



THE REPORT OF THE ROYAL COMMISSION INTO BRITISH NUCLEAR TESTS IN AUSTRALIA VOLUME 2 AGPS



THE REPORT OF THE ROYAL COMMISSION INTO BRITISH NUCLEAR TESTS IN AUSTRALIA

VOLUME 2

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THE ROYAL COMMISSION INTO BRITISH NUCLEAR TESTS IN AUSTRALIA

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CHAPTER 10

THE MINOR TRIALS

10.0 Introduction

10.0.1 As well as the major trials, a large number of minor trials were carried out at Emu and Maralinga. These experiments were called 'Minor Trials' prior to October 1958 when they became known as 'Assessment Tests'; in December 1959 they became known collectively as the 'Maralinga Experimental Programme'.

10.0.2 The early minor trials, code-named Kittens, Tims and Rats, were tests of individual components or sub-assemblies of the nuclear weapon. Later experiments, code-named Vixen A, were also carried out to investigate the dispersal of radioactive material. A further series, code-named Vixen B, was carried out to investigate, *inter alia*, the effect of accidents on the weapons.

10.0.3 The minor trials were planned, controlled and executed by the UK authorities with virtually no Australian input beyond logistic and administrative support on the Range.

10.0.4 The UK Government forwarded proposals for minor trials, including safety assessments, to the AWTSC for review. In its work on the minor trials the AWTSC was responding to requests by the Australian Government for advice, rather than fulfilling a function under its terms of reference. In contrast to its role in the major trials, the Safety Committee possessed no right to veto a minor trial. The AWTSC then advised the Australian Government whether the proposals were acceptable.

10.0.5 Modifications were made to the approval system as a result of concerns that Australia was not being provided with adequate information on the nature of the trials. After 1960 proposals were additionally referred to the Defence Scientific Adviser and another officer in the Department of Defence for recommendation to the Minister for Defence.

10.0.6 Except in the local areas of the minor trials themselves, radiological safety on the Range during minor trials remained the responsibility of the Australian Health Physics Representative (AHPR), O H Turner, acting on behalf of the AWRE. At the minor trials sites, the senior UK scientist assumed responsibility, which was delegated to the Health Physics Adviser attached to the minor trials team. When a designated Health Physics Adviser did not accompany a team to Australia, the role was assumed by the Assistant AHPR, a UK appointment. The AHPR continued to oversee implementation of the Radiological Safety Regulations on the rest of the Range.

10.1 Nature of Minor Trials

Kittens

10.1.1 An atomic weapon needs to be supplied with a large number of neutrons at the time the fissile material in the bomb is most highly compressed by the high explosive. This source of neutrons is known as the neutron initiator. The initiator consists of a radioactive substance that is brought into contact with beryllium by a chemical explosive. The early Kittens trials were concerned with developing and testing neutron initiators. In the later Kittens trials, the neutron output was used to assess the performance of the high explosive assembly that compresses the fissile material in the core [RC 350, Schofield].

10.1.2 Five Kittens experiments were carried out at Emu and a further 94 at the Naya area, Maralinga. The experiments at Emu dispersed about 36 g of beryllium and 407 Ci of polonium-210 into the surrounding area. Polonium-210 is an alpha emitter with a half-life of 138 days. The Kittens experiments at Naya dispersed 7004 Ci of polonium-210, 750 g of beryllium and 120 kg of natural and depleted uranium [RC 589]. The location of the minor trials at Maralinga are shown on Figure 8.0.2.

Tims

10.1.3 The Tims experiments were concerned with the measurement of the compression of a simulated core of an atomic weapon and the design of the high explosive component to achieve the maximum compression. Probes sensitive to ionisation or small mechanical movements were used as detectors to determine the movement of material and the passage of shock waves through it. High speed photography and radiography were also used to obtain additional information on some of the experiments [RC 350].

10.1.4 Three hundred and twenty-one Tims experiments were carried out between 1955 and 1961 and in 1963, mostly in the Naya and Kuli areas. These experiments used and dispersed beryllium (77 kg), natural uranium (825 kg) and uranium-238 (6800 kg). In 1960, twelve Tims experiments used about 1.2 kg of plutonium and these were carried out at TM100 and TM101 [RC 589].

Rats

10.1.5 These experiments had a similar objective to the Tims experiments but used a different technique to determine the compression. An intense gamma-ray source was located in the

centre of a simulated core of an atomic weapon. The compression in various directions was determined from the decrease in the number of gamma rays recorded by detectors placed around the assembly [RC 350].

10.1.6 One hundred and twenty-five Rats experiments were carried out between 1956 and 1960 in the Naya and Dobo areas. The materials used in Rats included scandium-46 (2160 Ci), uranium-238 (180 kg), polonium-210 (400 Ci) and lead-212 (120 Ci). Scandium-46 is a beta and gamma emitter with a half-life of 83.8 days; polonium-210 is an alpha emitter with a half-life of 138 days; and lead-212 is a beta emitter with a half-life of 10.6 hours.

Vixen A

10.1.7 The Vixen A experiments were a study of the spread of radioactive and toxic materials that might result from an accident. Dispersion was measured by sampling airborne and deposited particles and detailed meteorological data were collected. Balloons were used to support some meteorological instruments and samples.

10.1.8 Three kinds of experiments were carried out: combustion in a controlled petrol fire; combustion in air in an electric furnace; and dispersion by high explosive. The petrol fire was in a chimney 11 feet high and four feet square and produced combustion temperatures in the range of 800 to 1200 degrees C for uranium and beryllium and 600 to 1000 degrees C for plutonium. The electric furnace was only used for uranium and operated at 600 to 800 degrees C. The explosive devices consisted of the high explosive implosion assemblies from the nuclear weapons [RC 343].

10.1.9 Thirty-one Vixen A experiments were carried out in the Wewak area between 1959 and 1961. The materials used during these trials included 6.0 kg of beryllium of which 4.2 kg was dispersed, 68 kg of natural and depleted uranium, 0.98 kg of plutonium of which 0.58 kg was dispersed, 99 Ci of polonium-210 and 1.96 Ci of actinium-227.

Vixen B

10.1.10 The Vixen B trials were 'safety experiments' to look at the effects of an accidental detonation of some of the high explosive in the weapon, such as might happen in a fire or a crash. The high explosive would explode in an unsynchronised manner and not properly compress the fissile core. The Vixen B experiments were said to be designed, *inter alia*, to measure how close such an accident would come to producing a significant nuclear explosion [RC 389].

10.1.11 The Vixen B experiments involved the release of fission energy, although the yield from fission was less than the yield from the high explosive in the weapon. As Symonds [1985, p.484] notes, 'While safety assessment was an important part of these measurements, the data and information collected were also likely to provide valuable design data in many other respects'.

10.1.12 Twelve Vixen B experiments were conducted in 1960, 1961 and 1963, plus a calibration round at the beginning of each annual series. All of the Vixen B rounds were carried out at Taranaki where they produced the worst of the contaminated areas at Maralinga. The materials used and dispersed in the Vixen B series included plutonium-239 (22.2 kg), uranium-235 (22.4 kg), uranium-238 (24.9 kg) and beryllium (17.6 kg) [RC 476].

10.1.13 The Vixen B trials were conducted on massive steel structures called feather beds. The damage to the feather bed and the concrete pad was greater than expected and a new feather bed was used for each round [Trans., p.6599]. Debris was buried in pits close to the firing pad. This included the feather bed, contaminated lead bricks, paraffin wax, cables, concrete, and rocks and soil blown up by the explosion [Trans., p.6594].

10.1.14 At the time of Operation Brumby (see Section 13.2), there were 21 pits in the Taranaki area containing about 830 tons of material contaminated by about 20 kg of plutonium [RC 530, 0-16/68]. The remaining plutonium, now estimated to be about 2 kg, was dispersed on the Range.

Materials Left on the Range

10.1.15 The minor trials nearly all involved the study of materials during explosions. The material under study would be monitored during compression such as might occur during the initiation of a nuclear explosion. The high explosive then continued to disperse the material over a wide area around the trial site. Some of the dispersed material was collected and buried in pits, but there was no consistent effort to do a complete clean-up.

10.1.16 The main materials dispersed at the minor trials sites were plutonium, uranium and beryllium; these are discussed in more detail in the following paragraphs. In addition, a number of short-lived radionuclides were dispersed - 7900 Ci of polonium-210, 120 Ci of lead-212 and 2160 Ci of scandium-46. These have decayed to insignificant amounts over the past 23 years. A small amount of actinium-227 (0.015 Ci) was dispersed at Wewak. Actinium-227 has a half-life of 21.8 years.

Plutonium

10.1.17 Plutonium is still present at the Taranaki, TM101, TM102 and Wewak sites. The amounts of material and its disposition are discussed in detail in Section 13.5. The total amounts of plutonium used are given in the Table 10.1.1.

TABLE 10.1.1
Plutonium Used at Different Minor Trial Sites

Location	Trial	Date	Plutonium Used (kg)
Taranaki	Vixen B	1960-63	22.2
Naya 1 (TM100)	Tims	1960	0.6
Naya (TM101)	Tims	1961	0.6
Wewak (VK 33)	Vixen A	1959	0.405 (only 0.008 dispersed)
Wewak (VK 60A)	Vixen A	1961	0.294
Wewak (VK 60C)	Vixen A	1961	0.277

Sources: RC 589, RC 476

10.1.18 Apart from the 1959 Vixen A series, where the distribution of most of the plutonium was recorded, it is not known how much of the plutonium from the other series was dispersed and how much was deposited in the pits but attached to contaminated debris and soil. The ARL survey of surface plutonium contamination at Taranaki was able to account for only between 1.5 and 2 kg of plutonium (see Section 13.5). The remaining 20 kg is presumed to be in the burial pits.

Beryllium

10.1.19 It was well known at the time of the minor trials that beryllium was a toxic material. Occupational hygiene procedures for handling the material were well established to protect against the main hazards of inhalation and entry to the body through broken skin. The occupational standard for air concentration of two micrograms per cubic metre, which was proposed in the USA in 1948, still forms the basis of occupational standards in use today in many countries including the UK, USA and Australia.

10.1.20 During the minor trials in which beryllium was used, precautions were taken by the British teams to guard against the known occupational hazards. No Australians were present. Protective clothing was worn and air sampling was carried out. The Royal Commission has not received evidence of any problems related to occupational exposure to beryllium at the time of the minor trials in which it was used. It was also used in some laboratories, notably in building XA3.2 [RC 385].

10.1.21 About 101 kg of beryllium was used in the minor trials and 99 kg of this was dispersed on the Range. Only 1.8 kg is known to have been recovered. However, some of the remainder would have been deposited in pits with the contaminated equipment and soils.

10.1.22 Table 10.1.2 shows the amounts of beryllium used and dispersed at the various trial sites. The data are taken from the minor trials schedules [RC 589; RC 476].

TABLE 10.1.2
Beryllium Used and Dispersed at the Various
Minor Trial Sites

Location	Trial	Date	Beryllium (kg)
Emu	Kittens	1953	0.036
Naya	Kittens	1955-57	0.75
Naya	Tims	1957	1.6
Kuli - TM11	Tims	1959-60	26.2
- TM16	Tims	1960-61	39.0
- TM50	Tims	1961	10.0
Wewak - VK29	Vixen A	1959	1.00 (0.14 dispersed)
- VK28	Vixen A	1959	0.49 (0.25 dispersed)
- VK27	Vixen A	1959	0.58 (0.23 dispersed)
- VK30	Vixen A	1959	0.50 (0.10 dispersed)
- VK60A	Vixen A	1961	1.72
- VK60B	Vixen A	1961	1.72
Taranaki	Vixen B	1961-63	17.6
Total:			101.2 kg (99.35 kg dispersed)

Sources: RC 589, RC 476

10.1.23 There was an effort to collect the beryllium fragments at the Vixen A trials because the experiments were designed to measure the dispersion. Some fragments were also removed from the TM11 and TM16 site in 1959 and 1960 [RC 408]. As part of Operation Hercules, the areas around TM11, TM16 and TM50 were graded and the collected material was buried. This grading operation had the effect of collecting small fragments of beryllium [RC 385].

Uranium

10.1.24 Over 8 tonnes of depleted uranium was used on the Range in the course of the minor trials. Most of it was used during Tims trials at Kuli with about 6.6 tonnes at the TM4 site, and 0.73 tonnes at TM16. TM4 was renamed TM16 in 1960 when a new firing plate was installed. The approximate amounts used for these trials are shown in Table 10.1.3.

TABLE 10.1.3
Uranium Used at the Various
Minor Trials Sites

Location	Trial	Date	Uranium-235 (kg)	Natural Uranium-238 (kg)
Naya 3	Tims	1955		138.
Kuli - TM4	Tims	1956-60		6605.
- TM11	Tims	1959-60		67.4
- TM16	Tims	1960-63		731.
- TM50	Tims	1961		90.
Kittens Area	Kittens	1955-57		120.
Naya 1	Rats	1956-58		151.
Naya	Kittens	1957		5.
Naya 2	Kittens	1960-62		32.0
Naya 3	Kittens	1956-59		23.4
Wewak	Vixen A			67.8
Dobo	Rats			28.
Taranaki	Vixen B		22.4	24.9
Total:			22.4	8083.

Sources: RC 589, RC 476

10.2 The Politics of the Minor Trials

10.2.1 The first and most obvious question which poses itself about the minor trials is why they were not conducted in the United Kingdom. In the case of the major nuclear tests, it was obviously unthinkable that they should be conducted anywhere near highly populated centres. However, experiments of a similar type to some of the minor trials, involving the use of high explosives and the dispersal of beryllium, were in fact carried out in 1962 and 1963 at the AWRE range at Foulness on the Thames estuary, apparently without dire consequences [RC 346, RC 350].

10.2.2 The answer to the question is to be found in the politics of radioactive contamination. A memorandum from the Assistant Deputy Director of AWRE, Admiral P W B Brooking, to his Director, dated 23 September 1958, which touches on the question of where the rest of the planned minor trials were to be held, contains the revealing phrase 'I know you feel that radio-active contamination in UK is politically impossible' [RC 386].

10.2.3 The earlier minor trials were carried out to gain information about various components of an atomic weapon [RC 350]. About October 1958, they became known as Assessment Tests and about December 1959, the various experiments became known collectively as the Maralinga Experimental Programme. The later trials, notably Vixen A and Vixen B, were allegedly designed merely to test the safety of nuclear weapons during storage and in extreme conditions such as fire.

10.2.4 What's in a name? Sometimes a great deal. There is an almost comical touch of camouflage in the changes of name of the minor trials, especially against the background of discussions of a possible international agreement to ban nuclear tests which were on the agenda from 1957 onwards. Though it is nowhere definitively spelt out in the evidence, a clear impression emerges that a euphemism had to be found to counter any suspicion that minor trials were merely a smaller version of major trials [Trans., p.6271]. For the sake of simplicity, it is proposed to adhere to the original designation of minor trials.

10.2.5 The minor trials involved conventional high explosives and also various amounts of radioactive, fissile and toxic materials. When the test ban came under discussion, there was much perturbation in British nuclear circles that these trials might be included in the ban. The scientific establishment rallied to the defence of their continuation.

10.2.6 On 29 August 1958, Mr A R Bryant, Senior Superintendent Weapons Assembly at Aldermaston sent a memorandum to Brooking. He stated that 'In my opinion these trials are not even remotely in danger of infringing the spirit of a possible international agreement to ban nuclear tests' [RC 386, pp.1-3].

10.2.7 There follows a convoluted argument in which Bryant makes it clear that an international ban on nuclear tests would be regarded, at least by him, as having considerable nuisance value for Britain's nuclear weapons program which, he seems to assume, would still proceed despite any such ban:

'There is a continuing need for explosive trials involving uranium, and other radioactive materials, which will if anything be increased if there is a ban on nuclear (fissile) tests.'

10.2.8 There follows a sophistic discussion about finding a form of words which would exclude the minor trials from any contemplated ban. One definition suggested by Bryant is that

'A minor trial is defined as a trial in which small amounts of radioactive or fissile material are involved in association with the detonation of conventional high explosive in such a manner that no fission results.'

10.2.9 He then turns to the question that such a definition does not meet the possibility of fusion but suggests that this contingency

'...is covered by considering such testing as an experiment, of the sort normally carried out at AWRE without detailed political approval, rather than as a trial involving external approval.'

Evidently, an experiment cannot be an explosion.

10.2.10 He also suggests that

'Special consideration might have to be given to final safety proving trials, such as one point detonation trials, where there is no intention of producing fission, but where the amount of fissile material used is enough to give a significant chance of some fission resulting.'

10.2.11 Brooking was quite at home in this world of face-saving definitions. In a memorandum to his Director, dated 29 September 1958, after referring approvingly to another scientist's suggested definition of a minor trial he stated

'From the purist's point of view it might be taken to rule out "single point detonation" trials and maybe certain nuclear trials which could give rise to small amounts of fission. We can however argue that such fission is not the intention of the trial and that if we did produce any it would be an accident, which we are, of course, unable to guard against.' [RC 386, Brooking]

10.2.12 The disingenuous tone of this debate to be found in documents hitherto circulating only among Britain's nuclear elite hardly encourages a belief that the Royal Commission has been told the full story of the minor trials, even allowing for its self-denying ordinance in regard to matters touching weapons design.

10.2.13 Embedded in the evidence received by the Royal Commission are revealing little asides such as the following comment from Bryant:

'While the word minor trials is at present associated with Maralinga, to distinguish them from major or fissile trials, there is increasing evidence that most of such trials could in fact be carried out in this country [i.e. the UK] safely and with much consequent gain in efficiency and time.' [RC 386, Bryant, p.2]

10.2.14 He goes on to say

'The present policy of carrying out all such firings in Australia is believed to hang on the precise wording of a statement given by Lord Salisbury to Parliament, which in fact bans firings at Foulness using hazardous materials, even in amounts so small that the experiment as a whole involves no hazard.' [RC 386, loc.cit.]

10.2.15 The **pronunciamento** referred to above, and which was treated throughout this period as constituting an unbreachable veto on the use in Britain of radioactive materials in explosive nuclear experiments, was the following answer given in the House of Lords on 7 April 1954, by the Lord President of the Council, the Marquess of Salisbury:

'The Foulness Range has been used over some years by the Atomic Weapons Research Establishment, for experimental work with ordinary conventional high explosives. The work is an essential step in the development of atomic weapons. The explosions are also used to study the effects on model structures and so provide valuable data for those forms for Civil Defence. I can say definitely that no nuclear explosions have been or will be made, nor will experiments be made with fission products or any other hazardous radioactive material.' [RC 391]

10.2.16 The politics of radioactive contamination may be best summed up in the following exchange between Counsel assisting the Royal Commission and Pearce, who played a prominent scientific role in both major and minor trials:

'Q. ...the planning foundation for your work was that radioactive contamination of Australia may be politically acceptable but not for the UK.

'A. Yes.' [Trans., p.6402]

10.2.17 When Counsel assisting the Royal Commission suggested to Stewart that appropriate places for the minor trials might have been found in remote parts of Scotland, the witness replied: 'I doubt if the people owning the estates in Scotland would look on that with very great favour. They are interested in pheasants and deer in Scotland.' [Trans., p.6266]

10.2.18 The point, underlined by the cosmetic change of name, is that the minor trials were not minor at all in terms of their consequences. Most of the radioactive and other contamination remaining on the Range is due to the Vixen trials:

'While the Australian Senior Health Physicist, Mr J F Richardson, was at Maralinga in October 1959, a matter of some significance was discussed with him by the Range Commander. The Range Commander was concerned about his responsibility for radiological safety for the whole of the Range, particularly in relation to the assessment trials. He sought clarification of his position in this respect. As Mr Richardson pointed out in some observations recorded in a file note at the end of January 1960, there was little doubt that the long term hazard presented by the material left on the ground from the assessment tests was becoming considerably more important than the hazard due to residual fallout in the forward area.' [Symonds, p.503]

10.2.19 It should be borne in mind that, apart from the five minor trials carried out at Emu in 1953, nearly 600 minor trials were conducted at Maralinga [Trans., p.6463].

10.2.20 Throughout the decade of the minor trials (1953-1963), the information about them conveyed from the British to the Australian Governments was notable for its economy. They were to be, and in fact were, a strictly British show. The tone was set by Churchill's adviser Lord Cherwell who, in the Aide Memoire handed by him to Menzies in London in December 1952 seeking the Australian Government's approval and co-operation for the carrying out of the Totem tests at Emu in October 1953, made no mention of an intention to carry out the first of the Kittens trials there as well [Symonds 1985, p.126]. However, Australian agreement was sought before all the subsequent minor trials [RC 381].

10.2.21 Australian knowledge of what was going on at the minor trials was kept to an absolute minimum. At no trial was any Australian present at the firing site [Trans., p.6321]. When a

series was about to be conducted the Range Commander, an Australian, was informed but told nothing of the detailed nature of the tests [Trans., p.6322].

10.2.22 The biggest question mark about the exact purpose of the trials and the degree of British frankness about them hangs over the Vixen series which were conducted at Maralinga between 1959 and 1963. Information about the impending tests was given to the Australian authorities in so-called Safety Statements. These statements for tests in the years 1959 to 1963 were tendered in evidence [RC 371]. They are all couched in the most general terms and although plutonium was used in all of them (see Table 10.1.1), it is not specifically mentioned in any Safety Statement until that of 1962, by which time the concealment of its presence on the range would have become impossible.

