 September 1946.

(Reference 7.)

d. Findings.

In accordance with its major purpose, the survey determined the general status of the atomic bomb survivors and the bombed cities one year following the atomic bombings. The acute effects of the injuries on the inhabitants had apparently long since passed away. No deaths attributable to the atomic bombings had occurred in 1946. The group, therefore, was interested in determining if any lingering subacute clinical manifestations of atomic bomb injury still existed or if any of the more chronic manifestations of radiation injury had yet appeared. The work and activities of this group were much different than from those of the American group in Japan shortly after the bombings in 1945. Information as obtained was in agreement with all significant findings of the group in 1945. However, it was thought that perhaps more emphasis should be placed on the very practical fact that by far the greatest number of deaths occurred on the first day and in the first week after the bombings.

At the time the group was in Japan relatively few patients were hospitalized primarily because of injuries sustained from the atomic bombings. In those cases that were hospitalized, the sequelae of inadequately

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treated burns and mechanical injuries were the cause. These sequelae included contractures, chronic ulcerated areas, and keloidal scars.

A relatively high incidence of scar keloid formation had occurred at the sites of flash burns. The many variable factors to consider render an attempt to explain the occurrence of these keloids difficult. However, it was thought that they did not represent a peculiar effect of the atomic bomb, but were at least partially the result of inadequate treatment, delayed healing, poor nutrition, and severe infection in a people who perhaps have a greater tendency for such formation than the white race does. There was no evidence of any type of malignant tissue change in the survivors studied, nor was such change indicated by any Japanese studies.

In practically all cases black, slightly thinned, hair had again returned to cover areas previously partly epilated. No persons were found who had had extensive epilation, and it may be presumed that most of these had died, for they should have been rather numerous among the survivors.

No definite abnormalities of the peripheral blood were disclosed by total red and white counts and blood smear studies.

Studies of the peripheral blood in a group of inhabitants of the Nishiyama area, the location of the greatest intensity of fall-out of fission products near Nagasaki, had caused quite a bit of discussion among the Japanese. Studies started in October 1945 were interpreted by the Japanese as indicating that these individuals had developed a leucocytosis as a result of chronic exposure to small amounts of radiation. Blood studies on these individuals performed by the investigating group indicated that some did have a leucocytosis with an eosinophilia and mild lymphocytosis. However, all of the data collected thus far were insufficient to indicate that the radiation

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caused these findings. It was thought that they might be more logically explained by the presence of parasitic infection in the individuals. Similar studies done by the same group of Japanese workers on Japanese inhabitants of areas not contaminated by fission products disclosed similar hematologic findings. There was reason also to question the validity of the Japanese technique.

It was difficult to obtain very much significant information pertaining to the problems of sterility, birth rates, incidence of congenital abnormalities in newborn, abortions, miscarriages, and stillbirths. The atomic bomb apparently did cause some abortions which occurred shortly after the explosion. Data collected by the Japanese also indicated that many female survivors did experience amenorrhea. Normal menstrual periods had returned in most of these cases within a year after the bombing. The few small studies of sperm counts done by Japanese investigators indicated that abnormalities resulted from the radiation exposure at the time of the bombing. The birth rates in the bombed cities were gradually increasing during the year 1946. No evidence was obtained to suggest any increase in abortions, miscarriages, or congenital abnormalities, but data obtainable were scanty. Inherent technical difficulties, insufficient data and many variables preclude conclusions concerning problems such as these.

Apparently no epidemiological alterations in the bombed areas had been noticed in 1946. No change in general incidence of the contagious diseases was reported.

The Japanese investigators had apparently devoted more of their time in 1946 to the organization of reports concerning studies of acute effects of the atomic bomb than to a continued program of study of the survivors. A large number of reports had been compiled and the Medical Section of the

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Japanese National Research Council Special Committee was planning to publish a special monograph. However, a review of the translated reports concerning the effects of the atomic bomb did not reveal any additional significant information not previously known to American investigators. A group from the Tokyo Imperial University spent several weeks in Hiroshima, in June 1946, examining survivors, and had reached about the same conclusions as presented above. Staff members of the Kyushu Imperial University had made several trips to Nagasaki in 1946, largely to determine the amount of residual radioactivity and to perform white blood cell counts on inhabitants of the Nishiyama reservoir area. The Japanese had outlined plans for continued studies of atomic bomb survivors which included the problems that should be investigated. However, it seemed that they lacked in financial support, in expert personnel, and in thoroughness. One can appreciate the general situation of life in Japan only by having been there and in close contact with their life. Practical obstacles to complete long-term studies of Japanese atomic bomb survivors are truly great. To realize this fully one must also appreciate that the character and extent of medical care and science in Japan are far below those in this country. It was thought that many of the Japanese investigators tend to arrive at definite conclusions based on insufficient data.

