Dr Kathleen Dermody
Secretary
Senate Foreign Affairs, Defence and Trade Committee
PO BOX 6100
Parliament House
CANBERRA ACT 2600

17th October 2006

Dear Dr Dermody

Please find attached a submission to the Senate Foreign Affairs, Defence and Trade Committee, on the Australian Participants in British Nuclear Tests (Treatment) Bill 2006; and, the Australian Participants in British Nuclear Tests (Treatment) (Consequential Amendments and Transitional Provisions) Bill 2006.

The submission is made on behalf of Mr F Robotham, MInstP, Dr G Williams, BSc(Hons) PhD, and myself.

Should you have any questions about the submission, or require any further information, please contact me as below.

Yours sincerely

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# SUBMISSION

to the

Senate Foreign Affairs, Defence and Trade Committee

on the

Australian Participants in British Nuclear Tests (Treatment) Bill 2006; and the
Australian Participants in British Nuclear Tests (Treatment) (Consequential Amendments and Transitional Provisions) Bill 2006.

Submitted by

Dr PC Crouch BSc(Hons) PhD

Mr FJP Robotham MInstP

Dr GA Williams BSc(Hons) PhD

25th October 2006

# Aim of the submission

The purpose of this submission is to ask the Committee to redress the anomalous treatment of certain Commonwealth Police[1] officers who were stationed at Maralinga from the completion of the tests until August 2001. These officers were required to patrol through some of the most heavily plutonium-contaminated areas of the Maralinga range, without any radiation protection training or oversight prior to 1988, and potentially received much larger radiation doses than the majority of test participants. However, since for many of them their period of service fell outside the interval used to define a “participant at the tests” for the purposes of the epidemiological study of test participants, they have been denied the health care benefits granted to other test participants.

# Submission authors

The authors of this submission were all involved in the determination of the radiation doses received by participants at the British atomic tests in Australia. Drs Williams and Crouch were members of the “Dosimetry Panel” and Mr Robotham was the “Researcher” to the Panel, and was responsible for searching out and gathering the available data on radiation exposures. Together we had responsibility for writing much of Volume 1: Dosimetry – Australian Participants in British Nuclear Tests in Australia.

We have all worked in radiation protection for many years and have had long involvements with the atomic tests and test sites in Australia.

# The “Nominal Roll”

In any epidemiological study such as this, it is an essential requirement that the group under study be very clearly defined. For this reason, a definition used by the Department of Veterans’ Affairs was used to define an “atomic participant”.

> “Someone who was present, either working or as a visitor, in at least one of the testing areas whilst a test or tests were conducted in that area or was there within a 2 year period after the explosion”

Using this definition a “Nominal Roll” was formed, and this became the basis for the epidemiological study of Australian Participants in British Nuclear Tests in Australia. This definition was used to give a firm cut-off to the number of “participants” forming part of the study. It was derived as a matter of

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[1] The name of the Commonwealth’s police force at Maralinga changed a number of times during the period. During the tests, the security officers were called the “Peace Officer Guard”. In 1960, they became the “Commonwealth Police”, then the “Federal Police” (AFP) in 1976 and finally the “Australian Protective Service” (APS) in 1984. The term “Commonwealth Police” has been used throughout this submission.

convenience only, and had no relation to the activities being conducted nor to the radiation exposures that might be experienced after that cut-off date.

This definition has now been taken up in the Australian Participants in British Nuclear Tests (Treatment) Bill 2006, with the relevant part of Clause 5 defining a "nuclear test participant" as

> "a person [who] was present in the Maralinga nuclear test area at any time between 27 September 1956 and 30 April 1965 inclusive".

(The last series of "minor trials" (Vixen-B) was in April 1963).

The benefits in the Bill are only available to "nuclear test participants".