10.2.23 When referred to these documents, Pearce admitted that at least the 1959 and 1960 statements provided a totally inappropriate basis on which the Australian authorities could form a judgment about the safety of the proposed tests.

10.2.24 It seems to have been recognised in the UK that the introduction of plutonium for the first time into the minor trials might give rise to some political problems in Australia. On 15 June 1959, Penney wrote to Titterton, giving an explanation of the problems of the formation and dispersion of particulate matter formed by an explosion or during a fire. The answer to these problems could be obtained only by conducting field tests involving the use of plutonium.

10.2.25 Penney pointed out that no plutonium had as yet been used in assessment tests at Maralinga and, since its use could easily be misinterpreted politically, he sought Titterton's advice about how best to seek approval from the Australian Government for such tests [RC 800, p.590467].

10.2.26 Penney's letter was considered at the 52nd Meeting of the AWTSC on 9 July 1959, where support was expressed for Penney's proposal [RC 800, p.590550].

10.2.27 On 10 July 1959, Titterton wrote to the Minister for Supply informing him of his receipt of Penney's letter, mentioning that plutonium would be used in the proposed tests and that this might have some political overtones in view of the discussions in Geneva on nuclear tests, and conveying to the Minister the AWTSC's recommendation that the Government should agree to the holding of the tests subject to the following conditions:

- '(1) Agreement to the results being made available to Australia.
- '(2) Appropriate location of the test site within the restricted area so that no material could escape beyond its boundaries.

'(3) The Safety Committee being informed of the details of planning and location of the experiments when these have been finalised.

'(4) Adequate meteorological support be available to enable appropriate trial conditions to be settled.' [RC 800, pp.590553-4]

10.2.28 On 29 July 1959, the Minister for Supply passed Titterton's letter on to the Minister for Defence and recommended that the Government agree to the proposal [RC 800, p.590580].

10.2.29 On 30 July 1959, a formal request for approval of the tests was made by the UK Minister for Supply to the Australian Minister for Supply. It included the following:

'Although these experiments are in no sense nuclear tests, it will be desirable to avoid publicity for them in order to remove the risk of their being misrepresented by ignorant or ill-intentioned persons.'
[RC 559]

10.2.30 The reply of 31 July 1959 from the Minister for Defence, Mr Athol Townley, merits reproduction in full:

'Thank you for correspondence received today concerning proposed plutonium trials at Maralinga.

'I am quite happy as to the technical and scientific aspects as outlined by Professor Titterton, and, having complete confidence in him and his Committee, I am not troubled very much by the trials in themselves. This assumes that the recommendations of the Safety Committee are accepted by the United Kingdom.

'The political aspects, however, can be potentially dangerous. The Geneva meeting which you mention has a bearing on it. There is also the fact that for the first time it is proposed to use explosives on the Woomera Range which will bring the usual howl from the "Ban the H Bomb" section of the community - Communist and otherwise.

'It is my view, therefore, that there should be some political discussion on it. This might be done by yourself and the Prime Minister, or perhaps the Prime Minister and one or two others. I would hesitate to put it into full Cabinet, purely on the "need to know" basis.' [RC 800, p.590587]

10.2.31 The decision to allow a fissile material with a half-life of 24 000 years to be spread on Australian soil, no matter how remote, was evidently in the hands of politicians, one of whom did not know that the Woomera Range and the Maralinga

Range were not the same thing, and with the exclusion from such a decision of all but two or three members of the Cabinet. This is an instructive little lesson in the style of democratic government in Australia during the Menzies era. Symonds [1985, pp.501-2] writes

'When told of the UK proposal, the Australian Prime Minister consulted with senior Departmental officials whose advice contained the warning that Australia had very little information concerning these particular tests. It was not clear to them that the AWTSC was any better informed though it was possible that the Chairman had been given some information by AWRE officials. The view was expressed that, with a suspension of testing in place and with delicately balanced discussions proceeding in Geneva towards a complete cessation of nuclear weapon testing, Australia should not agree to the tests being performed without an informative statement from the UK authorities on the nature of the tests. The tests seemed to Australian officials to involve matters of deep political significance and not just safety and public health. In the circumstances, the advice appears to have been given with a feeling that Australia was being kept too much at a distance from the real nature of the proposed tests. The technical and scientific aspects were all that were being reviewed, and then by only a small group who were not charged with keeping a watchful eye on longer term matters of political importance to Australia.

'After some further consideration of information made available, approval was given to the UK authorities to proceed with the Vixen A trials.'

10.2.32 The trials, code-named Vixen A, were conducted at Maralinga soon after and are described in detail by Stewart [RC 343]. The materials used in the trials were uranium, plutonium and beryllium.

10.2.33 Nowhere is the special relationship between Titterton and the British authorities more clearly indicated than in the negotiations which preceded Australian approval for the Vixen B series.

10.2.34 On 25 January 1960, the following letter from D E H Peirson of the UKAEA was sent to D L Cole, Commonwealth Relations Office, London:

'You sent me a copy of your letter to Sabatini of 12th January about nuclear weapons safety experiments.

'The paper which Ministers approved included the following Recommendations:

"4. The Atomic Energy Authority, in conjunction with the Ministry of Aviation, should ask the Chairman of the Australian Safety Committee (Professor Titterton) informally for his advice on the best way to present the matter to the Australian Government.

"5. The Ministry of Aviation and the Atomic Energy Authority should proceed with the planning of a series of experiments and should prepare, in conjunction with the Commonwealth Relations Office and Ministry of Defence, a message to be forwarded through normal channels to the Australian Government at the appropriate time, in the light of Professor Titterton's advice."

'In accordance with recommendation 4, the Deputy Director and one of the senior staff of AWRE have left for Australia for discussions with Professor Titterton and later with Mr. Scott Hall, the Head of the UK Scientific Mission in Australia. In accordance with recommendation 5, we would expect that a formal message to the Australian Government would be prepared after the two AWRE representatives have returned.' [RC 405]

10.2.35 What had happened to necessitate a mission to Australia led by top brass of the AWRE for the special purpose of obtaining Titterton's advice on how best to lean on the Australian Government? The British authorities had decided at about this time to conduct the Vixen B tests in 1960, in addition to the tests for which it already had Australian approval, and some opposition from the Australian authorities was anticipated.

10.2.36 The Minutes of the 58th Meeting of the AWTSC contain the following item:

'The Committee discussed the possible programme for the forthcoming test series and the impending visit of Mr Pilgrim and Mr Newly, AWRE. It had been agreed that the Chairman (Titterton) would confer with them during their visit, and both the present programme and future plans would be discussed.' [RC 131]

10.2.37 The distinction between the Vixen A and Vixen B tests was described by Coppard, a health physicist with AWRE who spent several stints at Maralinga including the 1963 Vixen B tests, as follows:

'The Vixen A tests that I know about involved the safety burning of plutonium to determine what would happen to it in a fire. They were safety trials. The Vixen B trials were in the main single point detonation of something which looks like the heart of a nuclear weapon and involved a dispersion by explosive means, and this would be a much bigger dispersion and possibly more energy into the source.' [Trans., p.6352]

10.2.38 The following exchange occurred between Counsel assisting the Royal Commission and Coppard:

'Q. Was a fission event contemplated as possible according to your knowledge?

'A. Not to my knowledge, no.

'Q. Do you know all there is to know about Vixen B?

'A. No, sir!' [Trans., p.6352]

Schofield admitted that a Vixen B test could fairly be described as a 'very small atomic explosion' [Trans., p.6304].

10.2.39 Jones agreed that a Vixen B experiment was 'basically a nuclear reaction, certainly' [Trans., p.6536]. Questioned further as to the distinction which was drawn by the British at the time between a nuclear reaction and a nuclear explosion he stated that so long as the devices 'did not give a nuclear reaction in excess of ten tons of fission TNT equivalent', no violation occurred of what was contemplated by the Test Ban Treaty then under discussion [Trans., p.6537]. This limit was, however, never agreed upon at the Test Ban discussions.

10.2.40 The sensitivity of the proposed Vixen B tests in the light of the international discussions in preparation for such a treaty is at once apparent. This is highlighted by the following exchange between Counsel assisting the Royal Commission and Jones:

'Q. In scientific terms there was no difference of real significance if you stayed under the ten tonnes, but the chances are you would not get caught, is that right?

'A. I suppose that is a way of putting it politically.' [Trans., p.6540]

10.2.41 The discussions between the AWRE mission and Titterton duly took place. Titterton, in his usual compliant way with the British authorities, saw no objection in principle to the proposed Vixen B series, which he regarded as a logical extension of the 1959 program. The AWRE team went away with the understanding that the approval given to the original 1960 program was sufficient to cover the new proposals as long as a satisfactory statement was provided to the Safety Committee [Symonds 1985, p.506].

10.2.42 Unfortunately, there is a gap in the AWTSC Minutes at this point. The critical Minutes of the 59th to 64th Meetings, i.e. of meetings occurring after 29 January but before 24 August 1960 were, for some reason, not written up. Mr Moroney, the Secretary of the Safety Committee, produced his

notes but they do not supply any useful information on any discussions which may have taken place about the proposed Vixen B series. There is, therefore, no record of what, if anything, Titterton told to the other members of the Safety Committee about his discussions with the AWRE officials.

10.2.43 Apparently the British authorities did not see fit to discuss Vixen B with any 'Australian' other than Titterton until discussions between the Deputy Director of the AWRE and the UK High Commissioner in Canberra resulted in the Australian Prime Minister's Department being informed orally of the intention to extend the 1960 trials by the addition of Vixen B [Symonds 1985, p.506].

10.2.44 A letter from the UKAEA dated 22 February 1960 reveals the official British state of mind on how much the Australian authorities needed to know about the minor trials:

'We do not specify, nor does the Australian government inquire into the details of our experiments when seeking formal approval. Such approval is always subject to Titterton's Safety Committee accepting a detailed Safety Statement. Titterton's view is that we will have met our obligation if details of the effects of our proposed experiments are given in the 1960 Safety Statement. This can be done without disclosing such details that could lead to confusion with full scale nuclear tests. I agree, therefore, with Titterton that we should avoid formal communications on these contentious experiments and propose that we proceed without going through the normal channels...'
[RC 800, pp.600119-20]

10.2.45 In a letter of 30 March 1960 from the UK Defence Research and Supply Staff (in Australia), the Secretary of the Australian Ministry of Supply received a bald notification of the extension of the Maralinga test program for 1960 by the inclusion of the Vixen B tests. The necessary safety details were said to be in a Safety Statement 'now in the hands of Professor Titterton' [RC 800, p.600175].

10.2.46 On 6 April 1960, the AWTSC informed the Australian Department of Supply that on the basis of the new Safety Statement and other information made available to the Safety Committee during the recent visit to Australia of the Deputy Director, AWRE, that the AWTSC had accepted the safety provisions for the 1960 test program as amended, and recommended that the Prime Minister's Department be informed. As we have observed, this was not a strictly accurate statement as the AWRE briefing had been of Titterton only and the Safety Committee would have had to rely on him for information from AWRE.

10.2.47 Dissatisfaction with the paucity of information on the Vixen B tests was expressed at the meeting on 6 May 1960 of the Maralinga Board of Management. On 16 May 1960, the Secretary of

the Department of Supply informed the Prime Minister's Department that the Board felt that the information it had received about Vixen B was too meagre to enable it to make a recommendation that the trials should proceed and had requested that it be furnished with 'broad general particulars of the tests' [RC 800, p.600262].

10.2.48 The flurry of correspondence which ensued between departments and governments showed that Titterton's agreement with the British authorities to keep the Vixen B details as vague and uninformative as possible was coming unstuck. The advice of Titterton began to be subjected to scrutiny and a memorandum to the Prime Minister from his departmental officer, Timbs, of 29 July 1960 informed him that the 'Defence Department have realised belatedly that they find difficulty in relying only on the technical content of advice from the Safety Committee and are interested to secure for political reasons an official voice on safety aspects' [RC 800, p.600394]. It was suggested by Timbs that Sir Leslie Martin, Titterton's predecessor as Chairman of the AWTSC, should be given access to all material on the Vixen B series before agreement was reached on these trials [RC 800, pp.600394-5].

10.2.49 When this came to Titterton's ears he was obviously annoyed. On 9 August 1960, he wrote to AWRE saying that the situation was a 'silly one' and expressing his astonishment that the Vixen B series had not yet been approved by the Australian Government. 'Moreover,' stated Titterton, 'I gather, a suggestion has been made that the Safety Committee has been given too little information for it to properly assess the safety position. I don't know where that one came from but I will knock it firmly on the head tomorrow' [RC 800, p.600415].

10.2.50 A clue to the missing Minutes of the AWTSC may be discerned in the following sentence of Titterton's in the same letter:

'If it should be agreed between our Government and yours that information on the present and future trials be made available to Martin and White [an Australian Department of Defence official] then we shall have to ask you for much more written material than has been the practice at any time in the past. The one thing Martin made clear to me was that he would insist on paper work and would not be satisfied by discussion.' [RC 800, p.600415]

10.2.51 In other words, the cosy little agreement under which AWRE officials confided only in Titterton, whom they were obviously entitled to regard as 'their man', and the fact that he kept paper work to a minimum, may have suggested to him that it would be wiser not to keep minutes on matters so sensitive as Vixen B.

10.2.52 But, seeing that his bluff had been called, Titterton asked the AWRE to send certain additional information, adding the warning: 'It would perhaps be wise to make it quite clear that the fission yield in all cases is zero' [RC 800, p.600416].

10.2.53 The clear tone of the letter, that of a man who regarded himself as a member of the British 'team' rather than the custodian of the safety of Australian citizens, together with other evidence received by the Royal Commission, gives cause for scepticism about the truth of Titterton's last statement.

10.2.54 Titterton's statement seems to be contradicted by the evidence of Schofield and Jones which has been cited earlier. The Safety Statement for 1960, in reference to the Vixen B firings, states 'In some rounds the possibility of a fissile reaction is envisaged...' [RC 371].

10.2.55 It was suggested to Pearce by Counsel assisting the Royal Commission that the Vixen B trials were not safety trials **simpliciter** but in fact weapons development trials. This suspicion was based on the existence of inverted commas in the phrase 'safety shots' used in a highly confidential document to describe some of the Vixen B trials [RC 390]. This suggestion was rejected by Pearce but he made no claim to know everything that there was to know about the Vixen B trials.

10.2.56 Agreement to the Vixen B trials was finally conveyed by the Prime Minister's Department to the Office of the High Commissioner for the UK on 1 September 1960.

10.2.57 On the night of 23/24 September 1960, seven out of eight captive balloons which were to be used in connection with the trials broke free from their moorings at Maralinga. One got as far as Cobar and was recovered and returned to the Range. Five were located a few miles from the trials area and the seventh was found near Hungerford in northern NSW. This caused some consternation in official circles and a Committee of Inquiry was set up. The Committee duly reported in October. Details of balloon incidents at Maralinga are provided in Section 11.2.

10.2.58 It found, **inter alia**, that no safety plans for the balloons had existed and the necessary criteria had not been laid down to ensure the development of such balloon safety and mooring systems and handling procedures as would have avoided any escape of balloons from the range area; that the self-destruction device attached to the balloons was not reliable; and that there were no warning markings on the balloons to indicate that they were filled with hydrogen and that an explosion hazard might exist. However, there appear to have been no identifiable adverse consequences of the balloon escape.

10.2.59 Approval for the 1961 series was sought by letter dated 29 September 1960 to the Prime Minister's Department [RC 800, p.600580]. The pattern of deception which has been observed in

relation to Vixen B tests was maintained in this letter since it referred to a previous letter of 3 June 1960 in which Vixen B tests were described as being similar to the Vixen A tests only more elaborate [RC 800, p.600278]. A Safety Statement was delivered to the AWTSC in which, although it was admitted that 'long lived fissile elements and a toxic material' would be used, they were not specifically named. Responding to the pressure for more openness, Titterton wrote to AWRE on 24 October 1960 asking that the materials be named, but in any event agreeing to them in general terms [RC 800, p.600679].

10.2.60 Further correspondence and personal discussions ensued and finally a letter from Pilgrim of the AWRE, dated 1 December 1960, was sent to Titterton, containing the information that in Vixen B tests 'Quantities of materials are such as to ensure a low limit to any fissile reaction...' [RC 800, p.600828].

10.2.61 On 21 December 1960, Titterton sent a telex to the AWTSC Secretary, Moroney, in the following terms: 'Statement from Pilgrim is excellent and clears all our questions. They have answered everything we asked. Advise Stevens and Dwyer' [RC 800, p.600899]. It is not apparent whether the Safety Committee met to give approval to the tests but on 17 January 1961 Titterton wrote to the Minister for Supply stating that the AWTSC was completely satisfied with the proposals as they now stood and recommended that the Australian Government agree to the tests [RC 800, p.610079]. Approval was granted on 13 March 1961 [RC 800, p.610233].

10.2.62 There was a further incident on 22 March 1961 when four balloons escaped from their moorings. Again a Committee of Inquiry was constituted [RC 800, p.610306].

10.2.63 The Safety Statement for the proposed 1962 minor trials, including Vixen B, was received in September 1961. For the first time in relation to the Vixen B tests, it identified the materials to be used as beryllium, natural uranium and plutonium. However, the 1962 program was postponed to 1963. Approval of this program was communicated by a letter of 13 November 1962 [RC 800, p.620570].

10.2.64 The 1963 trials brought to an end a drama characterised by persistent deception and paranoid secrecy. In their desire to avoid international repercussions, the British authorities embarked on a course of determined concealment of information from the Australian Government aided and abetted by the 'Australian custodian', Titterton.

10.2.65 The last word on the minor trials belongs to Dr Lokan. Asked about the wisdom of the tests which dispersed plutonium in the way it was done at Maralinga, he replied

'It is very easy to be wise after the event. My view is that they should not have been conducted because plutonium has a very long half-life and the problem is with us then for a very long time.' [Trans., p.1925]

Conclusion

10.2.66 In view of the known long half-life of plutonium (24 000 years), the Vixen series should never have been conducted at Maralinga.

CHAPTER 11
SUNDRY TOPICS

11.1 Decontamination of Aircraft

Operation Hurricane

11.1.1 Despite an acknowledgement by Air Vice Marshal Davis that the RAAF Lincolns which flew the cloud sampling sorties could be contaminated there was no procedure to check, and if necessary, decontaminate the aircraft. The five Lincolns involved in this exercise were A73-41, A73-51, A73-53, A73-54 and A73-61.

11.1.2 Davis requested Gale on 15 September 1952 to provide equipment to monitor the exterior of the aircraft which had made 'positive collections' and requested that special attention be paid to recesses where '...lodgement might occur'. He suggested that 'Information so obtained will assist Air Ministry in formulating aircraft cleansing procedure after flight through similar clouds' [RC 800, p.520622].

11.1.3 However, Davis' request was denied by Gale who replied, on the 22 September 1952,

'Broome has no suitable equipment for monitoring aircraft and when planes land all available effort will be otherwise occupied. Advise importance this new project noting effort will have to be found. Only suitable equipment is at Townsville as standby for filter monitoring probably could not reach Broome in time.' [RC 800, p.520648]

In the event, no additional monitoring equipment was provided and no decontamination of the aircraft undertaken [Trans., p.5271].

Operation Totem

11.1.4 Procedures for decontaminating the RAF Canberra which flew through the Totem 1 cloud in Operation Hot-Box had been established, as is noted in the account of the operation by Group Captain Wilson, RAF Medical Services [RC 295]. Prompt action was taken on arrival of the Canberra at Woomera [RC 240, pp.5-6]. This included a wash-down with solution, and scrubbing and rinsing with a high pressure hose, after which the aircraft was left in isolation for 48 hours. The entire surface of the aircraft was then rubbed down to reduce surface contamination.

The three ground crew had been dressed in full protective clothing while washing down the aircraft, using long-handled brushes. Final decontamination of the RAF Canberras used for cloud sampling was carried out in the UK.

11.1.5 Neither the contamination nor the necessity for decontamination of the RAAF aircraft involved in cloud sampling sorties during the Totem test series was foreseen. Indeed '...assurance had been given by the Scientific Director, Emu Field that no such problem was likely to exist as far as Totem Beta aircraft were concerned' [RC 36, Operation "Totem" - Consolidated Report., p.3]. The Totem Beta aircraft were the Lincolns involved in cloud sampling (see para.6.5.46).

11.1.6 There were no advance arrangements for decontamination of the cloud sampling Lincolns which flew from Woomera or Richmond. On returning from the sortie at Totem 1 the captain of one of the Lincolns contacted the control tower at Woomera and requested the presence of Gale when the aircraft landed and that ground crews be kept away from the aircraft until it was inspected.

11.1.7 Gale was asked for advice and Group Captain Wilson who had flown Operation Hot Box was also present. It was recommended that all five Lincolns be isolated for 12 hours. Stevenson arrived at Woomera on 17 October (D1+2) and, on checking the Lincolns, discovered that the leading edges of the wings and tailplanes as well as the engines of the aircraft were contaminated.

11.1.8 Because of this, Captain Butler of the RH Group was called to Woomera on 19 October (D1+4). He checked ground personnel and the aircraft were then washed down. A detergent was scrubbed onto the fuselage and then washed off with a high pressure water hose. After four days, one aircraft was declared clean, two retained isolated spots of contamination on the engines and the tailplanes and the remaining two were decontaminated to a level that was considered safe, provided that normal precautions were taken [RC 36, p.14].

11.1.9 The aircraft which flew from Richmond were isolated for 72 hours on the advice of the USAF crews who fortunately were stationed there [RC 36, p.6].