Much clearing of debris and reconstruction in the bombed cities occurred during 1946, this having progressed much more rapidly in Hiroshima than in Nagasaki. The Red Cross Hospital reopened in December 1945 and gradually was restoring its facilities. The Post Office Hospital in Hiroshima had not reopened but was treating out-patients. The Nagasaki Medical College had moved to new quarters in a former school building. The supply problem, as well as the inflationary economy, in Japan, was extremely acute. The people had lost much of the lethargy that was noted shortly after the war

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and were working with some renewed hope. No outward expressions of animosity or hatred toward the United States for having dropped the atomic bombs were encountered, although some apparently believed that it was not necessary to drop it on a city. The people were more interested in recovery from what injury they might have received and in regaining as much of a self-sufficient and happy life as possible.

In November 1946 a return to Japan was made with the Atomic Bomb Casualty Commission. This Commission was formed as a result of collaborative efforts of the National Research Council, the War Department, the Navy, the Public Health Service and the American Cancer Society. It was composed of two civilians, Dr. Austin M. Brues and Dr. Paul S. Henshaw; and three military officers, 1st Lieutenant Melvin A. Block, 1st Lieutenant James V. Neel, and Lieutenant (jg) Frederick W. Ullrich, USNR. The Commission arrived in Japan 24 November 1946. Its mission was largely to evaluate the plausibility of long-term studies on atomic bomb survivors. Observations during this stay, which extended to 5 May 1947, were, in general, identical with those presented above. However, it was more fully appreciated that future studies on atomic bomb survivors would be long-term population studies in nature, and to be significant the difficult process of designing and conducting them as closely as possible as a controlled laboratory experiment would be required. Spectacular effects might never be evident, and, if the problem was to be approached, large amounts of reliable data would have to be accumulated, with similar control data, before any significance whatever could be achieved. It was considered doubtful that an independent Japanese or American program could be completely successful. Problems of supply and maintenance for such a study could be great. A definite program of study, competent American personnel,

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and a definite understanding with Japanese investigators would be required. The desirability of continued observations of atomic bomb survivors was well recognized.

(References 7, 15.)

12. Investigations by Others.

This chapter of the Manhattan District History is intended to be confined to the activities of the Manhattan District and its representatives and personnel. One of the major purposes that General Groves emphasized in directing the organization of the Manhattan District mission in August 1945 was that he wished to obtain a quick preliminary report on the after effects of the bombings of Hiroshima and Nagasaki. Therefore, as soon as the various groups had obtained the data available for such a quick report they returned to the United States, leaving further and lengthier investigation to other agencies who were on the ground. Some of these other agencies acted more or less independently and some were coordinated with the Manhattan District mission. The evidence shows that the findings of the various other agencies (with the single exception of Major deSeversky's one-man agency, hereinafter described) were usually not far from agreement with the findings of the Manhattan District, particularly with respect to the most important over-all conclusions, although there were of course differences of opinion with respect to details.

Other agencies which conducted investigations of the after effects of the bombings, in Japan, included:

a. The United States Strategic Bombing Survey. This agency, established by the Secretary of War on 3 November 1944, was requested by the President on 15 August 1945 to conduct a study of the effects of all types of air attack in the war against Japan. Study of the effects of the atomic bombs

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was a part of this survey. Mr. Franklin D'Olier was Chairman, and Messrs. Paul H. Nitze and Henry C. Alexander were Vice-Chairmen of the Survey during its Japanese phase. (See Report of the Medical Division of the United States Strategic Bombing Survey, "The Effects of Atomic Bombs on Health and Medical Services in Hiroshima and Nagasaki", March 1947. Reference 13.)

b. The Joint Commission for the Investigation of the Atomic Bomb in Japan.

