

**REPORT TO THE ADVISORY COMMITTEE
ON THE HEALTH OF VETERANS' CHILDREN**

**REPORT ON THE POTENTIAL FOR RADIATION INDUCED
GENETIC EFFECTS IN CHILDREN OF CHRISTMAS ISLAND
VETERANS**

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Preface

In October 1998 I was asked to provide Professor Mark Elwood of the University of Otago with comments on the likelihood of any radiation-induced genetic effects in the offspring of veterans who had served with the New Zealand Navy during the time of its participation in the British nuclear test series in 1957-58, based at Christmas Island. Professor Elwood was undertaking a review for the Advisory Committee of evidence on the effects on the health of veterans' children arising from potential or actual exposure of Vietnam war veterans to defoliants. Subsequently in December 1998 I was asked to provide comment on publications which had been forwarded for the Advisory Committee's attention which raised concerns about possible effects on Christmas Island veterans of radiation exposure. This report is a summary of advice provided in response to these two requests. The first issue is addressed in the body of the report. The comments on publications are included as an appendix.

**THE POTENTIAL FOR RADIATION-INDUCED GENETIC EFFECTS IN
THE OFFSPRING OF CHRISTMAS ISLAND VETERANS.**

There are two fundamental issues to be addressed in the study of the health of children of veterans who were present for some of the tests in the Christmas Is region in 1957-58. One is, what were the radiation doses received by the men, and the second is, what would be the effect on their offspring arising from any radiation doses received. The answer to the second question has a clear dependence on the answer to the first. I discuss both questions briefly.

1. Doses received.

Monitoring of radiation exposures of servicemen involved in the tests was carried out by the British and is reported in the National Radiological Protection Board Report NRPB-R266 (Darby et al, 1993). Apart from air crew involved in cloud sampling missions and a few other persons no significant exposures were received by servicemen attending tests. Taking account of the positions of the observing ships during explosions and the movements of the ships and crews there are no reasons to suppose that NZ servicemen received any significant

exposures. Doses received by servicemen are discussed in more detail in the Appendix.

Epidemiological evidence

In response to claims by navy veterans the New Zealand Government commissioned an epidemiological study conducted by a group at the Wellington Medical School. The report on the health of the New Zealand participants was published in the *British Medical Journal* on 5 May 1990 (Pearce et al, 1990). The study concluded:

Although the numbers are small ... some leukemias, and possibly some other haematological cancers, may have resulted from this programme. There is little evidence of an increased risk for non-haematological cancers, and there is no evidence of an increased risk for causes of death other than cancer.

A report following up the participants for a further 5 years was issued in 1996 (Pearce, 1996; Pearce, et al, 1997). The findings were essentially unchanged with no evidence of increased health effects except for the possible excess of haematological cancers. This elevated relative risk was mainly due to 4 deaths from leukemia. The report speculated that radiation may have been a causal factor and that internal exposure from ingestion of foods or neutron radiation may have been involved.

In examining these epidemiological findings it is to be observed that the number of haematological cancers in the study was very small. In regard to the four leukemia cases two points should be noted. Firstly, one of the cases was a chronic lymphocytic leukemia which is a type which has not been demonstrated as being caused by radiation. Secondly, the increased risk of leukemia in the exposed Japanese (Hiroshima and Nagasaki) populations in the 15-29 age group falls to near zero at 25 years after exposure. In the test participants, who were largely within this age range, 3 of the 4 leukemias occurred more than 25 years after the putative time of exposure. Without further evidence, therefore, the epidemiological findings cannot be considered to provide any support for radiation exposure as a cause of the small increase in leukemias.

The much larger British study of British participants at the Australian and Christmas Island tests found no increases in health effects in participants. The NRPB report (p.51) makes similar comments on the NZ study to those in the preceding paragraph. The weaknesses in the New Zealand study conclusions had been earlier flagged in the National Radiation Laboratory publication *Radiation Protection News and Notes* of July 1990 (McEwan, 1990).

Radiological evidence

The National Radiation Laboratory carried out a radiological survey of Christmas Island in 1981 following a request from the British Overseas Development Administration for an independent survey (McEwan et al, 1981). This was in response to a request from the newly independent state of Kiribati.

This study demonstrated that no significant radioactive fallout had been deposited on the island and was consistent with British results of personnel monitoring conducted at the time of the tests. Apart from small groups of British personnel such as aircrew involved in cloud sampling missions, the doses could be considered trivial.

In speculating on possible causes of radiation exposure, the Wellington Medical School reports refer to neutron radiation and possible intake of fallout products. Neither of these are credible sources of significant exposure. The observers were stationed many miles from the detonations, and for megatonne yields, neutron radiation is completely attenuated at distances where blast and thermal (burn) effects do not occur. Further, significant intake of fallout radionuclides is not possible in the absence of accompanying external exposure.

Conclusions

There is no evidence that the participants received any significant radiation exposures, and certainly no exposures that would give rise to any observable health effects.

Apart perhaps from the weak epidemiological evidence for a possible increased risk of leukemias, there is no evidence that the New Zealand test participants suffer from unusual or increased health effects. There is no evidence that the small number of additional leukemias observed have any causal relationship to radiation exposure.

2. Hereditary effects of radiation exposure

Authoritative reviews of sources and effects of radiation exposure are provided by the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR). The last major comprehensive report (over 900 pages) was published in 1993 (UNSCEAR, 1993). Reports on specific topics were published in 1994 and 1996. The 1993 Report has an annex on "Hereditary effects of radiation" and this reviews the evidence from the atomic bombings, the epidemiological study of Sellafield childhood leukemias, and other studies. The summary notes,

Epidemiology has not detected hereditary effects in humans with a statistically significant degree of confidence. The risk estimate based on animals is so small that it would have been surprising to find a statistically significant effect in the end-points studied in Hiroshima and Nagasaki.

A review paper by Doll (1998) states

The intensive study of the children born to the survivors of the Hiroshima and Nagasaki bomb explosions has failed to demonstrate any significantly increased effect at all, and, for several of the postulated indicators, the direction of the trend with dose has been the opposite of what would be expected from damage to parental germ cells, though again not significantly so.

This paper also very briefly considers the Seascale evidence.

Other publications of relevance are "The children of atomic bomb survivors: a genetic study" ed J V Neel and W J Schull (1991), and papers related to the Gardner hypothesis which have references to many other studies: e.g. Little, Wakeford, Charles and Andersson (1996), and Bailey et al (1996).

The clear conclusion from these studies is that no genetic effects have been demonstrated in irradiated human populations and that the risk coefficient for genetic effects in subsequent generations is small. The risk coefficient estimated by UNSCEAR has recently been under review and is being revised downwards (Sankaranarayanan, 1998).

3. Conclusions

I consider therefore that a summary of the two points at issue is

- (a) there is no evidence of any radiation exposure of the servicemen in 1957-58 that could give rise to any health effects in the individuals themselves or their offspring, and
- (b) no radiation induced hereditary effects have been reported in human populations, even for those exposed to doses giving rise to deterministic effects.

It may therefore be concluded that no hereditary effects in the children of Christmas Island test veterans may be attributed to exposure to radiation arising from the veterans observation of the nuclear tests.