11.1.10 Group Captain Headlam noted that only advice from the USAF made it possible to establish the level of contamination. This underlined shortcomings which should have been avoided. Headlam said that

'The presence of USAF personnel who were so widely experienced in this type of operation was extremely advantageous to the RAAF planning staff at RAAF Richmond and they gave valuable assistance in the meteorological task and decontamination problem.'
[RC 36, Headlam, p.22]

11.1.11 It is clear that procedures for decontamination of the RAAF aircraft which flew cloud sampling sorties for Totem 1 should have been in place before the event. The procedures which were implemented were introduced hastily in response to the situation. The contamination of the aircraft should have been foreseen and measures taken to ensure the safety of all RAAF personnel involved.

11.1.12 The two most contaminated Lincoln aircraft which flew from Woomera for Totem 1 were used to sample the cloud at Totem 2. In the light of the Totem 1 experience, radiological health and decontamination procedures were revised. Aircrew wore film badges and were instructed to use oxygen when in the cloud. Each aircraft carried two dosimeters.

11.1.13 When these aircraft returned to Woomera after Totem 2, much more care was taken. Ground crews wore film badges and the exterior of the aircraft was washed down. Washing-down did not commence until 28 October (D2+1) because of the high level of contamination on the aircraft.

11.1.14 The Lincolns of No. 82(B) Wing, Detachment B returned from Richmond to their home base at Amberley on 20 October 1953 and the Lincolns of Detachment A were flown back to Amberley on 30 October 1953, after partial decontamination at Woomera. Two Totem Radiation Hazards Group members, Butler and Austin, flew with them at the request of Group Captain Colquhoun to provide advice and assistance on decontamination procedures for the aircraft, aircrew and ground crew at Amberley.

11.1.15 In his report, Captain Headlam noted that on arrival at Amberley, the aircraft, equipment and aircrew were checked before personnel were permitted to leave the airfield. A complete decontamination laundry was set up and overalls and berets were frequently washed after being contaminated when in contact with the more heavily affected aircraft. All personnel were checked twice daily, before noon and the afternoon stand-down [RC 36, Headlam, p.15].

11.1.16 An interim report dated 9 November 1953 and written by Butler and Austin, noted that of the nine affected Lincolns at Amberley, only one (A73-26) could be regarded as clean and required no further precautions [RC 36]. Of the others, aircraft No. 25, which had contacted the Totem 1 cloud near Charleville in Queensland and had subsequently landed at Williamtown, was the most heavily contaminated. The others ranged from being highly contaminated to having levels of contamination just above the surface tolerance level of 15 counts per second in a few areas as recorded by the type 1021B radiation monitor.

11.1.17 In general, little activity was found inside the aircraft: in fact the interiors of six of them were completely clear of contamination. On the airframes, contamination was mainly concentrated in areas covered with oil or grease, which

served to trap the active particles. The bulk of the contamination was on the engines and power plants, including the air intake trunking and filter, oily cowls, and inside the spinner and airscrew holes.

11.1.18 The report made recommendations for the safe handling of aircraft until decontamination was complete. These included recommendations on protective clothing, including gloves, and monitoring for all work on the outside of the most heavily contaminated aircraft. For the less contaminated aircraft, protective clothing and monitoring were prescribed for all work on engines, and monitoring only for work on airframes. Except for personnel working in the rear and upper turrets of aircraft Nos. 25 and 52, it was recommended that precautions for personnel working inside all aircraft be discontinued from 15 November 1953.

11.1.19 Butler and Austin also advocated that

'After the above (cleaning) processes normal servicing and minor inspections of all planes should not cause contamination of personnel...though it would be advisable to continue monitoring until the amount picked up on hands or clothes never exceeds 15 counts/sec on the 1021 instrument.' [RC 36, Interim Report, p.3]

In a major overhaul, which involved opening up the engine or stripping the induction system, strict monitoring of personnel was advised.

11.1.20 Training in radiation hazards was carried out by Butler and Austin at Amberley and a health control system was established for which eight monitoring instruments were loaned [RC 36, Interim Report, p.5].

11.1.21 Superficial cleaning of the Lincolns took place following the advice of Butler and Austin; this was done chiefly by steam cleaning and the use of detergents and solvents on the affected parts. Decontamination of the worst affected areas was left until major overhauls were due, after March 1954.

11.1.22 Between 2 and 5 March 1954, RAAF Amberley was visited by a team of senior RAAF officers, including Squadron Leader Thomas, who examined the radioactive contamination on the Lincolns. As a result of their investigations and discussions, the following recommendations were made [RC 44, p.2]:

- (a) establish a suitable site for an 'active' area;
- (b) erect a suitable decontamination building, incorporating health control features; and
- (c) provide a large capacity underground drain tank to collect contaminated liquid effluent.

FIGURE 11.1.1

RAAF Base Amberley Showing Location of
Decontamination Centre

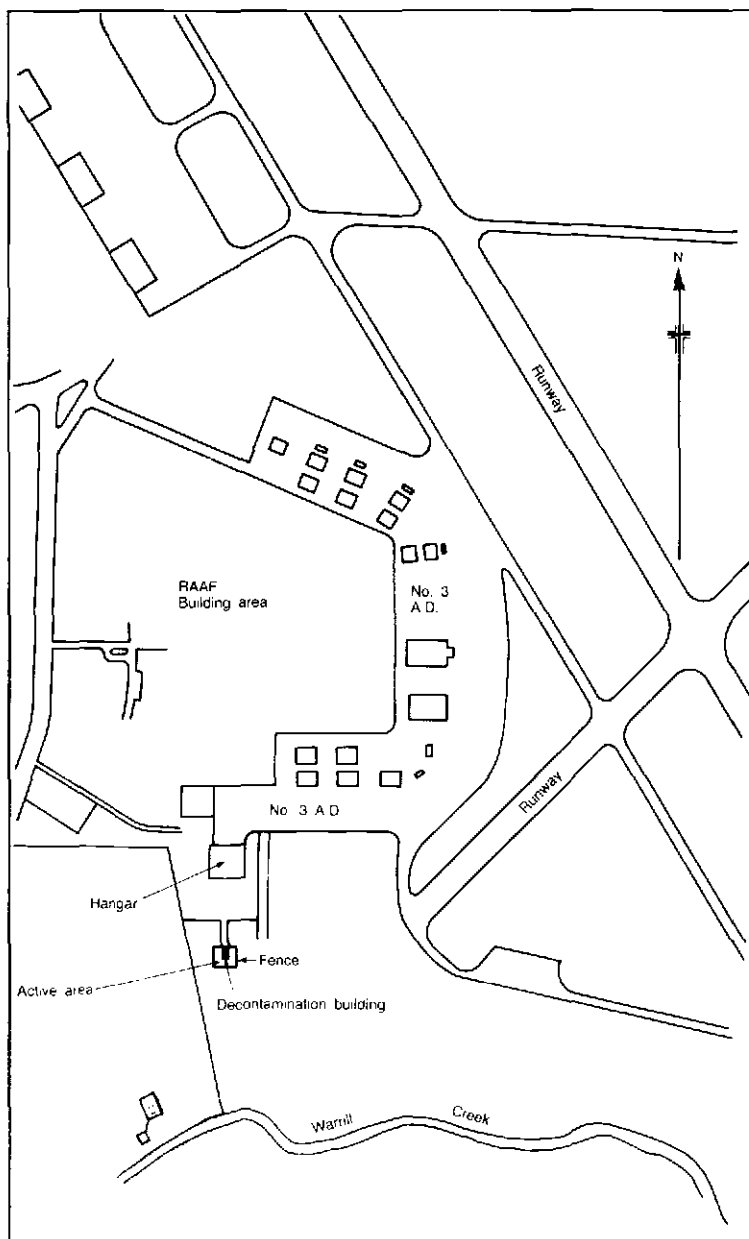
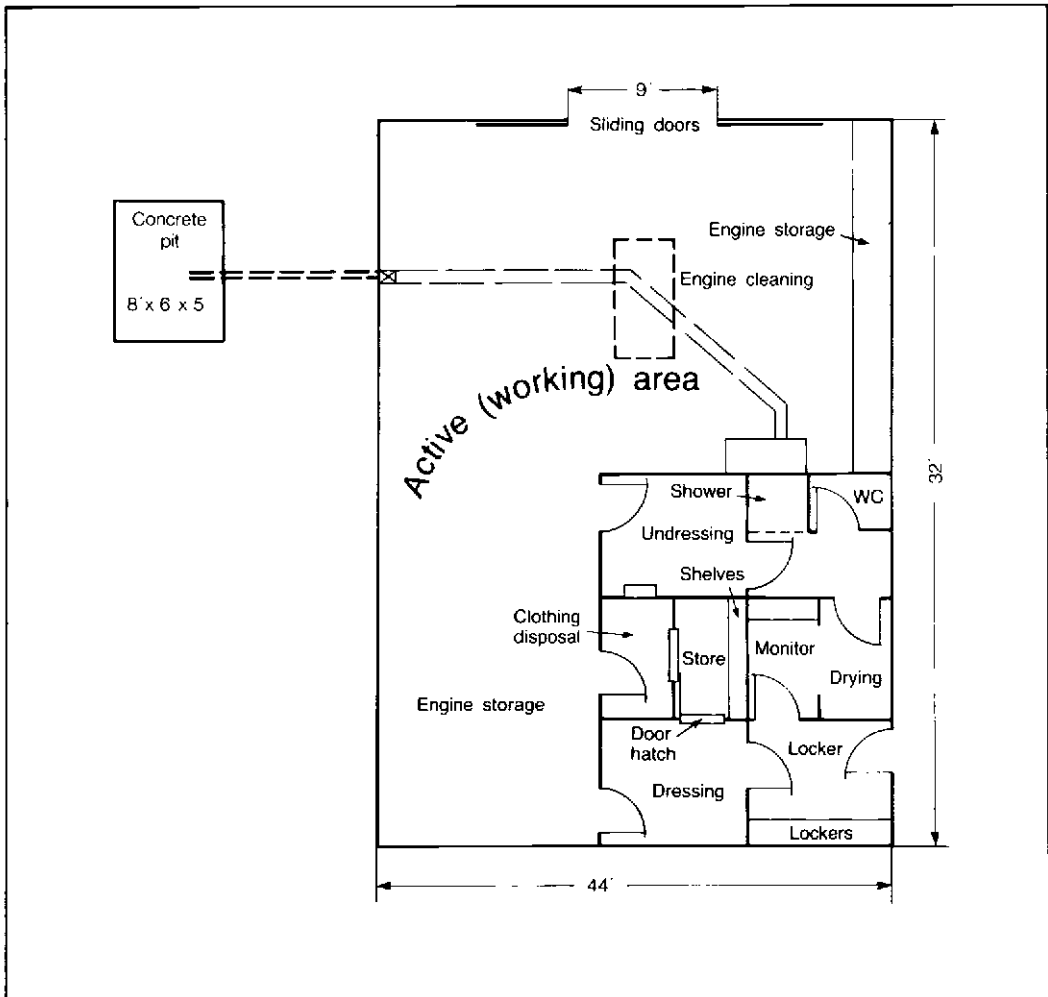


FIGURE 11.1.2

Plan of Decontamination Centre at Amberley



11.1.23 On 10 March 1954, a plan for this building was drawn up and submitted to the Department of Works by Thomas and a technical staff officer. The Centre was operational by November 1954. Figure 11.1.1 shows the location of the Decontamination Centre at Amberley, and Figure 11.1.2 is a plan of the Centre.

11.1.24 A more formal guideline for aircraft decontamination was issued as a result of the Totem experience. On 8 November 1954, Air Board Order A125, 'Radiological Safety in

Relation to the Results of Atomic Explosions', was issued. This order covered all aspects of decontamination procedures, disposal of radioactive waste, protection of personnel and procedures to be adopted by personnel of the RAAF Contamination Centre already in operation at Amberley [RC 553, A.B.O. A125, pp.12-13]. Aircraft and other equipment suspected of being contaminated were to be monitored as soon as possible and decontaminated if contamination was above the permissible level. Decontamination was to be carried out, if possible, in the Amberley Decontamination Centre. If circumstances prevented the movement of a contaminated aircraft to Amberley, a temporary facility was to be set up within the Active Area of the unit concerned, to enable decontamination to proceed within the same standards of safety as existed at Amberley [loc.cit.].

11.1.25 If only closed parts of the aircraft were contaminated, such as the engines, power plant and other sealed components, and full decontamination was not possible immediately, the aircraft was allowed to fly provided that crew positions, passages and loading points and any area which might be touched during refuelling tasks were below permissible levels. The contamination was to be monitored on a weekly basis. Partially contaminated aircraft and parts were not to be allotted to another unit or organisation, other than the Decontamination Centre, until they had been fully decontaminated. All internal aircraft parts were to be regarded as potential sources of radioactivity. Personnel working on decontamination and/or servicing tasks were fully covered by the Air Board Order. Large purple crosses were to be painted on both sides of the fuselage to identify contaminated aircraft [ibid., p.14].

11.1.26 The Order also provided for the disposal of solid and liquid wastes, evaporator filters and equipment and clothing which could not be decontaminated. Liquid wastes were to be dumped at sea in metal containers which would burst on impact, whereas solid wastes were intended to sink to the sea bed in sealed containers [ibid., p.17].

11.1.27 The Royal Commission was told that farmland adjacent to Amberley had been affected by the aircraft decontamination procedures [RC 81]. The radioactive waste from aircraft decontamination was collected in a holding tank, then placed in drums. Some was dumped at sea [RC 800, p.580798] and some was sent to Maralinga for disposal [RC 489]. Mr W Ravenscroft, a Warrant Officer within the decontamination team at Amberley, gave evidence of initial problems with an evaporator resulting in dispersal of some 'complex liquid' containing 'engine oils, detergents, paints, greases, hydraulic fluids and other things' [RC 489]. Stevenson was of the opinion that 'solvents used in cleaning' would be much more likely to 'cause damage to the environment, if such occurred, than what was a relatively small quantity of radioactive material' [RC 319]. The Royal Commission did not receive any evidence to support the allegation that environmental damage occurred adjacent to Amberley.

11.1.28 Ravenscroft concluded in his statement [RC 489], that the decontamination centre was 'a small, rather primitive installation which could not have handled any major task required of it'. This is in contrast to the report Ravenscroft made on 31 July 1958 when he reported that four aircraft (A73-47, 25, 52, 54) had been successfully decontaminated with no problems [RC 800, p.580797].

11.1.29 Various statements were made to the Royal Commission by RAAF personnel who had worked on contaminated Lincolns at Amberley and it would seem from their evidence, and from official documents, that routine medical records were kept and tests were made. For example, Ravenscroft stated that all personnel employed on decontamination were required to have medical checks and monthly blood tests, and to wear both a film badge and dosimeter. Film badges were replaced monthly and the results logged [RC 489].

11.1.30 This is confirmed by the monthly pathology report from RAAF Amberley for June 1956: 'Members working with radioactive material have been given routine blood checks as required' [RC 800, p.562934]. Some dose records for RAAF personnel at Amberley between 1957 and 1962 were supplied to the Royal Commission by the Queensland Premier's Department on 22 October 1985, after the close of the Royal Commission's hearings. The film badge records include some for personnel working in the Decontamination Centre and also personnel in X-ray, dental and luminising areas at Amberley [RC 800, p.580797]. The personnel whom Ravenscroft said did most of the work on decontamination of the Lincoln aircraft [Trans., p.7421] are recorded as receiving doses at or below the limit of detection for all the months for which records are available, with one exception in 1961 when the dose was just above the detectable limit. However, Ravenscroft reported that the decontamination of the four Lincoln aircraft was completed on 24 July 1958 [RC 800, p.580798]. Mr K Freeman told the Royal Commission that, after the decontamination work on the Lincolns was finished, the Decontamination Centre personnel were ordered to decontaminate the instrument painting section of the luminous dial area [RC 35]. This operation would have entailed a much greater potential radiation hazard than the aircraft decontamination.

11.1.31 Mr Freeman spoke of the use of protective clothing and the practice of showering and monitoring on leaving active areas [RC 35, pp.4-5]. He said that film badges and dosimeters were also used. In a report to the base Senior Medical Officer on 31 July 1958 on the decontamination of aircraft Nos. 47, 25, 52 and 54 [RC 800, p.580797], Ravenscroft stated that 'full records have been kept of individual hours worked, dosage received and any contamination found.' Further, he stated that film badge readings were invariably below 0.05 r per month and that at no time did personnel at the centre receive measurable doses of radiation.

11.1.32 This evidence of health control procedures was corroborated by Squadron Leader Bishop, who became Senior Medical Officer at Amberley in 1957; he wrote to RAAF Headquarters Maintenance Command, Melbourne, that complete records of individual exposures, including graphs of routine blood counts and film badge readings, were maintained [RC 800, p.580872].

11.1.33 Against this evidence can be placed such contradictory statements as that of Dr John Craig (Senior Medical Officer at Amberley, 1955-57), who said that no medical records were kept and that he was never formally briefed about the decontamination centre [Trans., pp.7437-8]. This could be because approval to start actual decontamination was received on 3 February 1958 and prior to this, work was confined to stripping and preparing the aircraft and engines for cleaning [RC 800, p.580797].

Operations Mosaic, Buffalo and Antler

11.1.34 By the time of the Mosaic series of tests, procedures for the decontamination of aircraft and the maintenance of appropriate safety standards for the personnel involved were well developed. The Decontamination (DC) Group was responsible for supervising and advising personnel engaged in decontamination tasks and the Health Physics Group was responsible for the issue and monitoring of film badges and supervising overall health safety control arrangements.

11.1.35 Procedures followed are well documented for Mosaic [RC 287, T33/57], Buffalo [RC 320, T63/57] and Antler [RC 321, T7/60]. The Report 'The Handling, Servicing and Decontamination of Radioactive Aircraft' [RC 320] was prepared by Stevenson at Pearce (WA) and based on the principles used in the atomic energy industry at the time.

11.1.36 Stevenson, who took control of the DC Group for Mosaic (at Pearce Field) and Buffalo (at Maralinga), had developed a barrier paint based on an alkali soluble emulsion with sufficient pigment to indicate its presence. Aircraft were sprayed initially and then re-sprayed after becoming contaminated, thus sealing the contamination and rendering it non-smearable. The paint was not removed after Mosaic as the aircraft were to be used again for Buffalo and decontamination facilities at Pearce were somewhat limited; all contaminated materials and, most significantly effluent, had to be transported to Maralinga for disposal.

11.1.37 At Buffalo, the aircraft were re-sprayed with strippable paint after each test and the main decontamination postponed until after the last explosion. All coats were then removed by using a stripping chemical and steam cleaning. At Antler, the paint was stripped and re-applied after each test. Air sampling tests were made during steam cleaning and start-up of contaminated engines but the results proved negative [RC 319].

11.1.38 The overall approach was to leave the aircraft for a few days to allow the fission products time to decay so that the 'residual contamination on the outside of the aircraft was negligible' [RC 319]. The levels of radiation on each aircraft were then checked before personnel were permitted to work on them. Those working on the aircraft wore protective clothing comprised of either 'Atomic Energy boiler suit overalls' [RC 319], boots, gloves and a cap or waterproof clothing if necessary. Respirators were worn for the more hazardous operations; a newly designed 'cyclops' version with a forehead inlet was used on such occasions. Film badges were worn by all those entering the Active Area. 'No Smoking, Eating or Drinking' rules were rigidly enforced.

11.1.39 At Maralinga, the liquid effluents were allowed to soak away into bulldozed pits within the Active Area.

11.1.40 The DC Group at Maralinga was also responsible for supervising and advising RAF and RAAF personnel involved in decontamination tasks at Edinburgh. Periodic inspections were carried out by the AHPR.

11.1.41 Stevenson also commented on the question of inhalation or injection hazards in the use of water jets and steam cleaners. In his statement he said

'...there are several common sense rules which would have been covered by the supervisor. One always works downwards, one stands upwind and one would not direct jets towards other personnel. In a wet situation the dust hazard is always far less. No contamination will be in the steam cloud, which is the condensed vapour, it will be in the liquid jet. The measurements on Antler cover this point.' [RC 319]

Conclusions

11.1.42

(a) Despite the acknowledgement by Air Vice Marshal Davis that the RAAF Lincolns which flew the cloud sampling sorties at Hurricane could be contaminated, there were no procedures to check and if necessary decontaminate the aircraft.

(b) Procedures to deal with the RAAF cloud sampling aircraft at Totem were nonexistent prior to the Operation. This was a serious omission because a number of the aircraft were contaminated with significant levels of radioactivity. Procedures had to be improvised until a decontamination centre was set up at Amberley.

(c) Measures to control the radiation and ingestion risk to personnel working in the decontamination centre at Amberley were generally adequate.

(d) The procedures adopted for the decontamination of aircraft at Mosaic, Buffalo and Antler were based on experience gained at Hurricane and Totem and were, for the most part, well developed and managed.

11.2 Loss of Balloons at Maralinga

11.2.1 From the outset, the use of balloons in the Atomic Weapons Testing Program was controversial. The belief that there would be public concern is obvious from the public assurances given by scientists, bureaucrats, and politicians on the safety precautions to be taken when using balloons for atomic tests purposes.

11.2.2 The use of balloons was first attempted during the Antler series (see Chapter 9) when the first problems with the balloons were reported. Those problems were related to the use of balloons at the test site and not to the escape incidents which occurred several years later.