This commission was formed by Headquarters SCAP, after the Manhattan District mission had started its survey, and after Colonel A. W. Oughterson, who had been directed by General Guy B. Denit, Chief Surgeon, GHQ, AF Pacific, to organize teams to survey the atomic bomb casualties, had visited the two cities. This commission, headed by Colonel Oughterson, was to include the Manhattan District group, the Army Medical Unit and a group of Japanese scientists appointed by the Imperial Government. This commission carried on the investigation work after the Manhattan District group returned to the United States. Colonel DeCoursey was in command of the field survey group, and his party returned in December 1945.

c. The Naval Technical Mission, Japan II.

This was a group which was directed by the Navy to carry out investigations in Japan, under Captain Shields Warren, USN. The leaders of this group and of the Joint Commission arranged, unofficially, for certain phases of the study to be assigned to each, and the Navy group also continued its investigations after the departure of the Manhattan District personnel.

d. British Mission to Japan.

This mission was composed of experts trained in methods of measurement of the effects of air attacks evolved by the Ministry of Home Security in Great Britain. By agreement between the United States and Great

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Britain this mission co-operated with the United States Strategic Bombing Survey in its investigation of the atomic bombing in Japan. It spent the month of November 1945 in the two bombed cities. In 1946 the British Mission issued a preliminary report, entitled "The Effects of the Atomic Bombs at Hiroshima and Nagasaki", which incorporated a considerable amount of data gathered by other agencies. It was estimated by the British experts that one atomic bomb dropped in average British urban conditions would produce 50,000 fatalities. Their comparable standard figure for the German V2 rocket was about 15 fatalities. The report says that this figure of 50,000 dead "is probably the most important which this report contains."

(Reference 13.)

e. Major Alexander P. deSeversky. As special consultant to the Secretary of War, directed to study the effect of air power in the Pacific theater of operations, Major Alexander P. deSeversky flew several times over Hiroshima and Nagasaki and spent two days in each city, during the course of a trip in the Pacific which extended from 25 September to 15 November 1945. After his brief survey of the damage caused by the two atomic bombs, he gave an interview to American correspondents in Tokyo; upon his return he reported to the Secretary of War under date of 11 February 1946, and also published an article in the Reader's Digest for February 1946. These statements and writings by Major deSeversky took issue with practically all previously published descriptions and opinions as to the character and effects of the atomic bombing, and they "evoked", as he expressed it, "a storm of controversy". The Major's principal contentions were, in brief: "that the effects of the atom bombs - not of future bombs but of the two specific specimens unloosed on Japan - had been wildly exaggerated and that the nature of the destruction

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had been fantastically distorted"; that "the destruction was entirely incendiary in character, and the deaths were due almost entirely to fire and to falling structures"; that "the same bombs, if dropped in the same manner on a modern city like New York or Chicago, would have done no more damage than a 10-ton blockbuster"; that "the results obtained in Hiroshima and Nagasaki could have been accomplished by about 200 B-29's loaded with incendiaries, though the loss of life in that case would have been much smaller."

Major deSeversky was invited to appear before the Senate Special Committee on Atomic Energy on 15 February 1946, and at the hearings on that day he repeated his principal statements and strove to defend them against formidable disagreement from members of the Committee and from a number of the well-informed witnesses. The witnesses who brought forth facts and figures to disprove Major deSeversky's statements were: Major General Thomas F. Farrell, who was General Groves' deputy in command of the Manhattan District investigating mission; Colonel Stafford L. Warren, who headed the medical personnel of the Manhattan District mission; Mr. Paul H. Nitze, Vice Chairman, United States Strategic Bombing Survey; Prof. H. R. Bowman, Director of the Physical Damage Division, USSBS; and Dr. Luther L. Terry, Medical Division, USSBS.

