

Testimony of Edward P. Radford, M.D.

I am a physician who graduated from Harvard Medical School in 1946. My career has been in research and teaching, most recently in the field of environmental public health. I am now retired from my academic position, although I continue to do consulting work, particularly on the health effects of ionizing radiation. I am presently a consultant to the Public Advocate of the Nuclear Claims Tribunal in the Marshall Islands.

In my academic career I was involved with teaching and research on the effects of ionizing radiation, and developed the first courses offered in this field at the Harvard School of Public Health in the 1950s. In 1969 I was made a member of the U.S. National Academy of Sciences Committee on the Biological Effects of Ionizing Radiation (BEIR). This committee issued its report in 1972; the report is now known as BEIR I. In 1977, a similar committee was appointed by the Academy to review new evidence, and I was made Chairman of the full committee, as well as of the subcommittee on somatic effects (cancer or other effects on the person irradiated). Its report (BEIR III) was issued in 1980. I submitted a dissenting statement in that report because I thought the evidence indicated significantly greater risks of cancer from radiation than was presented in the main report. The BEIR V report published in 1990 has vindicated my position in BEIR III.

In 1983-84 I was a Visiting Scientist at the Radiation Effects Research Foundation in Hiroshima, Japan, the organization supported by the Japanese and the U.S. governments to investigate the long-term effects of the Hiroshima and Nagasaki atomic bombs. At

that time I assisted in the epidemiological study of radiation-induced effects on the A-bomb survivors. The most recent evidence in 1993 from these follow-up studies has also supported my position in the BEIR III report.

My interest in radiation and its effects began in 1947 when, as a new flight surgeon in the U.S. Air Force, I was sent to the military Radiological Health School at Edgewood Arsenal in Maryland. After completing that course I was ordered in 1948 to join Joint Task Force Seven to participate in the second series of atomic bomb tests in the Marshall Islands, Operation Sandstone (the first was Crossroads at Bikini atoll). These three tests were carried out on Enewetak atoll. Most members of the Army and Air Force staff were based on Kwajalein atoll, 400 miles south-east of Enewetak. I was a radiological safety officer attached to a B29 crew, whose responsibility it was to photograph from 30,000 feet the evolution of the fireball and the mushroom cloud as it rose from the detonation site on a 200ft. tower. The tests were exploded just before dawn.

The night before each test we had meteorological briefings explaining the winds aloft to be expected at the next dawn's test. Meteorological conditions had to be such that there would be no likelihood of radioactive fallout on the American personnel in the area. No mention was made about Marshall Islanders, nor was any information then given to us as to where in the vast expanse of these islands the Marshallese were living. The impression I have now was that the Marshall Islanders, a few of whom were then living on Kwajalein, were not considered to be important in the minds of the test organizers.

Despite the meteorologists' assertions, we did have fallout on Kwajalein after the second (and largest) of the three tests. About 14 hours after the test, rain began falling on Kwajalein and our unit of radiation safety officers, about 25 men, was ordered to take our Geiger counters and measure the radioactivity coming down in the rain. We were assigned different areas to monitor, and proceeded for the next two or three hours to take readings in the rain on the ground, on tent surfaces, and on any other surfaces present. My experience was that the count rates were high, much greater than background. Both gamma and beta radiation was measured; the beta radiation showed it was fresh fallout. We turned in our results to our commander, but at that time there was no further comment that I can recall about the significance of this "rainout", certainly not about any possible health implications of it.

In 1983 a report prepared by Science Applications International Corporation reviewed the radiation exposures of the 7,000 Naval personnel taking part in Operation Sandstone in 1948. A single measurement of gamma radiation (only) from fallout recorded for Kwajalein (presumably from our survey) at about midnight on May 1, the date of the second (YOKE) test, was higher than any of the greater number of measurements made at Enewetak during the tests. There is little comment in the report about beta radiation, which evidently was much higher than the gamma measurements. The highest integrated gamma dose measurements to personnel through May 31 were recorded for Kwajalein residents. These were higher than the Enewetak values, and those for people on ships which remained in the Enewetak lagoon during all the tests. No comment is made about the fact that the fallout on Kwajalein was 400 miles away from the test, and that fallout on other islands could have been higher than on Kwajalein. The distinct impression is

that radiation exposure estimates in this report were determined solely by where measurements were available. The conclusion of their report is that "film badge" doses of gamma radiation were less than 0.1 rad to all Sandstone personnel.

Retrospective reconstruction of doses in this fashion 35 years later depended critically on two reports and one memorandum compiled at the time of Sandstone and apparently all unpublished. One of the reports was stated to be a draft. Questions of inhalation or ingestion of fission products, the variability of ground measurements (noted by me during my monitoring), or other details about possible exposures were not discussed. For example, on Kwajalein tent roofs and walls gave the highest readings, but these were dismissed as not pertinent to human exposure. It is likely that some of these issues will never be resolved, especially as there is no way to check the basic data. In any case, I do not have much confidence in the results presented in this report, unsettling to me as one of those exposed.

Recently I have returned twice to Majuro in the Marshall Islands to meet with the Nuclear Claims Tribunal, with one return visit to Kwajalein. In this period I have learned about the later tests up to 1958 and their consequences. It is significant that the Marshall Islanders did not know radioactive fallout had occurred on Kwajalein in 1948 until I told them of my experience in Operation Sandstone. We now know that 67 bomb tests were carried out on Enewetak and Bikini from 1946 to 1958, of which at least 17 were thermonuclear devices. The total kilotons of nitroglycerine equivalent explosive power of all these tests was 107,000 kilotons, or equal to over 7,000 Hiroshima type bombs.