11.2.3 The Antler balloon incidents were reported by the Services Commander in the following terms:

'The experimental Balloon system used for Round III was satisfactory, and proved that this system was practicable. Some balloons were lost during training, but this was expected. Unless some form of hanger is built to house returned balloons, similar losses can be expected in the future.' [RC 333]

11.2.4 The incidents do not appear to have been reported to the Australian Government by the AWTSC; in fact some support for the future use of balloons was given by the AWTSC in its report on the Antler series:

'The balloon experiment can therefore be regarded as fulfilling our expectations, and we have pressed our British colleagues to use this firing technique where it is possible to do so in relation to measurements and experimental work associated with the tests.' [RC 590, p.450]

11.2.5 The Trials Balloon Team became part of the military forces located at Maralinga; but owing to the cancellation of the Lighthouse series, balloons were not used in any further major tests. The major incidents relating to the escape of balloons took place during the minor trials.

11.2.6 The first major incident occurred during the Vixen B series on 23 September 1960. The incident was reported by the Range Commander on 29 September 1960 [RC 867]:

'5. At approximately 0600 hours on Friday 23 Sep 60, the Trials Balloon Team positioned and raised a total of eight captive balloons. Six of these were to be used for Trials measurement and two to be used to gather meteorological information to confirm Trials results.

'6. At about 0645 hours the Superintendent decided to cancel the firing due to unfavourable wind conditions.

'8. At about 1700 hours a Met. report was received from Forrest to the effect that Maralinga could expect to receive wind gusts of from 60-107 m.p.h. at all altitudes of up [to] 3000 feet within the next two hours.

'9. ...In accordance with his instructions issued by A.W.R.E. Aldermaston, he made the decision that it would be unsafe to lower them. Accordingly, a detailed check was made of each balloon, ensuring safe mooring and inspection of all safety devices.

'10. At 1900 hours on 23 Sep the first 60 m.p.h. gust suddenly hit Maralinga. The A.W.R.E. Trials Superintendent and the A.W.R.E. Trials Co-ordinator immediately proceeded to the forward area and balloon sites with the specific purpose of checking security of Trials equipment, including balloons.

'11. On arrival at the Trial site the Superintendent found conditions to be extremely adverse.

'12. Because of the danger from dust contamination, the probability of flying cables, and being assured of the operation of balloon safety devices, the Superintendent decided that it would be most unsafe to attempt to lower or inspect the balloons during the hours of darkness and high wind conditions.

'13. At about 0800 hours on Saturday 24 Sep, it was reported by Trials inspection teams that it was probable that seven balloons were missing. The Range Commander and Trials Superintendent immediately proceeded to the forward area to investigate.

'14. Investigation revealed that seven balloons were missing:-

5 of the 350 foot flying measurement balloons.
1 of the 1000 foot flying Met. Balloon.
1 600 foot flying Met. balloon.'

11.2.7 Ground and air searches of the Maralinga environs failed to locate all of the balloons and early steps were taken to investigate the matter. As a result the Secretary of the Department of Supply directed that a full inquiry be conducted into the circumstances which led to the loss of the balloons.

11.2.8 The Committee of Inquiry met and, after visiting Maralinga and examining the recovered balloons, stated

'It is a relatively straightforward proposition to define the proximate and contributory causes of this incident.' [RC 867]

The Committee determined that the causes were

- (a) failure to take adequate precautions;
- (b) excessively high winds;
- (c) inadequate mooring systems;
- (d) inadequate operating methods; and
- (e) failure of safety systems and an unwarranted dependence on them.

11.2.9 The Committee concluded that the lessons learnt from the Antler balloon incidents did not appear to have been put into practice. The conclusion was given in the following terms...'the operating instructions are inadequate to deal with a number of possible situations such as the development of high wind speeds or thunderstorms during the night'. These are the same circumstances which caused the destruction of the balloons during the Antler series and which were commented upon so prophetically by the Services Commander in his report on the Antler series (see para.11.2.3).

11.2.10 Although the escape of the balloons in September 1960 caused a great deal of public reaction, and despite the fact that two of them drifted to the east and were eventually recovered near Hungerford and Cobar in New South Wales, there is no report of injury to any person as a result of the escape. It would appear from the press reports and official reports of the time that the major concern was not the possibility of injury but rather that public alarm could be raised by the escape of the balloons. As the press reports indicated, this fear appears to have been well founded.

11.2.11 The second major incident involving balloons occurred on 22 March 1961 and involved ten inflated Mk XV kite balloons which were located at the Wewak site. The incident was reported in the following terms:

'At 1930 hours the storm hit Wewak area broadside on to balloons and with gusts up to 44 m.p.h. One balloon was seen to break away following very rapidly within 30 seconds by three more...' [RC 867]

11.2.12 Shortly after, searches were initiated in the vicinity of Maralinga and all of the escaped balloons were found to have been destroyed or were recovered within the area.

11.2.13 In a similar response to the earlier incident, the Minister for Supply on the 23 March 1961 directed that the committee which had investigated the previous occurrence should also investigate this incident. The concern that the incident had occurred so soon after the first incident is evident in the Minister's direction that the matter was to be investigated as a matter of urgency.

11.2.14 The Committee, in its report, disclosed that

'...no matter what measures are taken to prevent accidents there is always a residual probability, albeit small, that an accident will occur...The only way in which the probability can be eliminated entirely is to cease inflating balloons at Maralinga.' [RC 867]

11.2.15 The Committee reported that the cause of the latest balloon escape incident was not a recurrence of that which occurred in September 1960 but was due to the failure of components which were designed to prevent such balloon escapes. The Committee recommended that further safety precautions should be implemented if the balloon operations were to continue at Maralinga.

Conclusion

11.2.16 The balloon incidents demonstrate the inadequacy of the safety precautions governing the use of balloons at Maralinga. The fact that the incidents occurred and that the bureaucrats, scientists and politicians were prepared to give categorical assurances that they could not occur, casts doubt on other assurances given to the public at the time.

11.3 Allegations of Dead Aborigines at the Maralinga Range

11.3.1 In response to a subpoena served on 1 May 1985, Mr P G Connolly appeared before the Royal Commission in Perth on 2 May 1985. In his statement [RC 493] he alleges that late in 1961 the bodies of four dead Aborigines were discovered in a crater in an area forward of Roadside.

11.3.2 Connolly first made this allegation in response to a newspaper article which appeared in the Perth **Daily News** during 1980. He believed that certain references attributed to the UK Government were incorrect [Trans., p.7452]. He contacted the **Daily News** and, after being interviewed by a reporter, an article appeared in the **Daily News** based on Connolly's information.

11.3.3 A similar allegation by John Burke is contained in the Submission by the South Australian Government [SA 3, p.8] and a transcript of an interview between Burke and Mr Doherty, a reporter from **The Advertiser**, is given at Attachment 11. In the interview Burke affirmed that four bodies were 'found in a crater', and later in the transcript that 'four Aborigines were lying in a trench' [SA 3, pp.5-6].

11.3.4 In summary, Connolly alleges that he walked into Burke's office late in 1961 while the latter was engaged in a 'heated argument' with RAF Chief Technician R F Norris. This discussion centred upon 'a problem with some Aborigines whom "Tom" Burke had found' [RC 493, p.5]. Connolly then drove Norris and Burke to Squadron Leader Heffernan's office and from there to Major Maguire (at that time the only medical doctor at Maralinga) and then to the Range Commander, referred to by Connolly as Lieutenant Colonel Henderson. Connolly and Burke drove to a site in the Forward Area where Burke was alleged to have discovered the bodies. Norris, Maguire and Henderson followed in another vehicle. Upon arrival at the site, Burke, Norris, Maguire and Henderson walked to where the bodies were located about 50 yards from the parked jeeps. Connolly remained with the jeeps, but states that 'from where I was, I could see black huddled shapes on the ground' [RC 493, p.6].

11.3.5 Colonel W G Henderson was Range Commander at Maralinga between 6 January 1963 and 20 January 1964. In his statement to the Royal Commission he said that

'...at no time whilst I was Range Commander did I ever view such remains, and I did not hear of any incident taking place.' [RC 549, p.3]

11.3.6 Maguire served at Maralinga as doctor in charge of the 12-bed Maralinga hospital between December 1963 and December 1964. In his statement to the Royal Commission he said that

'I can state quite definitely that I was not involved in the alleged incident of the four Aborigines and I have never heard of it.' [RC 807, p.3]

11.3.7 Norris served with the RAF at Maralinga as Chief Technician between 6 March 1963 and 1 April 1964. In his statement he said categorically that

'I have never met any Aborigines on the Airfield. I only came across them once when we visited the mission where they lived.' [RC 808, p.1]

11.3.8 Neither Maguire, Henderson nor Norris could recall a Squadron Leader by the name of Heffernan. The Royal Commission has been unable to confirm whether a Squadron Leader Heffernan served with the RAF or RAAF at Maralinga during the 1960s.

11.3.9 It is clear that Connolly was referring to the period 1963-64 and not 1960-61 as he claimed. Burke claims that the bodies of the dead Aborigines were discovered in 1963, and Henderson, Maguire and Norris were only at Maralinga during 1963 and 1964.

11.3.10 While he was Range Commander Henderson's rank was Colonel, not Lieutenant Colonel as recollected by Connolly. He was the only Range Commander at Maralinga with the surname of Henderson.

11.3.11 In the Final Submission on Behalf of Aboriginal Groups and Individuals [RC 862, p.351] it is stated that no Aborigines were missing in the area in 1963. However, the Royal Commission acknowledges the fact that Aboriginal people would not name dead people and that four people could die in such a manner without the event being known to people living in the area today. In this specific allegation by Connolly, the Royal Commission prefers the evidence of Henderson, Norris and Maguire to that of Connolly and Burke and thinks it unlikely that the bodies of four Aborigines were located in the area north of Roadside at any time during the 1960s. Connolly may have been mistaken, and from 50 yards away, the 'huddled shapes on the ground' may have been dead animals.

11.3.12 A further allegation made by both Burke and Connolly is that they were approached some years ago and warned that neither should make public statements. Connolly states that he was approached by members of the Australian Security Intelligence Organisation (ASIO), and that public statements about his time at Maralinga were 'rocking the boat' [Trans., p.7452]. Connolly stated that 'I was told to keep my mouth shut' [Trans., p.7452].

11.3.13 The Royal Commission has consulted files held by ASIO and found no record of any approaches to either Connolly or Burke.

11.3.14 Apart from the allegation of dead bodies, Connolly stated that there was a rumour that 'quite a few Aborigines had been contaminated by one or more of the explosions in 1956' and that a special hospital had been set up at one of the missions to care for them. Moreover there was a rumour that many of them suffered from radiation sickness, blindness and disfigurements [Trans., p.7447]. There is no evidence that a special hospital was established, and no evidence was presented to the Royal Commission that radiation sickness, blindness and disfigurements occurred among the Aboriginal population of the Maralinga area at that time.

Conclusion

11.3.15 In the light of all the evidence the Royal Commission does not accept that a number of dead Aborigines were found at Maralinga as alleged by Mr Connolly.

11.4 Allegations of Burning of Bombs at Woomera

11.4.1 Mr M V Earner stated that late in 1953 he was posted to Woomera, and approximately two years later transferred to an internal unit called the Assembly Air Ranger. He said that

'...it was the function of the Assembly Air Ranger to assemble atomic bombs under the supervision of British scientists.' [RC 34, p.2]

11.4.2 Earner then alleged that 11 atomic bombs were assembled by the Assembly Air Ranger, a group of approximately six men under the command of a Mr Long. Two of these bombs were not used, and they were 'taken out into the desert and I burned and buried them'. Earner elaborated on how this was achieved:

'What we did first off, we got a grader and dug a 6 foot hole, a 10 foot hole actually deep and about 50 foot long and we placed the bomb in that. We took our crane out to the desert for that purpose. Igniting was not a problem so much as we did not know really how to ignite it, or what to use, so we mixed up a mixture of geletrol.

'You smear that over - we did, over the bomb, and ignite it with a signal pistol, a cartridge, stood back a long way and fired and ignited it. Our problem was when they were half burnt, they started to go out...

'I hopped in the jeep and went back to Woomera, and I saw one of the scientists there, and told him the problem, and he told me that the booster was water, so I got a dozen empty beer bottles and filled them with water and took them out to the site and threw them up against the bomb casing and they flared up again and burnt away to powder.' [Trans., p.514]

11.4.3 Earner was never informed that he was assembling atomic bombs, and under cross-examination said that this belief was based on the high level of security surrounding his work, including the fact that 'they built 20 foot walls right around the whole of the armament section of the yard' [Trans., p.513], being informed that 'we would be working on a top secret project [Trans., p.513], and noting that 'there were 50 or 60 English scientists floating around the place' [Trans., p.538]. The bombs detonated at Maralinga during Operations Buffalo and Totem travelled from the UK to Adelaide and then directly to Maralinga, and not via Woomera [Trans., p.538]. Thus, it is clear that Earner was not assembling atomic bombs used in those particular tests.

11.4.4 One possible explanation for Earner's allegation has been placed before the Royal Commission by J M R Frost, Officer-in-Charge of the Joint History Project Team, Defence

Research Centre, Salisbury. Frost claimed that RAE (Armament Department) asked the Long Range Weapons Establishment at Woomera to undertake ballistic trials on UK atomic casings, which were called 10 000 lb. LCs. He indicated that assuming there were surplus bomb casings, the UK would not have gone to the trouble and expense of transporting them back to the UK and they would have been destroyed, probably by burning. The bomb casings would have been inert ballistic dummies.

11.4.5 This was confirmed by Earner who said under cross-examination by Counsel assisting the Royal Commission that he could not imagine the bombs exploding 'seeing they did not have a warhead in them' [Trans., p.543]. Later Earner said that 'I knew what went into them and, as far as I was concerned, there was no explosive that went in them' [Trans., p.544].

Conclusion

11.4.6 The Royal Commission concluded that there was no reason to disbelieve Mr Earner's statement about his burning of what he believed were bombs at Woomera, but it is clear that whatever was burnt contained no radioactive material.

11.5 The Marston Controversy

11.5.1 During the course of Operation Buffalo, a program of biological studies was planned with particular reference to the movement of fission products from radioactive fallout within the food chain.

11.5.2 Included in the program was a survey of the uptake of iodine-131 in the thyroids of grazing animals to the north and north-east of Maralinga. The UK Agricultural Research Council, the UK Medical Research Council the CSIRO's Division of Biochemistry and General Nutrition collaborated in this survey. The survey would contribute to the already established program of long-range fallout monitoring by the AWTSC. Dr Hedley Marston FRS, Head of the CSIRO Division, directed the survey.

11.5.3 Marston started collecting thyroids and analysing them for iodine-131 in March 1956 to obtain data on seasonal variations. Consequently he was able to detect the increased levels of iodine-131 resulting from the Mosaic tests.

11.5.4 After Mosaic G1, Marston found an increase in the levels of iodine-131 in the thyroids which he characterised as disquieting. Sheep thyroids from Bourke and Marree had given count rates of 800 counts per 100 seconds as against a usual background of 50 counts per 100 seconds [RC 824].

11.5.5 Following the G2 explosion, count rates of 8000 to 24 000 counts per 100 seconds were obtained on some specimens. These results contradicted the statement in the Safety Committee report to the Prime Minister that

'Incontrovertible evidence had been obtained which shows that all contamination of the mainland was near the low limit of detection...' [RC 527]

11.5.6 A count rate of 34 000 counts per 100 seconds was estimated by the AWRE to correspond 'to 0.03 per cent of permissible dose and is therefore of no significance' [RC 800, p.563047]. This statement was repeated by the Safety Committee in its report to the Prime Minister [RC 527].

11.5.7 Marston accepted that the iodine uptake was not a serious hazard but was very concerned about what the iodine survey meant about the uptake of radiostrontium. He also objected to the Safety Committee's conclusion that the contamination was insignificant. It is now known that radioiodine and radiostrontium act differently in the biosphere and that the radioiodine in the fallout from the tests in Australia was of greater concern, particularly through drinking of milk.

11.5.8 Again after Buffalo, Marston measured increased levels of iodine-131 in the thyroids. There was a considerable disagreement between Marston and the Safety Committee on the interpretation and significance of the iodine-131 results. Marston's equipment also detected the passage of the cloud of the third Buffalo explosion (Kite) over Adelaide. In each case, Marston saw the formal reports as official duplicity and lying [RC 824].

11.5.9 There have been claims from time to time that Marston's results were suppressed for their disturbing findings; but this would appear to be not so. The iodine-131 results were all published by Marston in The Australian Journal of Biological Sciences. However, two figures showing gamma spectra of fallout were removed at the insistence of AWRE and the Safety Committee on the grounds that they could be used to derive bomb design information. The Safety Committee also objected strongly to Marston and to CSIRO about the criticism of its integrity implied in early drafts of Marston's paper, and was very high-handed in its treatment of Marston in the ensuing argument.

In a letter to Titterton (dated 31 July 1957), Penney wrote:

'The deletions required to allow open publication are quite small. The two figures [3 and 4] would have to be removed, and also the first sentence on page 14 and the phrase "...Fig. 4...of this animal", in the penultimate sentence on the same page. Personally, I think the paper would still serve the scientific

purpose for which it was written if the deletions are made...It should be made clear to him [Marston] that the condition has nothing to do with any debate on radiological safety and is purely a technical matter of the security of weapon information.' [RC 800, p.571603]

11.5.10 Marston could not be told in technical terms why publication of these data was not possible. In a letter dated 9 August 1957 to Titterton, Mr F W G White, Deputy Chairman of CSIRO, was concerned that because of this it would be impossible to convince Marston on technical grounds. White thought Marston would have immediately reacted that this prohibition was aimed at preventing him from revealing that fallout from Maralinga occurred over Adelaide:

'I personally would not assume that this is Penney's intention, but Marston certainly will...'

11.5.11 On 20 August 1957, Penney reiterated the importance of deleting the two figures:

'Certainly I do not want to block Marston from making his comments on health and safety nor from saying that there was some fallout well below tolerance levels on Adelaide or elsewhere in Australia. I must insist on his not publishing data revealing weapon diagnostics obtained with our instruments and while he was working subject to classification. I hope that you and Adams can find a suitable compromise.' [RC 800, p.571752]

Marston agreed to delete the figures and associated text in a letter to White on 19 August 1957 [RC 824].

11.5.12 The Safety Committee also objected to Marston's report on scientific grounds: his parallel speculation for radiostrontium levels in the food supply and the interpretation of his figures on iodine concentrations.

11.5.13 Marston based his concern over the hazard of intensive internal radiation caused in particular by the accumulation of strontium-89, strontium-90 and its daughter product yttrium-90 within the skeletons of individuals. He saw the thyroid uptake of radioactive iodine primarily as a possible indicator in parallel, of the uptake of radioactive strontium-90. However, Marston conducted no specific measurements on radiostrontium.

11.5.14 Marston's paper, with the two figures removed and with some toning down of his criticism of the Safety Committee was published in The Australian Journal of Biological Sciences in August 1958. In it, Marston concluded that the rapid accumulation of iodine-131 in the thyroids of grazing cattle indicated a rapid gathering of strontium-89, strontium-90 and other bone-seeking isotopes. All of the results on iodine-131 measurements were published.

11.5.15 The Safety Committee was still not very happy with the tone of the paper, and with extension of the results to radiostrontium. The Safety Committee, L J Dwyer, J H Martin and E W Titterton, prepared a paper in reply to Marston's paper. The authors objected to the final section of Marston's paper which raised an 'entirely new issue: that of the take-up of radiostrontium by human beings'. They observed that his opinions were 'unsupported by scientific evidence on the route and rate of strontium take-up into the body and "the probable" hazards...' [RC 800, p.581075]. They went on to assert that although Marston made no measurements of radiostrontium, he devoted Part III of his paper entirely to the problem:

'It must be pointed out that there is no experimental evidence to support the assertion that either leukaemia or bone cancer are induced by the low levels of radiostrontium associated with fallout.' [RC 800, p.581080]

11.5.16 This paper and Marston's reply were submitted for publication in The Australian Journal of Biological Sciences. However, both were withdrawn at the suggestion of Sir Macfarlane Burnet who was on the editorial board of the Journal.

11.5.17 As Chairman of the National Radiation Advisory Committee, Sir Macfarlane Burnet wrote to Titterton on 3 November 1958 suggesting that the papers be withdrawn and noting that

'...I have knowledge and sympathy on both sides of the current uncertainties about Marston's paper and the reply from the Maralinga Safety Committee. I am frankly worried by the situation because of its latent potentialities to give rise to action which could be labelled by the press as an attempt by Government to interfere with scientific integrity, or on the other side, as an attempt by left wing scientists to interfere with defence preparation. All concerned are fully aware that neither is the case.' [RC 800, p.581018]

11.5.18 He further observed that 'Marston's original paper had an emotional colour that made it unacceptable to a scientific journal as well as statements which could be legitimately objected to by the Safety Committee as reflecting on their competence and/or integrity'. He also suggested that the errors of fact in Marston's paper as published were 'scientifically trivial' and such as appear in many scientific papers.

Conclusions

11.5.19

(a) None of Marston's results on the levels of iodine-131 in thyroids was suppressed. However, the AWRE and the AWTSC insisted that two figures giving the gamma spectra of fallout at Adelaide be deleted. Marston readily agreed to these deletions.

(b) Marston and the Safety Committee strongly disagreed on the health effects of the nuclear tests and this resulted in a public dispute since the Safety Committee tried to answer Marston's criticisms in the scientific literature. The Safety Committee was very high-handed in its treatment of Marston's paper. In contrast, Penney did not seem to object to Marston's speculation, once Marston had removed the two diagrams which inadvertently contained bomb design information.