In contradicting the comparisons which the Major had made, General Farrell testified: that the atomic bomb released the energy equivalent of 20,000 tons of TNT, while the 10-ton block buster would have the equivalent of about 5 tons of TNT; that the destructive effect (as distinguished from the energy release), if both bombs were dropped on a city like New York, might be such as to destroy 3 to 3½ square miles of the city, in the case of the atomic bomb, and one-fortieth of a square mile, in the case of the blockbuster; that the records of the Twentieth Air Force showed 84 B-29's loaded

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with incendiary bombs were required to destroy one square mile of a city target, and on this basis the physical destruction equivalent of one atomic bomb would be an incendiary raid of from 303 to 730 planes, instead of 200 planes as stated by the Major. Mr. Nitze, in his testimony, questioned the applicability of the Twentieth Air Force's figures to a city which had not been previously bombed, and expressed the opinion that a raid of 300 incendiary planes might be more accurate as the average equivalent of one atomic bomb plane, but he emphasized that this covered only a part of the result and did not include blast effect, casualty effect or psychological effect.

Other statements made by Major deSeversky were disproved by citation of facts and figures which have been set forth in previous sections of this chapter. Although the evidence shows that Major deSeversky was endeavoring to correct what he considered misconceptions in the minds of the general public, it also shows that he was mistaken himself and that his efforts were actually tending to misrepresent the facts and to underrate dangerously the power of the atomic bomb. As Colonel Warren pointed out in his testimony, it was difficult for an observer, in Hiroshima or Nagasaki some time after the bombings, to get oriented and to analyze what had happened, in a brief period such as that which the major had devoted to each city.

(Reference 14.)

13. Graphic Descriptions.

Much has been written about the atomic bombings of Hiroshima and Nagasaki, and some literature on this subject will be deservedly long remembered, by the layman as well as the scientist, the technician and the military man. In guiding the reader to some of the most impressive pieces of writing, mention should first be made of a graphic description of the explosion of the test bomb, in New Mexico on 16 July 1945 - the only forerunner of the two combat

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bombs dropped on Japan less than a month later. This description was written by General Thomas F. Farrell shortly after the test and was released by the War Department after Hiroshima. (Printed in Appendix 6 of the Princeton University Press Edition of the "Smyth Report", of 1945).

Noteworthy descriptions of the effects of the two combat bombs include:

a. "Eyewitness Account - Hiroshima - August 6, 1945 - by Father John A. Siemes, Professor of Modern Philosophy at Tokyo's Catholic University"; translated from the German, written by Father Siemes in a report to the Pope. (Appended to Colonel S. L. Warren's Preliminary Medical Report, 27 November 1945; also, to Report by the Manhattan Engineer District, "The Atomic Bombings of Hiroshima and Nagasaki", 30 June 1946. References 1, 3.)

b. Statement by Dr. Philip Morrison, Physicist, of Los Alamos Laboratory, to the Senate Special Committee on Atomic Energy, 6 December 1945; gives a comparative description of the take-off of a thousand-plane raid, of B-29's with incendiary bombs, and of a single atomic bomb plane. (Printed in the Government Printing Office record of the Hearings of the Committee, "S. Res 179", Part 2, pages 233-235. Reference 12.)

c. "Hiroshima", by John Hersey (Published by Alfred A. Knopf, 1946; previously published in "The New Yorker" on 21 August 1946, all space in that issue being devoted to the story.)

In addition to these published accounts, two less formal pieces of writing, which have not heretofore been published, deserve to be quoted here, as they add interest and realism to some parts of the story told by

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this chapter of the Manhattan District History. These informal writings record some vivid personal recollections, set down some time after the event by two officers who took part in the surveys of the effects of the bombs.

The first recollections are those of Brigadier General (then Colonel) R. C. Wilson, U.S.A.F., quoted from a memorandum dated 13 August 1948, as follows:

"In compliance with your request, I have jotted down some of my recollections of Japan as it appeared to me just before and immediately after the surrender of August 14, 1945. I have confined my notes to strictly non-technical aspects since the latter have been covered elsewhere in a great number of reports - including my own.

"ARRIVAL IN JAPAN

"I had just returned to the United States from Okinawa when The Bomb was dropped on Hiroshima. I was immediately ordered back to the Pacific with instructions to find and report to Brigadier General Newman. I left in a great hurry, with only verbal orders - an almost certain way to become officially 'lost' - and after searching Hawaii, Guam and Tinian, I wound up back in Okinawa just 3 weeks after having bid it what I had thought was a final farewell. There I found General Newman pleading for transport with the 11th Airborne Division, which was then moving into Yokohama.