## Experience of Commonwealth Police

Commonwealth Police were employed throughout the period of operation of the Maralinga atomic weapons test range and beyond, principally on security duties[2]. Most importantly for this submission, they were required to patrol the "Forward Area"; that area in which the actual tests took place, and which was in places contaminated with radioactive materials from those tests.

The contamination in some areas was very heavy. This was particularly so in the areas around Taranaki following the Vixen-B trials in which large amounts of plutonium were distributed over the ground. Despite some limited clean-up efforts, heavy contamination remained until the completion of a clean-up in 2001. Commonwealth Police patrols were required to regularly cross these contaminated areas.

Prior to 1984, based on British advice – which was accepted unquestioningly by the Australian government at the time - that a clean-up in 1967 (Operation Brumby) had left the Range in a safe condition, the Commonwealth Police security officers were not given any briefings or radiation safety advice, nor monitored in any regular way. Their instructions were to regularly patrol in some of the most highly contaminated areas. As an example of the risks to which they were exposed, they were observed by Australian Radiation Laboratory (ARL) officers in 1984 filling in rabbit warrens in an area highly contaminated by plutonium. They were unaware of the risk involved in raising and inhaling plutonium contaminated dusts in this way.

After the discovery in May of 1984 of unacceptable levels of plutonium contamination left by the British, regular briefings on radiological safety were conducted by the ARL at Woomera for Commonwealth Police who were rostered for duty at Maralinga. A copy of the advice provided at these talks is attached. These briefings, with opportunities for questions and concerns to

[2] The Commonwealth Police were removed from Maralinga on 1 March 1974. The AFP resumed surveillance of the Maralinga site in December 1976. During the period that police were absent, there were two civilian caretakers of the Maralinga Range.

be raised by Commonwealth Police and their families, began in 1988. As well as the provision of basic radiation safety advice, regular radiation (gamma) monitoring by the Personal Radiation Monitoring Service of ARL also began at this time.

While provision of this advice and a simple explanation of basic radiation safety allowed Commonwealth Police officers to operate in a way that would reduce their radiation exposures significantly from 1988 onwards, there was a long period between 1965 (the cut-off of the current study) and 1988 during which the Commonwealth Police officers were required to serve in contaminated areas of the Range unsupervised and without adequate knowledge of the hazards to which they were potentially exposed.

The Dosimetry Panel assessed radiation doses on a scale of A (lowest) to E (highest). The Dosimetry report states (Section 7.9.1) "[Commonwealth Police] who continued to work in the post Antler period and drove for lengthy periods in contaminated areas would have had category D exposures… [Commonwealth Police] continued to patrol the range until 1987… [Commonwealth Police] patrols were unsupervised and members of the service were not adequately briefed on the risks and actions to be taken to minimise radiation doses". ("Antler" was the name used for the last series of atomic explosions.)

Only approximately 4% of the assessed doses to the test participants were in the highest D and E categories. Thus those Commonwealth Police officers referred to above and assigned dose category D are estimated to have potentially received doses greater than 96% of the overall atomic veterans' study group. They were clearly one of the most heavily exposed groups involved in the tests or their aftermath.

Overall Commonwealth Police served at Maralinga for about 45 years, from about 1956 until 2001. The period used to define the participants for the purposes of the epidemiological study was 1952-1965. Those who did not serve in the area during that period are excluded from the Government's offer of free health care, even though many of them may have had multiple tours of duty at Maralinga, and accumulated significant radiation exposures.

# Criticisms of the Dosimetry Report

We are well aware that there have been a number of criticisms of the radiation doses that were calculated for participants, and claims that exposures were underestimated. We stand by our report, but we do not believe that this is the appropriate forum to defend our results. However, should the Committee wish, we would be pleased to supply further information.

# Conclusion

Members of the Commonwealth Police served at Maralinga between approximately 1956 and 2001. Throughout this period they were likely to have received significant radiation doses as a result of patrolling through contaminated areas. These doses are substantially larger than those received by the majority of test participants. However unless members of the Commonwealth Police were present prior to 1965, they are denied the health care benefits now offered to all other participants. This appears anomalous and unjust, and we ask the Committee to recommend that this anomaly be rectified to allow Commonwealth Police serving at Maralinga after April 1965 access to the same benefits as other participants.