11.6 Peace Officer Guards

11.6.1 The Australian contribution to security for the British nuclear tests was provided by a combination of military and civilian services.

11.6.2 Security for the Monte Bello Island tests was primarily the responsibility of the defence forces. Australia also seconded an officer from ASIO to act in an active as well as an advisory capacity. Security at Emu and Maralinga was the responsibility of the LRWE and the Department of Supply. The security organisation consisted of officers from ASIO, security officers from the Department of Supply and members of the Peace Officer Guard Service.

11.6.3 Security at the first of the mainland tests conducted at Emu (Site X200) was provided by the Department of Supply Security Service located at Woomera. Under the directions of the Chief Security Officer, a Project Security Officer was charged with the security of Site X200. At that time the Peace Officer Guard Service, a branch of the Attorney-General's Department, was set up under the administrative control of the Chief Security Officer. The duties of the peace officers consisted of guard duties and to a lesser extent, security duties under the direction of the security officers. Instructions for peace officers were set out in Post Orders. The exact number of peace officers and security personnel cannot be readily identified from the records available to the Royal Commission; however, it seems that for the Totem series at least five peace officers were involved in guard duties together with three or four security officers.

11.6.4 When the permanent testing site was established at Maralinga, the security and guard arrangements were formalised by the establishment of a series of outposts and a central headquarters at Maralinga Village. The peace officers remained as part of the Maralinga establishment but, when the Commonwealth Police Force (later the Australian Federal Police) was formed, it absorbed the Peace Officer Guard Service. Except for a period of two years from 1974, Police Officers have been retained continuously at Maralinga since the end of the tests, although the number of officers has been reduced.

11.6.5 The Australian Government was responsible for providing certain services for the atomic tests program at Maralinga; among these was the provision of security services. A description of those services in the early stages is given in a Department of Supply memorandum:

'From early in 1954 intermittent security cover was given to the area by the Regional Security Officer, SA until February 1955 when a Security Office took up full time duties at the range to prepare for and cover a series of the minor trials and Buffalo Trials. Four Commonwealth Peace Officers were present for the 1955 series of minor trials and this force has been built up during the construction programme until its strength is now 1 Sub-Inspector, 2 Peace Officers, 1st Class, and 17 Peace Officers. This force is considered adequate to cover all known requirements of the Buffalo series. The strength to be maintained on site during any passive or maintenance period will be decided when the post Buffalo safety factors have been assessed.

'During the build up period of the trials area the movement of classified freight was also covered by the Regional Security Officer, SA.' [RC 800, p.563695]

11.6.6 The structure of the Peace Officer Guard contingent changed from time to time. It seems that the duties of the peace officers were primarily guard and patrol duties, however, there was an element of security involved:

'As the Security Officer at Maralinga, broadly, you are operationally in control of the Peace Officer Detachment. However, you exercise that control through the Sergeant in charge who is responsible to you for the Peace Officers in his Detachment and for ensuring that they carry out their duties in accordance with your instructions. The Sergeant is responsible for the discipline of the detachment, and it is not within your power to reprimand any Peace Office [sic] individually. You should direct any complaints to the Sergeant in charge. Similarly any instructions to the Guard should be directed to the Sergeant for implementation.' [RC 800, p.551470]

11.6.7 Evidence was received from several former peace officers who were posted to Emu and Maralinga at the time of the tests. That evidence largely confirms the documents available to the Royal Commission which record the activities of the Peace Officer contingent. One former officer, Murray, told the Royal Commission how he had 'to check on the movement of personnel...and inspect their passes...to prevent natives from moving into the area at Emu and later the Prohibited Area at Maralinga' [RC 148]. He also recalled other more unusual duties '...at One Tree I went into the Forward Area to trap rabbits...and skin them...I was also sent into the forward area to destroy dingoes. I was with Harry Turner when he used geiger counters'. Murray was involved in the so-called Pom Pom incident.

11.6.8 The broad and unusual range of duties undertaken by peace officers is confirmed in correspondence regarding the selection of personnel suitable for posting to Maralinga. That peace officers and security officers were required to be in most areas of the test sites from time to time, that they were able to move more freely than most personnel, and the diverse nature of their duties suggest that there is potential for exposure of these personnel to radiation. The evidence and records available to the Royal Commission suggest that the monitoring of peace officers and security personnel may not have been as carefully maintained as that for other personnel.

Conclusion

11.6.9 The Royal Commission cannot exclude the possibility that those persons employed as Peace Officer Guards and security personnel at Emu and Maralinga may have been subjected to increased risk from exposure to radiation.

CHAPTER 12

THE 'NEED TO KNOW'

'There are some occasions in which a man must tell half his secret in order to conceal the rest; but there is seldom one in which a man should tell it all.'

- Lord Chesterfield

12.0 Introduction

12.0.1 Understandably enough, given the nature of the enterprise upon which they were embarking, secrecy was a crucial factor in the minds of the British scientists and bureaucrats involved in planning the first atomic weapon test in Australia. It was to continue to hold a position of paramount importance throughout all subsequent tests and minor trials, and was so deeply entrenched that a large proportion of contemporary documents relating to the test program still retained their security classifications when the Royal Commission commenced its enquiries.

12.0.2 While any such operation could be expected to be shrouded in secrecy, there were a number of additional factors which established a prevailing atmosphere wherein the initial and dominant attitude was that information should be withheld unless a 'need to know' was established.

12.0.3 This 'reverse onus of knowledge' was engendered and fostered in the immediate post war and 'cold war' atmosphere. As Margaret Gowing put it,

'Wartime secrecy produced a distortion of constitutional government in countries such as Britain where atomic matters were never discussed within the small War Cabinet, and Mr Attlee, as Deputy Prime Minister, the Service Ministers and the Chiefs of Staff knew almost nothing about it. The effects of the obsessive secrecy were felt for many years after the end of the war and were carried on through Mr Attlee's period as Prime Minister.' [Gowing, 1978, p.12]

Moreover:

'Secrecy was not only a guard against enemies but a barrier between allies. It caused much wartime ill-will between Britain and the United States.' [Gowing, *loc.cit.*]

12.0.4 Against this background, the capacity of other countries to maintain security was always in question.

12.0.5 The factors which gave additional force to the British predilection for extreme security were

- (a) the passage of the McMahon Act in the United States;
- (b) embarrassment over recent British spy scandals; and
- (c) a lack of trust in Australian security, stimulated by American concerns.

12.0.6 There is no doubt that British concerns about risking US antipathy to the passing on of any US information about nuclear matters were extreme. This was particularly so until the UK was able to demonstrate that its scientists had the knowledge and skills to explode an atomic device and could do it on their own. These concerns were the root cause of the severe restrictions which were imposed on the passage of information to Australians - especially during the early periods of the testing program.

12.0.7 There are three levels at which the question of whether Australians were provided with an adequate degree of information in relation to the tests should be considered:

- (a) Were Australian scientists given sufficient information to judge properly whether the safety criteria established for each firing were appropriate?
- (b) Did the Australian Government receive adequate advice and briefing to enable it to reach well-balanced and well-founded decisions as to whether, initially, Australia should play host to the test program and, subsequently, whether each test and minor trial should be conducted in the conditions prescribed?
- (c) Did the Australian people receive sufficient information about the testing program to allow them to assess the correctness, propriety and value of decisions being taken by the Australian Government and to reflect that assessment through the democratic machinery available to them?

12.0.8 This chapter sets out the procedures adopted at each level throughout the testing program, analyses them and identifies those deficiencies which occurred.

12.1 The McMahon Act

12.1.1 In August 1946, the McMahon Bill became law in the United States of America as the US Atomic Energy Act. Of vital importance to the United Kingdom was the provision which prescribed that there was to be no exchange of information concerning the use of atomic energy for industrial purposes until such time as Congress declared by joint resolution that effective and enforceable international safeguards against the use of atomic energy for destructive purposes had been established. The effect of this legislation was to nullify previous agreements between the United States, the United Kingdom and Canada on co-operation on atomic matters (such as the Quebec Agreement of 1943, the Hyde Park Memorandum of 1944 and the Truman-Attlee-King Concordat of November 1945), and to shatter British hopes for a return to the close atmosphere of Anglo-American collaboration which existed during the war.

12.1.2 This was bad enough, but when the United Kingdom Government took the decision to manufacture its own atomic weapons, the need for some form of interchange of information on atomic matters became vital. Negotiations were set in train to establish a working relationship known as the *modus vivendi* and a formula was established on 7 January 1948. It is reproduced at Appendix F.

12.1.3 If Britain was to resume the position of close collaboration with the United States under the *modus vivendi*, however, there could be no question of passing on information attained to third countries. The spectre of the McMahon Act was, therefore, bound to affect Britain's relations with Europe and 'the Dominions'. Gowing indicates that this question had been raised at the Conference of Dominion Prime Ministers in May 1946:

'It was acknowledged within British Government circles that since Dominion co-operation was one of the cardinal principles of British defence policy, close co-operation in the development of atomic energy logically followed.' [Gowing 1974, Vol.1, p.147]

But:

'There was one big snag in all this: if Britain was known to be engaged in far-reaching discussions with the Dominions, envisaging the automatic sharing of any information received from American sources, this would finally wreck any possibility of atomic agreement with the United States; Commonwealth co-operation came lower in the order of priority. The Dominion Prime Ministers were therefore told at the May 1946 Conference about the importance of United States co-operation, and were given information about the British programmes. They were also asked to help in finding and developing raw

material supplies and in seconding scientists to Harwell. Otherwise collaboration went no further.' [Gowing 1974, Vol.1, pp.147-8]

12.1.4 Apparently none of the Dominion Prime Ministers voiced disquiet at this prospect.

12.1.5 Matters were to become even more complicated. Once Britain had developed her own bomb, she was going to need somewhere to detonate it. The obvious choice was the United States weapons range in Nevada where equipment and facilities were already in place. But the coolness in Anglo-American relations over atomic matters and the blanketing provisions of the **modus vivendi** raised grave doubts about whether the Americans would make the range available. As early as 1949, the United Kingdom was looking elsewhere, and some eyes at least turned naturally to Australia:

'...it seems that the rocket range in Australia is the obvious choice for all reasons except the distance from U.K. The area is comparatively uninhabited and due to its remoteness from civilisation security should be comparatively good.' [RC 558, p.32]

12.1.6 By July 1950, provoked, in part at least, by Menzies' presence in the United Kingdom, it was recognised that '...it is therefore, necessary to get the agreement of the Australian Government in principle' [RC 558, p.35, Tizard]. It is not clear what was said to the Australian Prime Minister during the visit but, on 16 September 1950, the UK Prime Minister, Attlee, sent a message through the UK High Commission in Canberra to Menzies asking

'...first whether the Australian Government would be prepared in principle to agree that the first United Kingdom atomic weapon should be tested in Australian territory and secondly, if so, whether they would agree to our experts making a detailed reconnaissance of the Monte Bello Islands so that a decision can be taken on their suitability.' [RC 800, p.500021]

12.1.7 The message was classified 'Top Secret and Personal' and was covered by a note from the UK High Commissioner's office asking Menzies '...to make the most effective arrangements for security on your side' [RC 800, p.500021]. Attlee informed Menzies that the Australian Resident Minister in London knew 'personally and on a Top Secret basis about this message'.

12.1.8 Menzies replied on 19 September 1950:

'We agree in principle and to proposed detailed reconnaissance.' [RC 800, p.500022]

12.1.9 This was not a Federal Cabinet decision. In fact there is no record of any Federal Cabinet consideration of the matter until 27 May 1952 - after the public announcement of the tests. Symonds indicates that

'During the initial phases of the decision making process, only three Australian Ministers were taken into the circle of confidants - the Prime Minister, the Minister for Defence, and the Treasurer (who acted as Prime Minister in Mr Menzies absence).' [Symonds 1985, p.17]

It can be seen from this illustration that the 'need to know' principle was being rigorously applied. The Minister for Supply knew nothing about it because, in answer to a question in Parliament on 29 June 1951, he described as 'completely false' and 'utterly without foundation' a report that 'Australia would provide an area for the testing of atomic weapons, including atomic bombs' [RC 800, p.510040]. There is no evidence that the Minister was subsequently embarrassed by this misinformation.

12.1.10 The Australian Prime Minister's commitment to secrecy was indeed extreme. A press report of 22 June 1951 records Menzies as saying that he had heard nothing about a report that Britain would explode its first atom bomb in Australia [RC 800, p.510066].

12.1.11 Meanwhile, the British were still hoping to gain access to the US range and facilities. In a cable message to Menzies, dated 26 March 1951, Attlee indicated that the Americans

'...have replied that they are not in a position to consider the loan of such facilities to the United Kingdom until they are ready to put forward proposals which they are at present considering for cooperation with the United Kingdom in respect of the military uses of atomic energy...My colleagues and I have decided that to wait any longer for the Americans would mean subjecting our plans to an intolerable delay.' [RC 800, p.510008]

12.1.12 Attlee went on to ask whether the Australian Government would agree formally that 'if necessary' the trial go ahead on the Monte Bellos. As late as October 1951, however, the British were still hoping for US agreement and Penney was sent to the United States to try to secure that agreement. In his evidence, he said, in answer to a question about the availability of Nevada

'They did not say that Your Honour. What they said [was] you could go to one of our sites - they had two, one in the Pacific, one in Nevada - providing certain things are done...they would do the tests and they would want a drawing of exactly what was in it; that kind of information. And our Government said: "No,

that is unacceptable"; but I would have taken it...and the reason was I wanted to get back to Anglo-American collaboration. That was the reason.' [Trans., p.4312]

12.1.13 A further issue of relevance was that the British wanted to let the weapon off under water and the Americans did not have a site which would offer such an opportunity.

12.1.14 So the British had a dilemma. Even though they were forced - by the American attitude - to look to Australia as a site for firing their weapon, British authorities were still hopeful that relations might improve, hence Britain was bound by the *modus vivendi* not to pass on American information to Australians. Although 'going it alone' held some attractions, these attractions were mainly aimed at proving to the United States that Britain had something to offer, and that a closer relationship on atomic matters represented value to the United States. As will be seen later, US concern about Australian security added an extra dimension to the need to ensure that the UK/Australian relationship did not alienate the Americans.

Conclusions

12.1.15

(a) The Royal Commission received no evidence to disturb the overwhelming impression that the decision to make the Monte Bello Islands available to the United Kingdom for the purpose of the latter's first nuclear test was taken by Australian Prime Minister Menzies without reference to his Cabinet.

(b) The decision was also taken without the benefit of any scientific knowledge of the hazards that would be involved.

(c) There is no documentation to suggest that Menzies was informed of the long-term program that the British had in mind once they abandoned the United States as a possible site for their first test, but it is likely that he was given at least a broad outline.

12.2 Operation Epicure

12.2.1 As stated above, the decision to agree in principle to the use of the Monte Bello Islands as a test site was taken by the Prime Minister, in consultation with two other Ministers at the most. After Menzies agreed in September 1950 to a reconnaissance of the Monte Bellos, the Secretary of the Department of Defence was nominated by Menzies as the major Australian co-ordinator on all detailed matters. A cover plan, named 'Operation Epicure' was established and a very limited

number of Australian servicemen and officials were briefed. It is interesting to note the terms of a minute of 9 July 1951 to Mr E J Harrison, Acting Minister for Defence (who had been the resident Minister in London when the proposal had first been made to Menzies) from the Acting Secretary in which he stated

'...at the request of the United Kingdom Government, full knowledge of the operation in Australia is confined on the ministerial level to the Prime Minister, Mr McBride and yourself, and on the departmental level, to the members of the Defence Committee and their deputies, the Director-General of Security, the Secretary, Department of Defence Production, the Chief Scientist, Department of Supply, and certain selected officers in the Defence Department...' [RC 800, p.510060]

12.2.2 It may be unfair to make a literal interpretation of this statement but, quite clearly, it would today be unthinkable for any foreign government to tell an Australian Prime Minister which of his Ministers and officials might be given certain information. It is also interesting to note that although the Chief Scientist of the Department of Supply (and eventually his permanent head, Mr Breen) was briefed, his Minister was not.

12.3 Operation Hurricane

12.3.1 When he received the UK request for formal agreement for the use of the Monte Bello Islands, Menzies replied that it would be inappropriate for him to give a definite answer as the Federal elections were imminent. It does bear mention, however, that he indicated to the UK High Commissioner in Canberra that although he regarded it as 'essential' that the Leader of the Opposition be taken into his confidence,

'...he did not feel that he could talk to Mr Chifley whilst the election heat was on about so highly important a matter as this.' [RC 558, p.125]

12.3.2 After the Menzies' Government was returned to office, the United Kingdom Government was informed - towards the end of May 1951 - that Australia was agreeable. There is no reason to believe that consultation was any wider in reaching the decision to agree formally. At this stage, the only advice available to Menzies in relation to safety aspects was the apparently unfounded, but certainly enormously optimistic, statement in Attlee's message of 26 March 1951 that

'...the effect of exploding an atomic weapon in the Monte Bello Islands will be to contaminate with radio activity the north-east group and this contamination may spread to others of the islands. The

area is not likely to be entirely free from contamination for about three years...' [RC 800, p.510010]

12.3.3 In the present-day context, it would be difficult to justify the limited level of consultation in Australia for decisions of such magnitude. This is particularly so when the range and complexity of the issues involved are examined. In a letter of 18 October 1951 to the Prime Minister, the Minister for Defence pointed out that

'...much greater expenditure will be needed before and during the tests...' and '...as we are not undertaking any atomic research we will get little if any direct benefit from having the tests conducted in this country.' [RC 800, p.510120]

12.3.4 There was some ongoing interchange of information at the official level and a Hurricane Panel (Australian) was established. But the problem of who knew and who should know was a continuing and recurrent one, often causing a shortage of knowledge in some crucial areas. On the whole, however, as the project progressed and security was downgraded in some areas the frustrations of maintaining a tight control on information were reduced but never completely absent.

12.3.5 It needs to be understood that the process of passing information to Australian officials at this stage was carried out so that they could assist with the conduct of the test, not for any other reason.

12.3.6 The British attitude is apparent in an incident involving an embargo on the mention of certain topics related to the proposed test. The Australian press became annoyed - quite justifiably - when it found that it could not repeat material which had already been published in London newspapers after 'leaks' had reached Australian Associated Press. The British officials first said that there was no attempt in the United Kingdom to restrain the press from using material to which it already had access; this seemed odd to the Australians as a 'D' Notice was apparently in force there. The Secretary of the Prime Minister's Department, Mr A Brown, was later told in London that the instructions had been prepared to enforce an embargo with respect to all aspects of weapon production and design in Britain and the question had not been considered until it was too late. Brown, in a letter of 11 July 1952 to Sir Frederick Shedden, referred to

'...very considerable disposition on the part of the United Kingdom authorities to adopt what I regarded as an "holier than thou" attitude, i.e. to assert that censorship was a bad thing in itself and that the United Kingdom would not have anything to do with it but, of course, those benighted Australians needed it.' [RC 800, p.520300]

12.3.7 On 29 October 1951, Vice Admiral Sir John Collins, Australian Chief of Naval Staff, raised with the Secretary of the Department of Defence, concerns about the desirability of a joint UK/Australian press release being prepared for issue if necessary, and

'...one consideration which applies to Australia only, and that is the possible after-effects of this project as regards the Australian mainland and its inhabitants.' [RC 800, p.510123]

12.3.8 It was not until after the UK authorities advised the Australian Prime Minister on 27 December 1951 that British authorities had decided to go ahead with the test in Australia that questions relating to publicity, finance, safety and Australian representation at the tests were addressed.

12.3.9 On 24 January 1952, Menzies wrote to the UK High Commission, raising the issues referred to by Sir John Collins. On the question of after-effects, he wrote

'The only persons in a position to make an authoritative statement in this regard are the United Kingdom scientists who know the precise nature of the experiment and who are now in possession of the necessary meteorological data to estimate its after-effects. From the point of view of the Australian announcement, some categorical and authoritative statement will be necessary that the effects will be innocuous.' [RC 800, p.520058]

12.3.10 This unquestioning approach lay at the very heart of the Australian Government's agreement to British requests thus far.

12.3.11 On 29 January, the 'categorical' statement was conveyed in a letter from the UK High Commission to the Prime Minister, together with a request that it not be made public until a full statement was settled [RC 800, p.520064].

12.3.12 On 17 February 1952, the following statement was issued:

'In the course of this year the United Kingdom Government intend to test an atomic weapon produced in the United Kingdom. In close co-operation with the Government of the Commonwealth of Australia, the test will take place at a site in Australia. It will be conducted in conditions which will ensure that there will be no danger whatever from radio-activity to the health of people or animals in the Commonwealth.' [RC 800, p.520080]

12.3.13 On 18 February 1952, a Cabinet Minute recorded that 'the Prime Minister informed Cabinet of his intention to release a press statement concerning the testing of an atomic weapon in Australia' [RC 800, p.520091].

12.3.14 The British attitude at this stage is epitomised by the terms of a message on 5 March 1952 from Mr E L Sykes of the Commonwealth Relations Office to the UK High Commissioner in Canberra, Mr Cockram:

'We hope that, now that the announcement is over, there will be no further pressure from the Australian side for fuller details, or for information about the grounds on which this assurance was given.