"Failing to move with the 11th, we ordered in one of the C-54's from the 509th Group on Tinian, and proceeded with our own private invasion.

"We landed at Atsugi amid a scene of tremendous activity. The airdrome was battered but fully operational.

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"We obtained transportation and headed for Yokohama. The countryside was green and peaceful, showing no sign of war. But along the roads women turned their backs, and demobilized soldiers trudged by individually or in small groups with a studied indifference. Only the children greeted us - and they did so with enthusiasm. They made the 'V' sign without fail, and shouted 'Haroo!' Some of them demanded gum, so it was plain that we were on the route of the 11th. The universally identical greeting of the children could only have been the result of careful schooling.

"The outskirts of Yokohama were thoroughly burned out, the people living in huts improvised of galvanized iron sheeting and other salvaged material. It was obvious that community life was being carried on under exceedingly great hardship.

"The center of the city, however, was not greatly damaged. Life appeared to be fairly normal, although the absence of any considerable number of people was notable. Through the streets passed mobs of demobilized troops, slogging along in informally organized companies as if the men clung together for mutual support. These motley companies were generally absolutely silent, and appeared to be ignored by the few civilians on the streets.

"The hotel selected for housing high-ranking officials and for assigning billets for others, was dramatically guarded by a squad of fully armed and bayoneted soldiers who greeted us with a crashing 'present arms.' In the gathering dark, backlit by the flooding hotel light, this scene was better than any movie could produce.

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"I was assigned a nearby apartment; and a maid of perhaps 15 years of age who knelt and touched her forehead to the floor whenever she entered the place.

"The place was kept spotlessly clean, had running water and was a vast improvement over Okinawa! The bed, however, was a huge boxlike structure of wood covered only with a straw mat and a thin quilt. The pillow appeared to be filled with either sand or compacted sawdust.

"After a day or two in Yokohama during which time we saw the headquarters develop into a faithful replica of the Pentagon, Colonel Doubleday and I obtained a jeep and visited Tokyo.

"Tokyo was in frightful condition. Hardly a building was undamaged, and vast areas were destroyed completely. There were no American troops in town, which as yet was 'off limits' to the 11th Airborne. We saw an occasional reporter, but otherwise had the conquered city to ourselves. The people were not hostile but exceedingly curious. They swarmed all over our jeep at each stop. Community life was organized and controlled by hordes of gendarmes.

"We stopped at the largest of the department stores, which was pitifully stocked. The clerks evidenced no apparent surprise to see us there but rather acted as if they were serving the American tourist of happier days.

"We did not see Tokyo again for about a week after our 'capture' of the city. Then, as we approached, we were greeted by an immense sign reading 'Welcome to Tokyo by Courtesy of the First Cavalry Division.' Thus goes unsung a notable military triumph!

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"HIROSHIMA

"The initial inspection party, which was led by Major General Farrell and Brigadier General Newman, and which included Dr. Morrison and other civilian and military personnel, departed for Hiroshima from Atsugi in a C-54 commanded by myself. We flew over the burned out and ruined cities of Osaka and Kobe, arriving over Hiroshima in midmorning. It was apparent that a landing on Hiroshima's airport was impracticable because of the limited runway length and the wreckage which littered the place. We proceeded, therefore, to the military airdrome of Iwakuni, about 20 miles to the south. Here we managed a successful landing despite bomb craters and the wreckage of many aircraft - one of which lay squarely on the runway.

"We commandeered a bus and soldier-driver from the local Commander and set out for Hiroshima. This was a notable journey marked by incredibly bad roads and frequent breakdowns. If my memory serves, it required 4 to 5 hours to cover the 15 miles from Iwakuni to the headquarters of the military commander of the Hiroshima area.

"At headquarters, we were allowed to stand in a huddle of baggage outside the gates, while our agitated guide, Dr. Tsuzuki, arranged for our reception. Eventually, we were admitted, and toiled up the hill from the gate to the 'taisa's' office in a plainly evident atmosphere of hostility.