Although the Bravo test was the largest U.S. bomb detonated, there have been many other large thermonuclear tests, and in any case the amount of radioactive fallout depends not only on the bomb energy but also on how close it was to the ground or lagoon floor at detonation. The Bravo tests in May 1954 was noteworthy because it was the first test whose fallout was recognized as hazardous to Marshall Islanders and the Japanese crew of the "Lucky Dragon", as well as to Americans. American military meteorological staff on Rongerik were evacuated to Kwajalein two days after the bomb. The Marshall Islanders on Rongelap, Rongerik and Utirik atolls were evacuated to Kwajalein three to four days after the test. Both Americans and Marshallese suffered from skin burns (presumably primarily from energetic beta radiation exposure) as well as nausea, vomiting, diarrhea and hair loss. The press release by the Atomic Energy Commission at the time stated that the evacuation was "precautionary", no burns were present, and all evacuees were reported well.

Fallout on these atolls was attributed by the test staff as due to "sudden wind shifts" before the test, but in 1982 the senior weather technician, who had been stationed on Rongerik in 1954 at the time of the test, said that the wind was blowing straight at Rongerik from Bikini before, during and after the test. There was no wind shift. This is not surprising in view of the prevailing westerlies at this latitude, particularly at upper altitudes. Neither the Marshallese nor the U.S. Air Force and Army men on Rongerik knew when the test would take place. On Rongelap the white dust-like fallout (including vaporized coral from Bikini) accumulated to two inches thick.

Although the test authorities and the Brookhaven Laboratory medical teams that subsequently studied those exposed Marshall Islanders have emphasized that fallout only affected Rongelap, Ailinginai, Rongerik and Utirik atolls, the Marshallese know that many more areas received substantial fallout from test Bravo. These include Ailuk, Bika, Likiep, Taka and Wotho atolls, and Jemi and Mejit islands. (Wotho atoll is 400 miles from Bikini). Let me tell a story told to me by Marshall Islands Senator Tony de Brum, who may be present in this room. He was 9 years old at the time of Bravo, living on Likiep atoll in a thatched house. He and the other residents noted a snow-like dust falling after the test, turning the water reservoirs a yellow color. Soon afterwards he noticed that gecko droppings were falling on him and other members of his family. (Geckos are small lizards.) Then a dead gecko fell out of the roof thatch. Then another gecko fell dead, and finally a whole rain of dead geckos fell from the thatch, something unique in his experience. My interpretation of this phenomenon is that the thatched roof filtered out much of the fallout particles, and the high radiation doses in the thatch, especially from beta radiation energetic enough to pass through a small animal, was enough to kill the geckos. Mr. de Brum also reported that a Navy ship stopped at Likiep and took a boy and a woman on board, evidently for whole body counting. The two were returned, but nothing was said about this to the Marshallese, and the ship sailed away. For many years the U.S. Navy denied that any ship visited Likiep, although recently they have finally admitted it.

Undoubtedly there was radioactive fallout on many of the inhabited islands, for example, on Ujelang atoll after test King in 1952, and test Magnolia in 1958. You will hear from Dr. Thomas Hamilton about his thyroid study, a biological indicator of thyroid adenomas

as a radiation dosimeter showing contamination of many of the islands south of Rongelap from Bravo and other tests. I also heard in Majuro that at the time of the bomb tests a number of abnormal babies were born. When asked about pregnancy outcomes at the time, the mothers affected denied that there had been any problems because of the stigma in the Marshallese culture attached to a family when an abnormal baby is born. Now as older and wiser mothers and grandmothers they are prepared to discuss the problems they had.

Finally I would like to share another anecdote I heard in Majuro. During the bomb testing period, exact date unknown, the people living on Kosrae island were told one day by men from the U.S. Navy unit on the island not to eat the local food nor drink the water. For a substantial period of time, many days or weeks, the Navy provided food and water to the people from their own (presumably covered) stores. Finally the islanders were told that it was once again all right to take their food and water from local supplies. Now Kosrae is not even a Marshall island and lies slightly south and about 600 miles west of Majuro. It is also about 600 miles due south of Enewetak. Certainly this episode sounds as though radioactive fallout had occurred on this relatively remote island far from the test site. I realize that this hearsay evidence, but there is no question that the facts can be provided by the U.S. Navy if they choose to do so. If they state that no such episode occurred, they will not be believed by the Marshall Islanders.

In conclusion I strongly suspect that radioactive fallout from the many American atomic and thermonuclear bombs detonated at Enewetak and Bikini atolls up to 1958 had caused exposure of many Marshallese to significant radiation doses. It will be difficult to

establish objective evidence of this exposure, though Dr. Simon's survey will help. At the very least the U.S. government owes compassion and attention to the Marshallese people for the way that the use of their islands to advance the military purposes of the U.S.A. has disrupted the lives of many of the people of the Republic.

When Operation Sandstone of Joint Task Force Seven left the Pacific and returned home, eventually all members of the Task Force were sent a book containing a photographic history of the bomb tests. This book still brings back many memories to me. On the last page of the book, opposite a color picture of a fireball rising above an Enewetak island is the following text: "The atomic energy Proving Ground at Eniwetok lies ready and waiting for man's next adventure in atomic wonderland." It may have been a wonderland for nuclear physicists, but for the Marshall Islanders it was part of their home, and the bomb test islands were not a wonderland but became a place of fear and danger.