'For your own information only, it is now felt here that it would be a mistake to pass any detailed memorandum on to the Australian authorities, for this would be of little value to Mr. Menzies without the comments on it of his own scientific advisers, and this in itself might lead to an embarrassing situation. For example, the Australians might disagree with the United Kingdom scientists' assessment of the risks, or they might suggest that, in order to ensure that necessary precautions against contamination were in fact taken, Australians should be allowed closer to the scene of the test than we at present propose. If therefore any request for further information on this subject is made to you, you should do your best to dissuade the Australians from pressing it. If the worst comes to the worst we should have to consider providing some further assurance, but we would not pass on the data on which the assurance was based.' [RC 800, p.520099]

12.3.15 In a letter dated 28 April 1952, Sykes went a little further:

'From our own experience therefore we are convinced that, in existing conditions and until the McMahon Act is substantially further amended, the United States Administration would be unlikely to pass classified information to Australia, however satisfactory Australian security arrangements might be.

'So far as the United Kingdom is concerned, our need for technical co-operation with the Americans has diminished with the progress which we have made in developing our programme on our own. Nevertheless, much of the information required to assist another country like Australia in developing its programme is classified and under the terms of the existing tripartite arrangements, we (and also the Canadians) are bound to consult the Americans before divulging such classified atomic information to other countries.' [RC 559, Bundle B, p.99]

12.3.16 A cable from the Secretary of State for Commonwealth Relations to the UK High Commissioner indicated that Menzies had been advised in London that full Australian participation on technical aspects of the test was impossible and that he 'has completely accepted' this position [RC 559, Bundle B, p.22].

Conclusion

12.3.17 The Australian Government willingly accepted the British view that, by the terms of its agreement with the US, the UK was prevented from providing information on, or allowing Australian participation in, technical aspects of the tests.

Australian Participation

12.3.18 In his message of 27 March 1951, Mr Attlee wrote

'We hope you will be willing to help with the preparation of the site for the test and with the logistic support of the expedition which will be needed to conduct it; we should be glad to arrange for your experts to take part in observation of the effects of the test. We can settle later details of finance and machinery.' [RC 800, p.510009]

12.3.19 In a letter of 5 January 1951, Mr M W Perrin of the Ministry of Supply wrote to Mr R Hunt of the Commonwealth Relations Office requesting that Menzies be asked whether the services of Titterton could be made available for the Monte Bello test. It was considered by the British that he '...would be able to make a very valuable contribution...' The letter goes on to say that '...we believe that Dr Titterton would be prepared to do the necessary work in connection with the Monte Bello test...' [RC 467].

12.3.20 Titterton had been a member of the British team which took part in the first post-war atomic bomb tests at Bikini in July 1946. An expert in telemetry, he was the instrumentation group leader at Los Alamos and remained there until the spring of 1947 when the 'Congressional witch-hunting about the members of the United States Atomic Energy Commission' was 'in full swing' [Gowing 1974, Vol.1, p.113], and he returned to Harwell. In 1950, Titterton was appointed to the Chair of Nuclear Physics at the Australian National University to work with Professor Oliphant. This raised a difficulty for the British. A cable from the Commonwealth Relations Office to the UK High Commissioner on 1 April 1952 in Canberra pointed out that

'He [Oliphant] is Titterton's superior and he has written to Cockcroft indicating that he expects to be present. But apart from other considerations it is

certain that if he took part in the test the Americans (who regard him as a doubtful security risk) would react very unfavourably. This would make it more difficult to use the test as a means of securing better co-operation from the Americans in future. Oliphant is unquestionably talkative and would give the impression (whether true or not) that he was in possession of all the secrets. It is therefore in the general interest that he be kept away.' [RC 558, p.260]

12.3.21 This cable also addressed the question of the roles of Australians and what information could be passed on to them:

'We have considered what technical assistance we should like from Australians and could usefully use during the test.

'We hope Mr Menzies will make Dr Titterton available to help in the field work on telemetry. We would arrange for him to be given certain other data (within limits imposed by security rules) which would be of interest and use to Australians in relation to weapon effects from point of view of civil defence.' [RC 558, p.260]

The cable also asked for the services of

'...two junior Australian technicians...on tasks of low security classification.' [RC 558, p.260]

12.3.22 A number of points are quite clear from this cable:

(a) The only interest the British had in Australian representation at the tests was the assistance it might be able to provide - there was no consideration, at this stage anyway, of the possibility that Australia might wish to make her own assessments of safety. Indeed, if the Sykes/Cockram letter referred to in para.12.3.14 is any guide, the less Australians knew, the better.

(b) As little information as possible was to be passed on to Australians.

(c) American views on the UK's conduct of the test were of paramount importance.

(d) Titterton was selected by the British to perform a particular task for them.

12.3.23 In the event, Titterton was asked by Menzies to participate in the test on behalf of the UK authorities and Oliphant was not. Titterton's recollection was that he was first approached in April 1952 by the Secretary of the Prime Minister's Department. This evidence cannot be accepted. His understanding

of the motivation for the approach was so that people in Australia could share in the project (Titterton was not Australian) and also that safety concerns could be satisfied [Trans., p.7614]. Titterton said that he knew nothing of the tests before he was approached by Brown.

12.3.24 It is inconsistent with a letter he wrote to Brown on 6 March 1953 in which he stated that

'...before coming to Australia, Sir William Penney asked me to act as Technical Director for the Monte Bello test but because of my commitments to the ANU, I felt unable to accept this offer.' [RC 525]

12.3.25 The letter of 5 January 1951 from Perrin to Hunt (see para.12.3.19) also implies that Titterton had been approached about participating in the test before he left for Australia.

12.3.26 The United Kingdom Government was certainly rigidly adhering to the requirements of the McMahon Act. In fact, as Gowing puts it,

'...the Americans themselves were much less inhibited than the British; they tended to be much more forthcoming to the Australians than they would allow the British to be...' [Gowing 1974, Vol.1, p.337]

12.3.27 Indeed, it seems that the British over-reacted and were content to make assumptions about American attitudes rather than argue Australia's case for access to more information.

12.3.28 Stringent restrictions were placed on the information which could be passed to service officers on the Hurricane Panel. They received information on survey, construction, tidal and meteorological requirements but not the basic data relating to weapon testing and fallout. On one occasion, fallout data were assembled and passed on in a form which was to provide an assurance to the Australian Government that the mainland would be safe from the effects of the test, but the data were not sent to the Panel. Technical information was kept out of communications at the official level so that there was little need to consult Australian scientists - a situation which the UK appeared keen to maintain.

12.3.29 By the beginning of August 1952, with the exception of two 'junior technicians', scientific representation was to be restricted to Titterton. The technicians were there to assist the British team and, although Titterton stated in evidence [Trans., p.7619] that he had a brief from Menzies to 'make certain that there will be no adverse effects on the Australian people, flora and fauna, and in particular the aborigines', there is no documentary evidence to support this. Indeed, the British regarded his services as being at their disposal. His American security clearance and the fact that he was well known to the

Americans made him an attractive proposition, and he was an extremely useful resource in terms of his skills and experience. The fact that Titterton was regarded as a member of the British team is borne out in an examination of the documents relating to the appointment of Martin as an official Australian observer.

12.3.30 On 15 August 1952, Penney drafted a letter to the UK Paymaster-General, Lord Cherwell, in the following terms:

'We have not treated the Australians very generously in the way of inviting their scientific help, and the invitation to Prof. Martin would, I think, give them pleasure and would make them feel that we were not attempting to use their land but at the same time were keeping them out.

'When I make my report on the technical feasibility of the Woomera region, the Australians would have a man of their own to whom they could turn for advice.'
[RC 559, Bundle B, p.252]

12.3.31 The generosity of this approach was somewhat weakened by the fact that it was tied to Penney's interest in future mainland tests:

'When I leave in early September, I shall go straight to Woomera, to study a site about 300 miles to N.W. in order to see if the site would be suitable technically for A.W. trials...It seems to be a good idea that, when I make my appreciation of the technical possibilities of this site, I should have the support of an Australian scientist.'
[RC 559, Bundle B, p.252]

12.3.32 In a letter of 19 August 1952, Mr How of the Ministry of Supply wrote to Mr Saner of the Foreign Office in the following terms:

'The Commonwealth Government are likely to be nervous about allowing the use of a site in the heart of the continent for atomic weapons tests, and may have to face criticism from their own people. It is obviously desirable that one of their own scientists should be able to advise them from first-hand knowledge, and it seems right to use the Monte Bello test as an opportunity for indoctrinating such a scientist.'
[RC 559, Bundle B, p.256]

12.3.33 Although some Australian personnel (see L Beadell's book 'Blast the Bush') had been used to reconnoitre this site, and Menzies may well have had some idea of the long-term program that the British had in mind (Titterton said that Menzies had been 'extensively briefed in the UK' [Trans., p.7619]), no official approach had yet been made to the Australian Government.

12.3.34 At about the same time, prompted (if not annoyed) by the knowledge that Canadian scientists would be attending the test as members of the British team, Collins wrote to the Secretary of the Department of Defence:

'I feel the time has come to make an approach to the UK authorities regarding official scientific Australian representation and suggest that the matter might be discussed, without being listed, at the next Defence Committee Meeting. It would seem that the Defence Scientific Adviser (Professor Martin) would be a suitable nomination and there may be others.' [RC 800, p.520512]

12.3.35 The Defence Committee and the Hurricane Panel were surprised at the rather insensitive and exclusive tone of the UK offer [RC 800, p.520582].

12.3.36 Collins also referred to Titterton's presence at the trial and said that he was 'attending apparently by private agreement'.

12.3.37 Moreover, an Australian press release, issued on 13 August 1952, stated

'It was announced in Canberra today that Professor E W Titterton, Professor of nuclear physics at the Australian National University, will be attached to the team of scientists assigned by United Kingdom Ministry of Supply to forthcoming atom test.' [RC 558, pp.247, 249]

12.3.38 In the light of this, it is difficult to accept Titterton's evidence that he was asked by Menzies to be the Australian watchdog of safety. A further indication appears in a letter of 18 September 1952 from Mr How of the Ministry of Supply to Mr Curson in the Commonwealth Relations Office in which he described Titterton as

'...the only person engaged in the test who is entirely freelance and not an employee of any of the Governments concerned.' [RC 559, Bundle B, p.291]

12.3.39 It is far more likely that even the request to have Martin, and later Butement, was motivated by national pride rather than any desire for a 'second opinion'.

12.3.40 On 22 August 1952, Captain Hutchinson, Head of the UK Services Liaison Staff Office in Australia was instructed to convey to Martin, from Penney, a message that

'Ministerial approval has now been obtained here for extending to you a cordial invitation to go to Montebello [sic] as a member of the Health Physics

Team. You will be given access to all weapons effects, all measuring apparatus, and all details of layout of site. In particular we should like you to work on with the meteorologists following movement of contaminated clouds.' [RC 800, p.520513]

12.3.41 It needs to be noted that this message contained no mention of restriction of access to information. It was couched in terms which made it clear that Martin would be performing a particular task and did not suggest that he would be an official observer.

12.3.42 The request for a Government to Government approach came the following day in the form of a cable to the Acting UK High Commissioner. The cable linked the invitation to Penney's future trip to Woomera and furthermore, stated that

'He [Martin] would not be given any access to the weapon itself nor to the results of the measurements of weapons functioning.' [RC 800, p.520515]

12.3.43 That approach was made in a letter from the UK High Commission to Mr McKnight of the Prime Minister's Department on 27 August 1952. Of note is the reference to a public announcement:

'...they [the UK authorities] would have no objection provided...the phraseology was the same as that used in the draft Press announcement about Professor Titterton...' [RC 800, p.520534]

12.3.44 There is, quite clearly, no concept of an 'official Australian observer'.

12.3.45 McKnight recommended to the Prime Minister next day that

(1) Penney may inspect Woomera, but without prejudice to the question of whether a trial should be conducted there;

(2) Martin can accompany him to Woomera;

(3) Martin can participate in the Monte Bello tests.'

He added:

'Defence are disposed to favour Martin's participation.' [RC 800, p.520536]

Menzies concurred.

12.3.46 Meanwhile, at a meeting of the Defence Committee on 28 August 1952, it was agreed that

'...the Prime Minister should be asked to request the United Kingdom Government to invite the Defence Scientific Adviser to be present in order that he might be fully acquainted [sic] with the details of the tests.' [RC 800, p.520547]

12.3.47 The letter from the United Kingdom High Commission to McKnight was referred to the Defence Committee and considered by it on 4 September 1952 with Martin being present. The restrictive nature of the information to be passed to Martin drew considerable offence and the Committee decided to recommend to the Prime Minister that the invitation 'was an insult and that it should be declined'. One member apparently suggested that 'the United Kingdom can be told to stuff their bomb up their jumpers' [RC 800, p.520599].

12.3.48 When Hutchinson became aware of the Defence Committee's attitude, he alerted Cockcroft, Director of AERE Harwell, who was in Canberra. Cockcroft then sent a personal message to Martin making no mention of the Committee's discussion but

'...eulogising the importance to Australia of the opportunity to study the health safety factor and the plotting of the radioactive cloud, and playing down the business of access to the weapon itself.' [RC 800, p.520599]

Hutchinson himself pointed out that

'...a refusal to accept the invitation would not only deprive the United Kingdom of his assistance and Australia of the experience but would also make rather invalid any further Australian criticism of lack of opportunity to be fully associated with the test.'

He concluded with the gratuitous remark that

'...I'm afraid that I find the Australians are better at standing on their dignity than on their feet. They look for insult where none is intended, far too often.' [RC 800, p.520600]

12.3.49 McKnight subsequently replied to the UK High Commission accepting the offer for Martin to accompany Penney to Woomera (his attendance at the Monte Bellos had already been agreed). He highlighted the sensitivity of this aspect by requesting that future references to this matter be classified 'Top Secret'.

12.3.50 The Secretary of the Department of Defence was

'...very alarmed at the way in which the letter coupled the attachment of Martin to the Monte Bello test with the possibility of a further series of tests, when this

matter had barely reached the discussion stage with officials, let alone the Government.' [Symonds 1985, p.58]

12.3.51 Cockcroft saw the Menzies early in September and asked whether the UK might have facilities on the Woomera Range for further tests, if desired. Menzies - again with little or no consultation with his Ministerial colleagues or any advice from officials - indicated his agreement in principle [RC 559, Bundle B, p.276].

12.3.52 On 19 September, the Secretary of the Prime Minister's Department wrote to Cockram, the Acting UK High Commissioner, seeking confirmation that Martin's attendance would be

'...in such a capacity as would enable him to acquire the fullest information on the details of the test relating to weapon effects and the layout of the site. It was not intended that he should have access to the weapon itself nor its intimate functioning. The Australian authorities agree that at this stage we are not interested in the weapon itself but only in its effects and the general set-up of the test.' [RC 559, Bundle B, p.296]

12.3.53 There was still no suggestion of Martin playing a safety role.

12.3.54 Cockram wrote back to Brown on 29 September 1952, informing him that Professor Martin would have '...full details of all weapon effects and the layout of the site' [RC 800, p.520658].

12.3.55 The Secretary of the Department of Supply sought Cockcroft's agreement that his Chief Scientist, Butement, might also attend the trial. The request was passed on to London by Cockcroft on 4 September 1952. Cherwell was not too happy about the request but realised 'that it is not possible to refuse...unless lack of accommodation provides a valid excuse'. He asked Penney to confirm that Butement would 'have no access to vital efficiency data' [RC 559, Bundle B, p.289]

12.3.56 Formal agreement for Butement's attendance under the same conditions as Martin was conveyed to the Prime Minister's Department on 29 September 1952 - the same letter finally setting out the conditions of Martin's attendance.

12.3.57 Two Australian meteorologists were present at the test, Mr Ashton and Mr Phillipot, but responsibility lay with the British Meteorology Group leader, Commander Westwater; they were there to report on the existing and predicted weather conditions, but not to advise whether the conditions complied with the various firing criteria. As has been mentioned above, the UK authorities sought the services of two junior Australian

technicians: the two who were provided, Squadron Leader A D Thomas, Scientific Adviser to the Chief of Air Staff and Brigadier Wardell, the Director of Civil Defence, were neither 'junior' nor 'technicians'.

12.3.58 Titterton arrived at the Monte Bellos on 21 September after receiving from Penney '...quite a bit of the vital information...' including '...the nature of the bomb...' and '...what the probable yield might be', on a Hastings aircraft flying from Melbourne to Onslow [Trans., p.7620].

12.3.59 In view of his capacity to receive British atomic secrets without a security problem, and having regard to the fact that an express limitation was imposed on the information which could be given to Martin and Butement, it is likely that Titterton was given significantly more information than the Australian scientists.

12.3.60 Butement arrived on HMS Campania at the same time as Penney, and Martin arrived several days before the explosion.

12.3.61 The extent to which Titterton and the two Australian scientists were involved in the decision as to whether it was safe to fire Hurricane is unclear. There is no documentary evidence to support a proposition that they had a power of veto nor that the Australian Government saw them as carrying out an independent safety role. From the point of the view of the British Government, Martin and Butement were there on sufferance rather than from a genuine wish to involve Australian scientists. On the basis of the documents cited above, it is a reasonable conclusion that Lord Penney in his evidence was confusing the situation at Hurricane with that at the later tests when he said that the Australians did have a power of veto [Trans., p.4327]. Similarly, Martin and Butement could not have been given sufficient information, in the very short time available to them, to allow them to use such a power properly even if they had it. They were 'passive observers'. The most likely situation is that they were given sufficient information to carry out adequately those tasks which the British felt they needed to know.

Conclusions

12.3.62

(a) At the Hurricane trial Australian scientists did not have sufficient information to advise the Australian Government whether the weapon could be fired in conditions which would represent no hazard to the Australian mainland.

(b) The Australian Government was, therefore, placed in a position where it was forced to accept UK assurances on the safety aspects of the tests without any critical examination by its own scientists.

The Press and the Public

12.3.63 As has been shown above, the attitude of the United Kingdom authorities was to allow as little public announcement of what was going on in Australia as possible. From Australia's point of view, no statement was issued without clearance from the United Kingdom.

12.3.64 The announcement of 19 February 1952 indicating that the test would only be conducted when there was 'no danger whatever from radioactivity to the health of people or animals in the Commonwealth' was based purely on advice from the UK Government.

12.3.65 The Australian Prime Minister was prepared to mislead the press (see para.12.1.10) and knowledge of the early planning for the test was so restricted that the Minister for Supply, Mr Beale, was able to inform Parliament that a report that Australia was to be host for an atomic test was absolutely false (see para.12.1.9).

12.3.66 The Directorate of Forward Plans in the Ministry of Defence in London saw things even more clearly:

'...the Prime Minister has instructed us to mount an operation to deceive the enemy about the time of the trial...we should interpret this directive as authorising us to convey the impression that the trial will in fact take place about five weeks later than the actual target date...Separately from this operation we should attempt to confuse the enemy about the nature of the trial...' [RC 558, Bundle B, p.274]

The Royal Commission was never informed of the identity of 'the enemy'.

12.3.67 Another announcement was made on 15 May 1952:

'The test of the United Kingdom atomic weapon in Australia will be carried out at Monte Bello Islands off the north-west coast of Australia as a joint operation involving the three fighting services and the [UK] Ministry of Supply. The operation will be under the command of Rear-Admiral A.D. Torlesse, and the test will be under the scientific direction of Dr. W.G. Penney, of the Ministry of Supply. Besides Her Majesty's ships ZEEBRUGGE and NARVIK which have already sailed carrying a detachment of the Royal Engineers, and stores, the special squadron will consist of Her Majesty's ships CAMPANIA Flag Ship, TRACKER and PLYM. These latter ships are being specially fitted to transport the scientific staff and test equipment and are expected to sail in about two months' time. Units

of the Royal Australian Navy and Royal Australian Air Force will work with the special squadron in Australian waters.' [Symonds 1985, p.63]

12.3.68 There was some Parliamentary debate when the Defence (Special Undertakings) Bill 1952 was introduced into the Australian Parliament.

12.3.69 Reference has already been made to press criticism about the operation of 'D Notices' in Australia. Stories originating in Australia were very limited because of the paucity of official press releases, the small number of people who knew anything about the program, and the security restraints on those who did.

12.3.70 The presence of extra ships and aeroplanes in the period immediately before the test provoked some comment. **The Advertiser** ran two articles from Titterton under the headlines, 'Ban War, rather than Atomic Weapons' and 'Tactical Use of Atom Weapons'.

12.3.71 On 11 September 1952, **The Age** carried a story that in an aura of mystery almost unprecedented even in the atomic age, the British would explode their first atomic weapon.

12.3.72 By mid-June 1952, after an approach from the press, Collins wrote to the Secretary of the Department of Defence outlining the Hurricane Panel's concern about the provision of information to the media. The Panel felt that it would be practicable to provide some background articles to outline the amount of Australian effort going into the test.

12.3.73 Some articles were eventually prepared, the first appearing after 20 August and others at weekly intervals up to 24 September.

12.3.74 In February 1952, consideration was given to the questions of possible press attendance at the test and what announcement could be made after the trial. It was decided that no members of the press or other observers would be allowed to witness the test first-hand. There are accounts of how members of a small press contingent made their own arrangements and set themselves up on Mount Potter (55 miles (88 km) from the Monte Bellos) with telephoto lenses and captured photographs of the atomic cloud.

12.3.75 The question of the release of a statement after the test had taken place did exercise the minds of British officials. On 15 February 1952, Cockram wrote to the Secretary of the Prime Minister's Department, Brown, stating that this matter needed to be carefully considered. He wrote that the test would have

'...considerable effect on the American attitude towards atomic co-operation with the United Kingdom

and, indeed, on Anglo/American relationships in general. If we are to secure the full benefit of the fact that we have been able to produce an atomic weapon on our own we would do well to see that the press (American as well as UK and Australian) have adequate information about the test. On the other hand the trial is the first scientific test of a new British weapon in its experimental form. Success cannot be guaranteed and failure in public even if temporary, would be damaging.