"It was clear that the taisa had not expected us, was doubtful of the purpose of our visit, and lacked instruction from 'higher authority.' Despite Dr. Tsuzuki's explanations (which we could only assume were correct) he remained cold, hostile and uncooperative. It developed that he expected

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some sort of a surrender demand and that this, with its attendant loss of face, he intended to resist. At long last, he accepted our visit to the 'Disaster' as inevitable, but refused to provide accommodation, or assume responsibility for our safety. He did agree to assign an officer to guide (and doubtless to watch) our party.

"We were surprised, in the light of all this coldness, at the taisa's request, just prior to our departure, to be photographed with the two Shōshōs. Generals Farrell and Newman agreed, and the taisa squared himself away in the middle of a short settee where he spread his knees apart and gripped his sword firmly with both hands. The generals sat on either side of him on the too-short seat. We got a ridiculous picture of the taisa firmly and expansively posed on the settee with an American general clinging for dear life on either side.

"The agitated Tsuzuki, now reinforced by the Jap major, got us back to our bus and headed to the shrine of Miashima for the night. The shrine, located on an island, is centuries old and still a goal for pilgrims. It is reached through a town which appears to be the Japanese equivalent of Atlantic City - or even Coney Island. Nevertheless, when our ferry docked, not a townsman was to be seen on the main street leading from dock to temple. At each street crossing along the main route, however, a gendarme was stationed. In absolute silence, except for the noise we ourselves created, we struggled up the street with our luggage. With the Major leading, we passed the closed shops and houses; and as we passed, each gendarme in turn fell in silently behind us. I have forgotten how far we walked, but we had quite a platoon behind us when we arrived at the shrine!

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"Here we were met by the head priest and by one who appeared to be a hotel keeper. After 'registering' we were scattered in pairs throughout a group of small houses along the bank of a running stream. The whole shrine area was forested, gloomy and strange to American eyes. Presently, each of us was presented with a kimono and sandals and directed to the community bath. There we compromised with the local custom by standing on the edge of the pool and dousing each other with bucketfuls of the hot water which flowed in from one side.

"We had taken the precaution of bringing our arms to the bath, and after emerging, we found that all other equipment had vanished (to protect it from wandering deer, it was explained). So we dressed in our kimonos and sandals, buckled on our weapons and followed a guide to the chief priest's quarters for dinner. The priest was most cordial, as was his wife. His excellent dinner of venison was served to the squatting gentlemen by his wife and a number of other ladies. After dinner, he served Japanese 'Scotch' (complete with UK label) which tasted like kerosene and which, perhaps fortunately, no-one could drink.

"Soon after dinner we retired to our mats with an odd sensation of unreality.

"Next morning things had changed. Although we left very early, the town was thronged with people who appeared curious and even friendly. Our baggage was carried to the ferry for us. And on the mainland we found a string of cars to take us into Hiroshima.

"A good deal has been written about Hiroshima, but no-one can describe adequately the smell - and the flies. The former was noticeable

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from a distance of several miles: first a faint taint which at certain points in the city became almost overpowering. Even the Japanese, who seem not to notice their nauseating 'honey carts,' had their noses bound up while they probed the ruins. And the blue-bottle flies swarmed in clouds. To open a car window was to fill the car with flies. And we climbed through the ruins in individual swarms.

"I tramped through Hiroshima unaccompanied, except for a photographer. The able-bodied people paused to watch us, but never displayed any hostility. I went where I wished, except that I was dissuaded from climbing a hill in the southeast part of the city. I was told that it was the abode of Yama - God.

"NAGASAKI

"The initial party entering Nagasaki was composed essentially of the Hiroshima group; Dr. Warren and his medical staff still were absent. Rear Admiral R. E. Byrd joined us as an additional observer to the party which once again departed from Atsuga in a C-54 commanded by me. Our landing field, Omura, was covered with low clouds and we were forced to fly far to sea in order to get under the low cloud layer. Omura airdrome was in frightful shape: its hangars were shot up or burned, its barracks abandoned, and its field pitted with bomb craters and littered with burned-out or wrecked airplanes. In picking our way through this ruin on landing, we blew out all four tires on the airplane.

"This left us virtually stranded, but after broadcasting aimlessly for assistance, the party requisitioned a bus and departed for Nagasaki. (In the absence of the party from Omura an airplane with spare tires and a maintenance crew arrived from Okinawa where our distress signal had been

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received. They repaired the airplane and departed with an air of unruffled efficiency.)