Philip Crouch
Francis (Rob) Robotham
Geoffrey Williams

October 25th 2006

ATTACHMENT: Advice provided to Commonwealth Police serving at Maralinga by Australian Radiation Laboratory

## MARALINGA - RADIOLOGICAL SAFETY FOR APS PERSONNEL

K.H. Lokan and G.A. Williams

June 1988

(revised January 1995)

## INTRODUCTION

Between 1955 and 1963 the British carried out an extensive program of nuclear weapons testing at Maralinga. The program included the detonation of seven atomic bombs plus a series of other experiments known as 'minor trials'.

The Government's aim is to render these former UK Atomic Test Sites suitable for selected land use and a series of scientific studies to assess contamination has recently been undertaken. In the interim, the Government's aim has been to protect the public from any possible harm arising from any hazardous substances remaining at the test sites, by continued APS surveillance at Maralinga and control of entry to the area. A map showing the layout of Maralinga is included with this document.

## TYPES OF RADIATION

In order to understand the nature and degree of the hazard posed by radioactive contamination at Maralinga, it is necessary to have some knowledge of a few basic principles. The term 'radiation' is very broad, and includes both the radiation we receive from the environment (e.g. from cosmic rays and from natural uranium in the earth's surface) and that from man-made sources (e.g. certain medical diagnoses and treatments). Ionising radiation is generally associated with medical applications and the nuclear industry and includes alpha, beta and gamma rays as well as neutrons and x-rays. The essential feature of ionising radiation is that it possesses sufficient energy to damage matter by knocking electrons out of stable atoms (i.e. by causing ionisation to occur). Hence, ionising radiation can be a health hazard to man as the energy it gives up can, depending on the dose, damage human tissue.

It is alpha, beta and gamma radiation that we are concerned with at Maralinga. Alpha radiation doesn't travel very far. In air it travels only a few centimetres; it cannot penetrate skin and is completely stopped by a piece of paper. Beta radiation is more penetrating than alpha, and can pass through 1 - 2 centimetres of human tissue. Gamma radiation is very penetrating and can pass right through the human body but is stopped by dense material such as concrete or lead. For these reasons, beta and gamma radiation can present a health hazard when the sources are 'external' - that is outside of the human body. All three radiations may present a health hazard if they are 'internal' - that is if they enter the body through an open wound, or are inhaled or ingested. However, alpha radiation is much more damaging to internal organs than beta or gamma radiation.

## THE RELATIONSHIP BETWEEN RADIATION DOSE AND RISK

The amount of damage caused to human tissue by exposure to ionising radiation increases with increasing dose. The unit of the amount of dose is the sievert (abbreviation Sv). Because most exposures to radiation are relatively small, the most useful unit is the millisievert (mSv) which is one thousandth of a sievert.

Exposure to ionising radiation can give rise to two kinds of injury. The first kind of injury results from exposure to large doses (acute exposure), and could never occur at Maralinga today as all the sources of radiation that remain from the atomic tests are too weak. Acute exposure leads to clearly discernible damage to tissue, such as skin reddening similar in appearance to sunburn, but slow to heal, or the formation of cataracts in the lens of the eye. Such effects have a clear threshold at about 500 to 1,000 mSv, below which they do not occur, and the <u>severity</u> of the effect increases with increasing dose. Massive exposure causes severe damage to the central nervous system, to various organs and to the body's immune system, and can lead to death within weeks. This sort of exposure is rare, and is usually the result of an accident where control is lost over a strong medical or industrial radioactive source. The 29 Chernobyl firemen, for example, who died as a consequence of their exposure to radiation suffered doses of 5,000 to 15,000 mSv.