'In these circumstances, the strong recommendation is that the press should be excluded altogether, but that special care should be taken to ensure that the best possible arrangements are made for a good service of official communiques...' [RC 800, p.520079]

12.3.76 Further, on 31 March 1952, he again wrote to Brown:

'(a) any official announcements which may be required...would be agreed before issue between the United Kingdom and Australian Governments;

'(b) ...Immediately after the explosion there should be a short communique...agreed in advance with the Australian Government. Speed of issue would be essential and to this end the intention is that the communique would be issued in the United Kingdom and in Australia immediately after the receipt of a pre-arranged code-word...

'(c) ...In order to extract the greatest prestige and benefit while still observing the strictest measure of security, it is proposed that the American practice for Eniwetok tests should be followed and that the bald communique should be supplemented by a press conference held in London...' [RC 559, Bundle B, pp.55-6]

Conclusions

12.3.77

(a) There was virtually complete government control of the Australian media reporting of the Hurricane test and the lead-up to it, thus ensuring that the Australian news media reported only what the UK Government wished.

(b) There was no opportunity for the Australian public to have an understanding of the nature of the Hurricane test and so make any critical analysis of the conduct of it. This was to be a recurrent theme throughout the entire weapons testing program.

12.4 Operation Totem

12.4.1 The documentation relating to the steps and processes leading up to the Australian Government's 'in principle' decision to allow the United Kingdom to use an area in Central Australia to test an atomic weapon is vague and incomplete. Certainly the whole matter was shrouded in a veil of secrecy which, by virtue of the lack of contemporary documentation is hard to penetrate.

12.4.2 The very early references in UK documents in 1949 and 1950 to the possible use of Australia as a site do mention the Woomera Rocket Range. As has been seen, the wish for the first test to simulate an explosion in a harbour led to the choice of the Monte Bello Islands. Nevertheless, the British were embarking upon a program of weapon testing and future tests would need a mainland site. The logistics involved and the need for speed precluded using the Monte Bellos again in the time-frame envisaged, as did the necessity to test component parts of the weapon and to set up complete target response items at varying distances to gauge the effectiveness of the weapon.

12.4.3 It seems inconceivable that, when he was in London in 1951, Menzies was not told of the longer-term planning that was in mind but there is no evidence to support this assumption.

12.4.4 It is quite clear, as has been mentioned above, that the somewhat casual reference, in a letter from the UK High Commission to the Prime Minister's Department, to Penney's visit to Woomera on the way to the Monte Bellos for Hurricane caused some concern to Australian officials. There is no question that a number of high ranking Australian officials knew of the UK's longer-term plans and the channel appears to have been through the UK Ministry of Supply staff in Australia to the Departments of Supply and Defence. In his book '**Blast the Bush**' [Beadell 1972], and in evidence before the Royal Commission [Trans., p.3497], Beadell indicated that he was asked, about the middle of 1952, to find a suitable area in the bush - some 300 miles west of Mabel Creek Station. There had been interchanges between UK and Australian officials for some period prior to that. By 4 August 1952, Penney had decided to make a visit to Woomera on his way to the Monte Bellos for Hurricane.

12.4.5 However, Shedden's concern stemmed from the fact that although some select officials [see, for example, RC 800, p.520635] were 'in the know', the matter had barely reached the discussion stage at that level. No formal approach had been made to the Government [Symonds 1985, p.117]. As has been seen above, the concern was accompanied by some chagrin at the low level of information which it was intended be passed on to Martin. This is a matter which warrants more examination.

12.4.6 Reference was made above (para.12.3.32) to the desirability - from the UK point of view - of 'indoctrinating' an Australian scientist at the Monte Bello test so that, in the

event that the Australian Government has to 'face criticism from their own people...one of their own scientists should be able to advise him from first hand knowledge' [RC 559, Bundle B, p.256]. The official approach, to the Australian Government dated 27 August 1952, was couched, of course, in somewhat different terms:

'...during his visit to Australia Dr Penney would be going to Woomera to study a site which might be suitable technically for further atomic weapon trials. The main problem is likely to be health safety and health safety (at 100 to 500 miles distance) needs careful study. It is suggested that it would be very helpful if Dr Penney could have the support of an Australian scientist on this aspect...' [RC 800, p.520534]

12.4.7 Shedden, recognising the significance of the fact that the Hurricane test 'is possibly the beginning of a series of further trials to be conducted at Woomera' suggested to the Prime Minister's Department that it was 'essential to establish the place of the Australian Government machinery' [RC 800, p.520617]. He referred specifically to

'...the need for the Defence Scientific Adviser to acquire the fullest information to assist him in advising, from the Australian viewpoint, on the technical feasibility of the use of the Woomera region for future tests.' [RC 800, p.520530]

Martin did not join Penney on the visit to Woomera although Butement did.

12.4.8 On 4 September (about two weeks before Penney's visit to Woomera), Cockcroft saw Menzies in Canberra and, during discussions on a number of matters relating to atomic energy, asked whether the United Kingdom might have facilities on Woomera Rocket Range for future tests if desired. In a cable to Sir Roger Makins, Cockcroft wrote that Menzies was agreeable in principle and also that he agreed to Penney making a reconnaissance for future sites [RC 559, Bundle B, p.276].

12.4.9 There is no record of Mr Menzies being briefed or consulting anyone before reaching this decision.

12.4.10 Any estimate of the capacity of Australian scientists to make balanced judgments of the appropriateness of Emu as a site for future tests on safety grounds needs to be weighed against the information they were given. Cherwell's telegram to Penney in relation to Hurricane should be recalled:

'Have agreed somewhat reluctantly about Butement. Assume he will not have access to efficiency data.' [RC 800, p.520645]

and the terms of Martin's attendance:

'...he will not be given any access to the weapon itself nor to the results of the measurements of the weapons functioning.' [RC 800, p.520534]

At this stage, no information about Totem had been promulgated. It would not seem possible for either of the Australian scientists to perform the function of advising the Government properly on the suitability of the Emu site prior to the in-principle decision.

12.4.11 In any event, there is no record of a report from Butement or Martin to the Prime Minister or the Minister for Defence in these terms. On the other hand, there was a very detailed cable from Penney to Cherwell and the Minister for Supply on 23 September:

'...the site, the aeroline base and the laboratory site offer great attractions for air burst drops from aircraft and for tower bursts. I consider the risks of contamination at one hundred to one thousand miles are too great for ground or underground burst at least in the first instance. As I anticipate only one burst of each type will be required I shall probably reconsider one more trial at Monte Bello two years from now exploding statically one weapon of the present type but small fissile charge and one weapon of the urgent experimental type.' [British Admiralty Records; quoted in Symonds 1985, p.118]

12.4.12 There is no documentary evidence that the Australian Government or its officials had any knowledge of this long-term program; the only agreement which had been given was Menzies' in-principle agreement consequent upon the feasibility study on Emu.

12.4.13 The general atmosphere and the decision-making process are well demonstrated by the fact that notices were prepared for Emu Field and the Long Range Weapons Project areas to be declared under the Defence (Special Undertakings) Act 1952, and the South Australian Premier was consulted by the Prime Minister about the proposed trials at Emu before Ministerial approval was obtained in London and before any formal agreement was made between the Australian Government and the UK Government.

12.4.14 Nevertheless, the UK Prime Minister sought Menzies' agreement while he was in London later that year. He was reported as saying that he felt that the Australian Government would certainly agree. On Friday, 12 December 1952, Cherwell handed an Aide Memoire to Menzies who handed it to Brown with an instruction to get an answer from Australia by Monday, 15 December.

12.4.15 The Aide Memoire stated that

'If desired the United Kingdom Government would be very glad to arrange for Sir William Penny [sic] to go through the calculations with Professors Martin and Titterton. Moreover, the test would only be carried out when the Australian authorities were satisfied that the necessary weather conditions were met.' [RC 800, p.521017]

12.4.16 On 15 December 1952, the following reply was sent:

'Acting Prime Minister has authorised me to say that he has conferred with the Minister for Defence and that they confirm that Australian Government will agree in principle to United Kingdom proposal.' [RC 800, p.521025]

12.4.17 It can be seen from the above that the level of information conveyed to the Australian Government was extremely limited; also the independent (i.e. Australian) advice available to it - or sought by it - was minimal as was the degree of consultation seen to be necessary at the Ministerial level to reach that decision. The offer of examination of 'the calculations' was an innovation. It would appear that the actual examination was limited to consideration of Document A32. No information was given to the Australian scientists which would have enabled them to verify the British calculations of anticipated yield. In fact, the actual yields at Operation Totem were close to 10 kt rather than the yield of 5 kt assumed in A32.

12.4.18 An interdepartmental panel under the chairmanship of a representative of the Department of Supply was set up immediately and, by January 1953, a Totem Panel was established to liaise with the UK Totem Executive (TOTEX) which had already been set up. An Australian mission led by Brigadier Lucas went to London in February 1953 and had extensive discussions concluding with their attendance at the 2nd TOTEX Meeting. The Australians were given basic information about the two trials and also the Kittens tests, which were designed to provide information about the initiator device.

12.4.19 On 3 March, Cockram, the UK High Commissioner, wrote to Brown of the Prime Minister's Department indicating that

'It is proposed to disclose to Professors Martin and Titterton details of the possible contamination at Emu Field in order that they may make their own independent evaluation of the hazards...For this purpose, information will be made available to them about the approximate yield of the weapon and an opportunity will be given to them to witness the bursts.' [RC 800, p.530258]

12.4.20 The letter went on to say that Australian personnel would be required to lift the weapons on to the firing piles and, as those personnel would learn of the size of the weapons, they would need appropriate security clearances as would other Australian service personnel who would be involved in radiological safety survey teams and hence would gain information about degrees of contamination.

12.4.21 Concern developed about the possible contamination of the mainland, and in May 1953 the UK agreed to provide Titterton and Martin with information which would enable them to make 'an independent evaluation of the hazards' [RC 800, p.530427]. Martin asked the Chairman of the Totem Panel to pass to Penney a series of questions and comments - a reply was received in mid-May.

12.4.22 A security officer was appointed to the project (known as Project X200) to implement arrangements for security of the area surrounding Emu. His role was similar to that of the security officer for the Long Range Weapon Project but was extended to include the briefing of station property managers on matters of security and nuclear safety in relation to the testing program. Security officers had the task of stressing the importance of keeping a check on the movement of the station staff and of Aboriginal people. The security officer subsequently reported that station property managers and owners had co-operated fully.

12.4.23 By mid-June, Martin and Titterton reported to the Australian Prime Minister in the following terms:

'It is possible for us to assure you that the time of firing will be chosen so that any risk to health due to radioactive contamination in our cities, or in fact to any human beings, is impossible.

'To sum up, on the basis of the information before us, we are able to assure you, Sir, that no habitations or living beings will suffer injury to health from the effects of the atomic explosions proposed for the trials.' [RC 800, p.530458]

12.4.24 This statement was patently incorrect - a fact that was acknowledged by Titterton in evidence before the Royal Commission when he said

'The impression to be given to the Prime Minister was that it was impossible for anyone to suffer serious injury.'

'Q. You were assuming, were you, Sir Ernest, that the Prime Minister would understand that the word, impossible, does not mean impossible?

'A. Yes, I am assuming that. I think he did. I had many, many talks with him...' [Trans., pp.7658-9]

12.4.25 Security was again a matter of paramount importance. The fact that trials were to take place was to be concealed for as long as possible and no official statements were to be made without the agreement of both Governments.

12.4.26 Cabinet and other Ministers were first told of the forthcoming tests on 24 June 1953 [RC 800, p.530486].

The Press and the People

12.4.27 At a meeting of the Defence Press and Broadcasting Committee on 26 June 1953, copies of a message from the Acting Prime Minister, Sir Arthur Fadden, were handed to the assembled media chiefs. The message commenced

'Within a few days a statement will be issued simultaneously in London and Canberra announcing a further United Kingdom atomic test in an isolated area of the Woomera Rocket Range.' [Symonds 1985, p.151]

It went on to say that

'(a) press and broadcasting representatives would not be allowed to witness the test as the foregoing information was most secret but "it will be our policy to see that the press in this instance is treated no less favorably than it was in regard to the Monte Bello test";

'(b) the "D" Notice applying to the Monte Bello test was to be "taken as applying to the forthcoming test".' [Symonds 1985, p.152]

12.4.28 On 25 June 1953, the Secretary and Executive Officer of the Committee had been instructed that the following information was not for publication:

- (a) technical details of the weapon design;
- (b) the precise form of the trials;
- (c) the results to be obtained;
- (d) the precise date and location of the trials;
- (e) passage arrangements for fissile material; and
- (f) nuclear efficiency and measurements so related.

12.4.29 He was also directed to inform those present at the meeting that background material would be released about

- (a) the initial survey of the area;
- (b) the survey of Sir William Penney;
- (c) work of construction personnel;

- (d) assistance given by the LRWE;
- (e) airlift operations;
- (f) the sinking of bores for water;
- (g) work of Australian scientists on safety margins;
- (h) transport of aircraft for target tests; and
- (i) co-operation of pastoral lessees.

12.4.30 The media chiefs were not pleased, especially when it appeared possible that the UK authorities were arranging that a special film report be prepared by a UK media team. A spate of editorials resulted, emphasising that the excessive veil of secrecy which shrouded the Monte Bello test had 'deprived the public of much interesting and harmless knowledge of what happened' [Symonds 1985, p.129].

12.4.31 **The Melbourne Herald** wrote

'These are trials of British weapons but the Australian Government should be using its influence now to secure reasonable facilities for the Press to report the non-technical side of what will be a landmark in British Commonwealth Defence work...Under supervision, Press reports and photographs of the Woomera test would benefit the defence effort by promoting public understanding. A complete blackout of normal news services could not be justified.' [Symonds 1985, pp.129-30]

12.4.32 Media pressure increased and Australian Government Ministers were becoming concerned. The Minister for Defence wrote to the Acting Prime Minister suggesting that the matter be taken up with UK authorities with a view to some facilities being provided for the press to observe the test.

12.4.33 On 31 July, a bland official statement was released announcing that trials would take place on the Woomera Range.

12.4.34 On 7 August, the Secretary of the Prime Minister's Department wrote to the UK High Commissioner suggesting that a limited press party might be taken to the administrative area at the site on the day of the trial.

12.4.35 No reply was received immediately and media pressure continued to build up. The United Kingdom Minister for Supply, Mr Sandys, arrived in Australia and at a meeting with press representatives on 10 September, at which Sandys, Fadden, McBride and Beale were present, the Prime Minister explained that, following discussions with Sandys, there was to be a maximum publicity approach. One photograph was provided for press representations, only still photographs were allowed and the period for photography and the movements of journalists and photographers were restricted.

12.4.36 On 8 September 1953, Evatt, the Leader of the Opposition, issued a press release seeking an assurance from the responsible Minister that a condition of adequate safety to the general public was being insisted upon [RC 800, p.530760]. Beale responded with an assurance that such precautions would be taken [RC 800, p.530761].

12.4.37 Martin was present for Totem 1 and Titterton for both tests. Australian meteorologists Ashton and Phillipot were also present but, as for Hurricane, the responsibility for endorsing meteorological advice was vested in the UK authorities.

Conclusions

12.4.38

General

(a) The decision to use the mainland for atomic tests was made without specific consideration by Australian scientists or others of whether weapons could be safely fired. Consideration was limited to the fact that Emu was a remote location.

(b) The Australian Government's agreement to make the mainland available was given with no independent advice or analysis and little consideration and consultation.

(c) Federal Cabinet was not informed, neither were the Parliament nor the Australian news media, until the preparation of the Emu site was well under way.

(d) There was no official approach to the Australian Government before Totem for approval for a long-term testing program although the UK's plans were well developed.

12.4.39

For Totem

(a) Information available to the Australian scientists on the movement and location of people was inadequate.

(b) A formal power of veto was not available to the Australian observers for Totem as was to be the case in later tests.

(c) Bearing in mind that the yield given in the document was about half that of the actual Totem explosions, the categorical and all-embracing nature of the assurance given by

Martin and Titterton gave legitimacy to the Australian Government's decision to allow the tests to take place.

(d) Although limited access to the site was given, the media was provided with almost no indication of any hazard which might arise for the Australian population.

12.5 Maralinga - A Permanent Proving Ground

12.5.1 By the middle of 1953, it was clear to the UK authorities that progress in research and development was such that a permanent proving ground would be required. The Monte Bellos were unsuitable for reasons outlined above, and Emu was unsatisfactory because of its distance from road and rail and the lack of adequate water supplies. In June 1953, the TOTEX Chairman, Elmhirst was asked by the UK Chiefs of Staff to prepare a report on a permanent site. On 17 June, Mr N Pritchard of the UK Commonwealth Relations Office recorded that he had raised with Brown of the Australian Prime Minister's Department the possibility that the UK may be making enquiries about future tests after Totem. He told Brown that the UK would consult with the Australian Government 'as soon as the preliminary investigation had got sufficiently far...'. Pritchard recorded that Brown had said that the UK experts could go ahead with their enquiries [RC 559, Bundle B, p.417].

12.5.2 It is probable that there were some discussions behind the scenes with Australian Ministers during their visits to Britain in the UK summer months.

12.5.3 A spin-off from the tight security and lack of discussion between officials and Ministers is exemplified by discussions in late 1953 about the proposed site. Butement said that he had concluded from the information available that Australia would be a 'partner rather than a mere contributor to this project' [RC 800, p.531270].

12.5.4 On the other hand, Cherwell's account of his own discussions with Menzies indicated a very different view. He said that Menzies had informed him that Australian Ministers had made it quite clear that they had no interest in atomic weapons, and that they did not wish to receive any information specifically related to the design and production of atomic weapons as they would on no account embark on any expenditure for such a program. Cherwell did comment that it would be reasonable to expect that Australia would wish to be informed on the effects of atomic weapons on people and the environment.

12.5.5 UK officials had advised the Australians that their broad planning was aimed at a series of trials in the latter part of 1955. By March 1954, the Australian Treasurer was given details of the estimated costs and the Prime Minister, in

anticipation of a firm request from the UK, asked the Treasury and the Departments of Defence and Supply to consult on the matter as soon as possible.

12.5.6 McBride wrote to Beale, the Minister for Supply, on 22 April 1954 in the following terms:

'My own view is that such a decision should only be taken on the basis of a firm United Kingdom proposal supported by the fullest possible information as to the type of weapons it is proposed to test, the safety factor and the financial implications involved. The question would, I feel, require the most careful consideration by Cabinet from the general policy and political aspects, especially having regard to the public reaction to the recent series of United States Hydrogen Bomb tests in the Pacific. We would need to be in a position to give the most categorical assurances as to safety, and the area of contamination.' [RC 800, p.540444]

12.5.7 There is a suggestion in a document of 25 January 1954 [RC 800, p.540094] that the Australian Government would not want any publicity about a permanent proving ground until after the forthcoming Federal election (29 May 1954). There is no discussion of the propriety of such a decision being taken shortly before an election. In the event, the formal request did not come from the UK until 2 August 1954. Agreement was sought in principle for a series of tests in 1956 and, as the necessity for trials to continue for ten years was envisaged, a permanent proving ground was considered desirable in the interests of efficiency and economy [RC 800, p.540639].

12.5.8 Some stumbling blocks appeared immediately. The Department of Defence saw the need for the provision of information on previous and future tests and their likely cost. An interdepartmental committee was set up and these and other matters were raised. There was also a formal committee of Cabinet, comprising the Prime Minister, the Treasurer, the Minister for Defence and the Minister for Supply.

12.5.9 On 19 October 1954, the Cabinet agreed that

'...the United Kingdom Government should be advised that a permanent site in Australia for atomic tests would be made available.' [RC 800, p.540847]

12.5.10 On 25 October, the Prime Minister wrote to the UK High Commissioner in Canberra:

'I have noted the views of your experts that under suitable meteorological conditions the Maralinga site would provide an adequate margin of safety for bursts of atomic weapons of somewhat higher power than those used in previous trials.

'My Minister and I have noted also that the power of the atomic weapons to be tested and the meteorological conditions suitable for the test would be subject to prior agreement with the Australian Government, and also that there would be no question of testing hydrogen weapons.

'In view of the foregoing...we agree to make the Maralinga site available for a permanent testing ground.' [RC 800, p.540866]

12.5.11 It was not until 2 December 1954 that the Minister for Supply made any mention of the new site [RC 800, p.541028].

12.5.12 There was a further discussion by the Maralinga Committee on 6 January 1955, after which serious negotiations followed with the UK Government. A UK Ministry of Supply team had visited Australia towards the end of 1954 and it was agreed that Australia would submit a draft Memorandum of Arrangements in January 1955, the Prime Minister's Department confirmed that Australia required the UK to agree on a formal Memorandum.

12.5.13 A Cabinet submission on the permanent proving ground covering a draft Memorandum of Arrangements was considered by the Maralinga Committee on 4 May 1955.

12.5.14 The establishment of the permanent proving ground was announced with considerable fanfare on 16 May 1955. Beale made no secret about his views on the matter:

'The whole project is a striking example of inter-Commonwealth co-operation on the grand scale.

'England has the bomb and the know-how; we have the open spaces, much technical skill and a great willingness to help the Motherland.