"On the trip from Omura to Nagasaki, it was observed that the rice paddies had been organized into a complex and deadly system of defense-in-depth. It was apparent that the capture of this area could have been accomplished only at a staggering cost in casualties.

"In Nagasaki our party halted in front of the government offices where we de-bussed and stood in the street while Dr. ^{Tsuzuki} Suzuki palavered with the gendarmes. It appeared that the governor was in his office but was too busy to receive us. He would let us know when he was free. Meanwhile, presumably, we were to wait in the street. This occasioned an outburst culminating with an oration by Admiral Byrd to the effect that he was the President's personal representative and intended to wait upon the pleasure of no minor Japanese functionary. The governor promptly joined us in the street, where he was allowed eventually to coax us into his offices.

"Our business being stated, we prepared to go about our inspection in the city, but found our transportation to be the now familiar decrepit bus. We requested cars, but were informed that there were none in Nagasaki - this although we could see American limousines passing just under the window. Further discussion developed the fact that cars were the property of the Japanese army - therefore, their use by us was unthinkable. We got our cars.

"Our first night in Nagasaki was spent at an 'American style hotel.' It was so completely vile that I, and several others, thereafter lived in our airplane and 'commuted' to Nagasaki.

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"One final recollection of Nagasaki: on the evening of the second day there, Colonel Doubleday and I went to the docks to watch the U. S. Marines land and occupy the town. It was very interesting to be on the 'wrong' end of a Marine landing. We noticed that some of the troops were as embarrassed as surprised to see us there. I don't really know if the two incidents are connected, but next evening the Marines arrested those of our party who were entering a geisha house to attend the now docile governor's welcoming party. The charge was 'out of bounds.' "

The second set of recollections are those of Colonel Stafford L. Warren, now Dean, School of Medicine, University of California, quoted from a letter dated 17 June 1948, as follows:

"There are three points of interest which involved our parties which might be of interest to you.

"Colonel Friedell's party in Hiroshima discovered a small amount of radium, presumably about twenty-five milligrams. It was picked up about three hundred feet or so off the main street in an area about one-half mile from the epicenter. There was a pile of bone fragments and bone ash where a great number of human bodies had been cremated by the Japanese. The Geiger Counter detected it and led them to the spot. They dug the pile up with shovels and by eliminating one shovelful after another, they finally located a small container, obviously a cervical or vaginal radium applicator, the best guess being that it was in a patient receiving treatment in a doctor's quarters or a hospital room at the time of the blast. Colonel Friedell brought the radium back to Tokyo and had a discussion among the group, including our own party and other

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personnel, concerning what was to be done with the source. We finally decided to turn it over to Dr. Tsuzuki who deposited it with the Japanese hospitals located at the Tokyo Imperial Medical School. This was done the day before we left. It was reported to our Intelligence and to MacArthur's Intelligence Section, but I do not know what the final outcome was. We also certified that it had no bomb potentialities. This was a good evidence of the accuracy of the surveys and the sensitivity of the equipment, in spite of the very rainy weather.

"Colonel Friedell's party entered the suburban area to the west of Hiroshima to follow the trail of the fall out. They traced it to the western peak adjacent to the edge of the city clear to the top of the hill where there was a shrine. They could go no further because there was an absence of roads and they were faced with an impenetrable bamboo forest which was located on the other side of the hill. By that time they were exhausted and also were nearing the end of their stay. The survey had to be terminated, so we do not know the western extent of the downwind contamination. It was very minor and not hazardous, being almost at the lower limit of sensitivity of their instruments.