The second type of injury results below a dose of 2,000 mSv; in this case there will be almost no fatalities in the immediate future, and the risk is one of contracting, in the long-term, cancer or leukemia, or of genetic damage which will not show up until later generations. The risk of contracting cancer from a given exposure is statistical - i.e. there is a chance of contracting cancer but not a certainty, and the <u>likelihood</u> of the effect increases with increasing dose. This is similar to the relationship that exists between cigarette smoking and lung cancer. Not everyone who smokes cigarettes will contract lung cancer, but the risk is greater with the more cigarettes smoked.

The risk of contracting a fatal cancer from a uniform exposure to the whole body of 1 mSv is about 5 in 100,000. This is the same as the risk of contracting lung cancer from smoking a few hundred cigarettes. The risk of being killed in a car accident in Australia in any year is 2 times greater or about 1 in 10,000. For the situation at Maralinga at present, the risks are at the low end of the risk curve. If the recommendations below are adhered to, any dose received by an APS officer at Maralinga will be way below l mSv.

## THE SITUATION AT MARALINGA

There are two main types of radiation hazard at Maralinga. Close to each of the ground-zeros of the seven major atomic weapon explosions, the ground is slightly radioactive due to the atomic explosions. The hazard is one of external exposure of a person at the site caused by the gamma rays emitted by the particular contamination. This type of radiation is monitored by the film or TLD badges worn by APS personnel. With the exception of Tadje, which has the added complication of plutonium contamination, the levels of gamma radiation from all ground-zeros (including the two at Emu) are now very low, and all except Tadje will be safe for continuous occupation by the year 2030.

The ground-zero with the highest dose-rate is One Tree, and in 1995 one would need to spend 200 hours at the hottest spot to receive a whole-body dose of 1 mSv (which would then carry a risk of 5 in 100,000 of causing a fatal cancer).

The second type of risk is that due to alpha particle radiation from plutonium and, to a very much lesser extent, uranium contamination. The sites where plutonium contamination exists are Taranaki, Wewak, TM100, TM101 and Tadje. The plutonium at Maralinga is associated with trace amounts of radioactive americium, which emits a low-energy gamma ray which is useful for purposes of monitoring the associated plutonium with very sensitive instruments but which is so weak as to not be detected by the film or TLD badges.

The alpha particles emitted by plutonium are very weak, and have a range of only a few centimetres in air. They do not penetrate human skin, and naturally are not detected by the film or TLD badges. Therefore, plutonium is not a health hazard outside of the human body. However, when plutonium is taken into the human body, either by ingestion or by inhalation, the alpha particles are emitted inside the body and have the potential to cause cancer. The type of plutonium found at Maralinga is very insoluble and therefore would probably present very little risk if it were ingested. The main risk is of breathing in some tiny particles small enough to stay in the lung for a long time, where the plutonium may irradiate the lung or be gradually transferred into the rest of the body.

The only way to detect radiation exposures of this sort is to monitor the human body in a 'whole-body monitor'. Such a facility, which has the sensitivity to detect plutonium inside the human body at levels lower than would be considered a health hazard, exists at the Australian Radiation Laboratory (ARL). Over the past ten years a large number of visitors to Maralinga, and scientists participating in surveys there, have been monitored by the facility at ARL and it is reassuring that in no case has any significant plutonium been detected.

It is possible to calculate the risk of contracting cancer from the inhalation of plutonium particles. The inhalation of a typical 10 micron (one hundredth of a millimetre) diameter particle of plutonium would cause a 'committed' effective dose of about 2.5 mSv over a lifetime (because the plutonium will remain within the body for a long period). The recommended limit for long-term exposure of members of the public is 1 mSv per year, giving a lifetime effective dose limit of no more than 70 mSv. Therefore, one would need to inhale about 30 such particles to exceed this recommended limit. Particles much larger than 10 micron diameter are very unlikely to find their way into the lung even if breathed in, and generally pass out of the body fairly rapidly through the intestine route.