"The second episode of some interest occurred when Nolan, Oughterson, Kasner, and I were grounded at the Hiroshima Airport. An ex-Los Angeles Japanese newspaperman appeared on the scene at dinner and interpreted accounts of the Japanese newspaper, of which he carried a copy. It contained the storm of controversy raised by the American correspondents over the ethics of using the bomb. The Japanese, of course, were beginning to chime in, but in general, were sitting tight, keeping their

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own thoughts to themselves about this matter. We discussed this far into the night, and came up with the following arguments:

"The Japanese knew they were beaten and had planned to give up in February after fighting two months following our invasion which was scheduled for November 1st. This was all news to us but was verified later as the assault date. By dropping the bomb, we made further resistance impossible, thus saving their face. They could surrender when the Emperor said to without having to commit mass hara-kiri, which was to be their fate if they surrendered at the end of the war. A second strong argument which they accepted completely was the belief that in the process of our assault, we would have killed perhaps as many as several million Japanese. In the assault we would probably have had as many as five hundred thousand American boys killed. Was it not better to extinguish two cities instancously and bring the matter to an abrupt stop by what amounted to a surgical operation, the net result of which saved many more lives? We thought, when we went to bed and until we got back to Tokyo almost four days later, that we would spring this on the staff and the newspaper people in Tokyo when we arrived. To our surprise, this had broken in the Japanese papers the next day after our night meeting as coming from the Japanese, not from us, the Japanese saying that it was ethioal to use the bomb and they were glad that we had done so because it had saved a great many Japanese lives, and a great many American lives. We were greatly amused at the puzzled expressions and comments of the local correspondents who felt that they had been sold down the river by the Japanese whom they expected to climb aboard the hand wagon. We, of course, kept quiet

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about our part of it. The matter soon quieted down both in Japan and the United States, although our own people frequently bring the subject up as a sort of neurotic self-flagellation.

"The third interesting episode was our visit to the Temple of Peace. As we left our bivouac area on the island the last morning, Tsuzuki had asked whether we would like to visit the Shrine and see this famous historical landmark. As I remember, it was about fourteen hundred years old, built on stilts over the tide water. It was a beautiful little building, old style Japanese Architecture, made of cedar planks of great dimensions and having a high polish. The four of us and four enlisted men finally were admitted to the inner Shrine. We took our shoes off and walked in. Tsuzuki halted us in a line, bowed to the idol. The High Priest came out dressed in pure white, and he and Tsuzuki went through a ceremony before the idol, and then came back and faced us. Two men, supposedly spirits, dressed in white came out and furiously waived plumes about the place, driving away the evil spirits. Then ceremonial dishes filled with hot sake were given to us and we were told this was a pledge to peace, and, on that basis, we all drank it. Colonel Oughterson, as MacArthur's representative at the time, stepped forward and paid his respects to the local factotum who had treated us so courteously. I got philosophical and gave a toast to the future peace between all nations and the hope there would be no more war again. I got a little emotional about it, and this, together with the knowledge that we did not rape or pillage his community, surprised the Priest greatly. We then backed out and took the boat to shore where we were greeted very

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respectfully, and much more effusively and ceremoniously by the local gendarme captain than we had been previously. It was hard for me to reconcile this ceremony with the knowledge which we had received several days before, that this Shrine was the center for kamikazes, who had lived a life of riotous celebration in the hotels located just above the shrine. The latter part of the week before their tour of duty was spent there, and then the last day or some period was spent in consecration and dedication at this Shrine before they took off for their missions. I wondered whether there were more kamikazes or relatives of kamikazes on this island where we were singularly vulnerable. It was interesting, but not unexpected, that it would take us some time, two to three days, to get a message from either of the two cities to Tokyo. However, Tsuzuki seemed to have a mysterious system of telepathy because he could make arrangements through Tokyo from those distances in a few hours. Since we were afraid that any investigation of how he did it at the time would cause the system to fail and leave us stranded, we did not inquire as to the mechanism.

"I shall never forget walking into the Medical School in Nagasaki about five weeks after the detonation, and, on the landing of the second floor, stepping over the body of a young female partly burned, going down the corridors of an American designed concrete building like those at home, finding in room after room the laboratory equipment so familiar at home, and on the floors, two or three or more bodies, partly burned, entangled in window frames, and twisted under the benches. They must have been doctors, nurses, technicians, and students. The

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school was located half of a mile to three-quarters of a mile from the epicenter, and the walls were thick concrete. In the basement below the main entrance, which was easily accessible, there were four pairs of new wooden shoes with pink or red ribbons for the toe. Each pair was beside an empty litter on the floor. Also beside each litter was a smear of what I interpreted to be bloody vomitus or bloody diarrhea. Outside was a pile of bones from the cremated bodies. The pile was about three feet deep and fifty feet in diameter."

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APPENDIX

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