'Between us we shall help to build the defences of the free world and make historic advances in harnessing the forces of nature.' [RC 800, p.550701]

12.5.15 The Minister for Supply was asked by the Prime Minister to establish an executive committee which would be responsible for a wide range of organisational topics relating to the construction and operational work at Maralinga. It was called the Maralinga Committee and then the Australian Weapons Test Committee. A Safety Committee was also established to advise on all safety aspects (Section 12.6) and to report to the Prime Minister through the Minister for Supply.

12.5.16 The text of the Memorandum of Arrangements was finalised on 7 March 1956.

Conclusions

12.5.17

(a) The Australian Government had no intention of testing public reaction before deciding to agree to provide a permanent proving ground at Maralinga; no announcement was allowed until there was a formal commitment.

(b) The Australian Government had reached the firm view that, so far as British security considerations would allow, Australian scientists should be fully informed and involved in all decisions to fire atomic weapons at Maralinga.

12.6 The Atomic Weapons Tests Safety Committee

12.6.1 When the Atomic Weapons Tests Safety Committee (AWTSC) was established in June 1955, the flow of information from the United Kingdom, although not becoming a torrent, increased from a trickle to a more steady flow.

12.6.2 The establishment of the AWTSC, or Safety Committee as it was sometimes called, was intimately related to the development of a permanent test site at Maralinga. It had the following functions:

'(a) To examine information and other data supplied by the United Kingdom Government relating to atomic weapons tests from time to time proposed to be carried out in Australia for the purpose of determining whether the safety measures proposed to be taken in relation to such tests are adequate for the prevention of injury to persons or damage to livestock and other property as a result of such tests, and

'(b) To advise the Prime Minister, through the Minister of Supply, of the conclusions arrived at by The Committee as a result of such examination.' [RC 800, p.550626]

The initial appointments to the AWTSC were Martin, the Defence Scientific Adviser, Chairman; Butement, Chief Scientist, Department of Supply; Titterton, Australian National University; Eddy, Director, Commonwealth X-ray and Radium Laboratory; Baxter, Deputy Chairman of the Atomic Energy Commission.

12.6.3 The United Kingdom's High Commissioner in Canberra had sent the names of Martin, Titterton, Butement, Eddy and Baxter to the Secretary of State for Commonwealth Relations on 16 March 1955. The telegram stated

'Australian authorities have now given us names of candidates for proposed Safety Committee. They emphasise that no decision has yet been taken on size of Committee and no approach will be made to candidates pending receipt of our comments on their suitability which are requested as soon as possible.' [RC 467]

The Secretary of State replied by telegram on 29 March 1955:

'...We have no objection to candidates proposed for membership of Safety Committee but in view of sensitive nature of information to be given to Committee we would wish to have formal assurance of Australian authorities that before appointment the individuals have been fully cleared in accordance with the positive vetting procedure necessary for those who are to receive atomic energy information.

'2. For your information this security requirement is vital in view of our discussions with Americans about collaboration in atomic weapon field.' [RC 467]

The United Kingdom had the power to approve or reject prospective members of the AWTSC.

12.6.4 The Secretary of the Safety Committee was to be appointed by the Department of Supply. Mr A H Wills filled that position.

12.6.5 The Safety Committee had the power to co-opt the services of other people but this was subject to the prior approval of the Department of Supply and the United Kingdom Government. The UK thus retained control over the composition of the Safety Committee and those Australians with knowledge of the tests

12.6.6 The first meeting of the Safety Committee was held on 8 July 1955 at the University of Melbourne. Baxter and Titterton were not present. The Minutes note that the Safety Committee was constituted so as to confine coverage of the subject to a minimum number of people. The general areas of responsibility were that Martin and Butement would cover defence aspects, Titterton scientific aspects, Eddy health matters and Baxter the peaceful applications of atomic energy. In recognition of the particular significance that meteorological matters were to have in relation to the safety aspects of the tests, Dwyer, Director of the Bureau of Meteorology was co-opted to the 2nd Meeting of the AWTSC and attended future meetings [RC 131].

12.6.7 The Safety Committee

'...generally regretted that Professor Oliphant was not a member of the Committee, but it was felt that Professor Titterton was well qualified to cover the

scientific aspects of the Committee's work and had in fact been more closely associated with the development and testing of atomic bombs.' [RC 800, p.551133; RC 131, Minutes of the 1st Meeting of the AWTSC].

12.6.8 Oliphant had at that time a high profile as one of Australia's foremost nuclear physicists with an international reputation. He was Titterton's superior at the newly established Australian National University. The absence of Oliphant from the AWTSC seems to have been a matter of some sensitivity, as reflected in the Minutes.

12.6.9 An explanation may be that Oliphant was not acceptable to the United Kingdom as he was regarded as a security risk by the United States. However, other considerations are apparent in the documents. An unsigned file note of 16 March 1955 states

'I have spoken to Professor Martin, who says that after discussion with Professor Titterton it is undesirable to ask Professor Oliphant to be a member of the Safety Committee, and in addition Titterton says that Penney would not be prepared to accept this recommendation.' [RC 800, p.550315]

12.6.10 Oliphant's involvement in the tests was a matter which, as mentioned above, had already been discussed and rejected in 1952.

12.6.11 Penney confirmed in evidence that he was told Oliphant was a security risk [Trans., p.7039]. In answer to the question

'But if a decision were made to keep Professor Oliphant away, would it have been exclusively because of the potential to damage your relations with America?'

he answered

'I think so yes. It would damage us in two ways: one that it was prejudicing American information, and the other was that we were at that time striving hard to get back on terms with the Americans and we had this awful disaster with security.'

It should be noted here that at the conclusion of his evidence, and at his request, Penney returned to this matter and said

'...I got to know Oliphant much better...I got to admire the man, and I'm a Dutchman if he was a security risk. What he was, I am sure, was a vigorous young Australian and he made his views known.' [Trans., pp.7076-7]

12.6.12 Prime Minister Menzies, on 16 May 1955, wrote to McBride, the Minister for Defence stating, in relation to the establishment of the AWTSC,

'I believe that the Committee must include members who are sufficiently well known to command general confidence as guardians of the public interest, and who are not in any way to be identified as having an interest in the success of defence atomic experiments.'
[RC 590, p.294]

12.6.13 The Safety Committee as finally constituted did not meet these Prime Ministerial requirements. As previously mentioned, Titterton had been intimately involved in ensuring the success of the atomic tests at Hurricane and Totem and could not be described as a guardian of Australian public interest.

12.6.14 It seems fair to say that Titterton did not fit the Menzies criteria.

12.6.15 Despite what might be seen as inadequacies, the Minutes of the 2nd Meeting of the AWTSC [RC 131] demonstrate a more vigorous approach to the questions of safety at the forthcoming Mosaic tests than had previously been the case. By way of example, the Safety Committee examined papers prepared by Adams of the United Kingdom Atomic Energy Authority relating to the prediction of ground contamination and laid down 'firm requirements' for predicting the track of the cloud. Item 9 of the Minutes records that 'the Committee had a need to know the latest time of day a test could take place'. Dwyer of the Bureau of Meteorology stated that he would 'appreciate advice' on the ranges at which cloud sampling was to be undertaken, details of the predicted shape of the cloud and details of the level and position of winds to be forecast. The Minutes of the meetings leading up to Mosaic demonstrate that the Safety Committee was endeavouring to to fulfill its charter.

12.6.16 At the 7th Meeting of the AWTSC on 9 May 1956, the Safety Committee noted that the Minister of Supply did not want the collective responsibility to be delegated to two or three members. The UK authorities were to be informed that the Safety Committee was required to function as a unit at all major trials and that provision must therefore be made for accommodation, transport and access to facilities needed to carry out the responsibilities effectively [RC 131].

12.6.17 The Secretary, Wills, wrote to Wheeler, the Head of Staff of the United Kingdom Ministry of Supply in Australia, on 15 May and made a specific request for

'...accommodation for six members of the AWTSC in VIP quarters at the Buffalo trials - a room with two tables and a telephone for exclusive use of the AWTSC - two light vehicles one of which is to be a cross country vehicle such as a Land Rover for the exclusive use of the Committee on a self drive basis - access to any equipment facilities or services the Committee might need for the effective discharge of its responsibilities.' [RC 800, p.562146].

Conclusions

12.6.18

(a) The establishment of the AWTSC was an important, albeit tardy, step in providing the Australian Government with the opportunity to obtain independent scientific advice on the safety aspects of the tests.

(b) Membership of the AWTSC, a committee established by the Australian Government and comprising Australians, was vetted by UK authorities.

(c) The Australian Prime Minister's stated requirements for the members of the AWTSC not to have any conflict of interests in relation to the success of the atomic weapons tests program was not met with respect to Titterton.

12.7 Operation Mosaic

12.7.1 As was mentioned above, as early as September 1952, Penney had been considering the possibility of at least one more trial at the Monte Bellos 'two years from now'. It was not until much later that this information was formally passed on to the Australians. By April 1955, the AWRE had established that practical experimental information was needed on the interaction of light elements in the environment of an exploding fission weapon. This was of the essence because, in the words of Penney,

'The top priority job was thermonuclear. We wanted to see if we could make a few fast neutrons; and we wanted to do it in yields of 40, 50, 60 kilotons. Cook, as the Chairman, said where this can be fired. I heard all this later from him because he was doing the running job. Maralinga was not going to be possible; it was too early; and if we had said to the Australians 50 kilotons at Maralinga I think they would have said "no". So we could not go there. The other possibility was to ask the Americans. Well, we had been through that hoop, and therefore it was either Monte Bello or wait - not to do it...' [Trans., p.7059]

12.7.2 Whether the Australians would have said 'no' or not, there was a further complication that testing at Maralinga would have seriously delayed the construction of the permanent proving ground. The UK was committed to the 'speediest development of efficient nuclear weapons' and as Eden, the British Prime Minister, told Menzies in a message passed to him on 17 May 1955, UK plans were in hand for a test of a thermonuclear weapon in 1957, possibly at a location in the Pacific. The formal request was couched in the following terms:

'...If we can carry out experiments in April, 1956 we shall not only save six months...but shall get greater value from Maralinga tests in September-October...your agreement should be sought to a programme of two firings in Monte Bellos in April, 1956. Experiments would consist of atomic explosions with inclusion of light elements as a boost. It would, of course, be made clear in any public announcement that explosions were atomic and not thermonuclear...Neither of two (firings) would give a yield more than [two and a half times] greater than...Hurricane...Explosions would be on towers to reduce contamination and fall-out would be less than one fifth of that of Hurricane bomb.

'We should of course ensure that shots would not be exploded unless conditions were such as to involve absolutely no danger to health of people or animals on mainland and should give your people same facilities for checking safety measures as they had at previous trials and as they will have at Maralinga...I am sending you now this brief summary of proposals to seek your agreement in principle to this extra trial. If as I hope will be the case you find that you can agree we can arrange for more detailed discussions.' [RC 800, pp.550712-13]

12.7.3 The message from Eden was referred to the Defence Committee with Martin present. The Committee concluded on 26 May 1955 that, from the defence point of view, the Australian Government should agree in principle to the tests being carried out on the Monte Bellos. The Committee felt also that

'In view of the greater yield of the proposed explosion, and its nature, the most meticulous care should be exercised in the scientific checking of safety measures to ensure the safety of people and animals on the mainland' and that 'facilities should be made available for senior Australian Service Officers to be present at the tests as observers.' [RC 800, p.550778]

12.7.4 The Defence Committee's advice was passed to the Minister for Defence who concurred; the Secretary of the Prime Minister's Department, the Treasurer, the three Service Ministers and the Acting Minister for Supply were then informed of the terms of the Committee's advice.

12.7.5 The UK Acting High Commissioner was informed of the Australian Government's agreement in principle on 20 July 1955 in the terms given in the Defence Committee's conclusion. The Prime Minister's letter to Tory [RC 800, p.550977] also suggested that UK officials should visit Australia for discussions as had been recommended by the Defence Committee.

12.7.6 No advice appears to have been provided - or asked for - as to why tests were being planned for April when it had been considered previously that 'for climatic reasons' the Monte Bellos were only suitable 'in the month of October' [RC 800, p.510008].

12.7.7 At its first meeting, on 8 July 1955, the newly established Atomic Weapons Tests Safety Committee agreed that

'...the tests scheduled for the first half of next year should not proceed until the Safety Committee had pronounced on the hazards involved.' [RC 131]

12.7.8 Eden replied to Menzies on 8 July, expressing his gratitude for the Australian Government's agreement and giving his assurance that

'...safety measures will be most meticulously carried out and that as before we would welcome discussions on safety checks with your scientists. We shall be glad to have some senior Australian Service officers as observers.' [RC 800, p.551137]

12.7.9 On 12 September 1955, a press release was issued in the UK and simultaneously in Australia where it was attributed to Beale. The statement made reference to the earlier announcement of the establishment of the permanent proving ground and then stated that

'...the Australian Government has agreed to the United Kingdom carrying out this third series of tests at the Monte Bello Islands which was the site of Britain's first atomic tests. The fall out from these tests will be less than that caused by the explosion of 1952.

'There will be no danger to people or stock on the mainland, and detonation will only take place when the meteorological conditions are fully satisfactory.

'...As in earlier tests, the decision to fire will only be made after a Safety Committee, consisting of eminent Australian scientists nominated by the Australian Government, have made their own independent assessments of the fallout patterns and have agreed that conditions are safe.' [RC 800, pp.551603-4]

12.7.10 The reference to a Safety Committee being in existence for the earlier tests was wrong and the release was, as has been shown above, quite erroneous. At best it was ill-informed, at worst it was dishonest.

12.7.11 Adams, the UK Scientific Director, met independently with Butement the Chief Scientist of the Department of Supply, and a member of the AWTSC, and gave him a description of the

scope of the operations which were planned, an indication of the probable yields, and an outline of the safety precautions and the permissible conditions for firing which would be in effect. He indicated that a report setting out these conditions had already been provided. He also produced the contamination contours (normalised to a given yield) for the Totem tests, being examples of the effects of virtually no wind shear and large wind shear plus results of the influence of different wind speeds. Adams indicated that, using the principles applied in the report, it should be possible to produce a set of meteorological conditions which would make the firing of two rounds possible.

12.7.12 These matters and others were subsequently discussed at a meeting of the Defence Committee and the Defence Scientific Adviser, Martin, now also Chairman of the Safety Committee, re-emphasised the safety aspects discussed at the earlier meeting and pointed out that the higher altitude which the cloud would reach, combined with the difficult weather conditions expected, would lead to an AWTSC requirement that a great deal more information would be needed when making its assessments of the radiation hazards involved.

12.7.13 Both the UK authorities and the AWTSC recognised the need to develop a sound meteorological forecasting system and to set maximum permissible contamination levels. This was particularly so in view of the likely wind conditions because, for a considerable percentage of the time, winds would be directed towards some part of the mainland.

12.7.14 In mid-September 1955, the Monte Bello Working Party was established to take over the responsibilities which had been assumed by a sub-committee of the Maralinga Committee.

12.7.15 Meanwhile, the AWTSC gave detailed consideration to problem areas and raised concerns about previous tests having shown serious deficiencies in meteorological data. It had been made clear to Martin that

'...the Australian Government expected that the Committee would satisfy itself that it had all the necessary information to make an assessment of the tests and that conditions were appropriate for firing. Only under these conditions would they agree to the test proceeding.' [Symonds 1985, pp.333-4]

12.7.16 The Safety Committee was present for both of the Mosaic firings. On the day of their arrival, Martell, the Operational Commander, declared 'standby' for the first Mosaic test, G1. The Safety Committee expressed to him its concern that the members had insufficient information about the nature of the tests to be able to carry out their responsibilities to the Australian Government and people properly. The fact that a formally constituted Australian committee had the power and responsibility to veto a test on safety grounds if it were not satisfied was

clearly news to Martell. His instructions had been that it was his responsibility to decide that conditions were appropriate for firing and that the final decision rested with him.

12.7.17 It was immediately apparent to the Safety Committee members that 'there was a new dimension in the design of the devices under test' [Symonds 1985, p.334]. But they had been given no formal details of the actual light elements involved beyond the brief mention in Eden's cable of May 1955. They were not to be given details of the explosive configuration nor the inner components of the weapon. They were not shown the assembled weapon nor informed of the amount of fissile material in each assembly - as they were to be for Buffalo. Thus for Mosaic, they were unable to check the calculations of probable yield. The speed with which the decision to set up Mosaic and fire the weapons gave the Safety Committee little time to prepare itself properly in advance.

12.7.18 One example of the approach adopted by the British scientists to requests from the Australians for data which, from an objective assessment, would seem highly relevant and necessary for them to carry out their duties, is given in a letter of 22 December 1955 to Sir Frederick Brundrett. In anticipation of a request from Australia for filters from Mosaic and Buffalo, Penney who said that 'he' was not very keen on the idea 'but did not see how they could refuse' and, recommended that samples be given after 'some of the short-lived key isotopes' had decayed. This would effectively hinder any attempt to diagnose the contents of the weapon and consequently estimate its prospective yield [RC 467]. This approach goes beyond a refusal to provide information, almost to the extent of being deliberately misleading.

12.7.19 It points to a very obvious deficiency that confronted the Australian scientists: they could only obtain the answers they needed if they asked the right questions. To ask the correct questions it is necessary to start with a good data base.

12.7.20 Following the procedure adopted at Totem, the UK prepared a predictive document for the 1956 trials seeking to identify acceptable levels of land contamination. The report for the first time identified Levels A and B which, although not formally adopted by the Safety Committee prior to Mosaic [RC 265] were considered in detail [RC 131, Minutes of the 6th Meeting of the AWTSC] and were adopted in a modified form for Buffalo.

12.7.21 On 10 May 1956, Penney sent the following message to Adams on board HMS Narvik:

'Strongly advise not showing Safety Committee any significant weapon details, but would not object to their seeing outside of cabled ball in centre section.

'They could be told that fissile material is at centre of large ball of high explosive and that elaborate electronics necessary to get symmetrical squash. No details of explosives configuration or inner components must be revealed. Appreciate that the position is awkward for you and that you must make minor concessions.' [RC 467]

12.7.22 The 'must make minor concessions' approach is symptomatic of the British attitude throughout the testing program although at either end, as has been the case at Hurricane and will be seen during the latter series of minor trials, the British perception of concessions was that they should be very minor indeed.

12.7.23 It is clear that Australian meteorologists played a greater part in the Mosaic trials than they had before [RC 555, para.43].

12.7.24 The Safety Committee certainly put some pressure on the British scientists. In a letter from the Ministry of Defence to Vice Admiral Clifford between the firing of G1 and G2, the following appears:

'Adams is in considerable difficulty with the Australian Safety Committee over the firing of G2 and he had to be very restrictive about weather conditions to meet the Safety Committee and so to obtain agreement to fire...' [RC 558, p.2353]

12.7.25 Concessions were granted by the UK officials and more information was provided for G2 and subsequently for Buffalo. That the Safety Committee was not prepared to be completely hidebound is demonstrated by the terms of a cable from Martin to Martell on 30 May 1956:

'The Safety Committee appreciated the trouble that was taken by the Commodore and his officers to accommodate it on "Narvik". We realise that this was not without inconvenience to you and as it is likely that a greater period of waiting may occur for G2 to arrive the Safety Committee makes the following proposals. One. That the Members of the Committee be accommodated on "Alert". Two. That it attends the 11 o'clock meeting on "Narvik" daily. Three. That on the approach of favourable conditions the Committee moves to "Narvik" for the duration of the Operation.' [RC 800, p.562257]

12.7.26 In a further cable of the same day, Martin wrote to Captain Marks

'The Committee feels strongly about this as we fear that our interests may possibly clash with those of the UK team on D-1 day. We require a room where private

discussion can proceed without the embarrassment of the presence of Martell and Adams. We would appreciate your support in this matter.' [RC 800, p.562257]

12.7.27 It appears that Martell and Adams agreed to produce further material for the Safety Committee provided that access was restricted to its members and strictly controlled. As Symonds points out,

'It is not surprising therefore that no mention of the content nor of the interpretation placed by the AWTSC on the information given them appears in Australian documents which have been made available. There are no records of any meetings held by the AWTSC while they were on Narvik.' [Symonds 1985, pp.336-7]

This is in fact true of all the major tests and makes it very difficult to determine the actual decision-making process adopted by the Australians.

The Government

12.7.28 The Australian Government gave the Safety Committee a very precise direction with respect to the monitoring of safety: if conditions were not right, then the weapon should not be fired. This, of course, meant that any report to the Government that there had been any risk, or that things had not gone completely according to plan, would automatically mean that the Safety Committee had failed in its duty. Moreover, there was a developing groundswell of opinion against the testing program - any admission of danger at all would add to that groundswell. For its part, the Government appears to have been quite happy to be in the position where it was unable to question assurances from the Safety Committee because it could not be given the information upon which those assurances were based.

12.7.29 On 20 May after G1, the following message was sent from the Secretary, Department of Supply to his Minister, Beale:

'Following message received Sunday 20th from Martin dated 17th May...

'You will be interested to have the following report of the Safety Committee which it would like you to transmit to the Prime Minister.

'2. The requirements of the Safety Committee for meteorological prediction of safe firing conditions and for examining the subsequent radio active fallout by air and sea operations were fully met...

'4. The meteorological predictions were complete and accurate and the operation was carried out without there being any hazard whatsoever to life on the mainland, ships at sea, and to aircraft.

'5. The whole operation proceeded with precision and was complete success.' [RC 800, p.562183]

12.7.30 This unequivocal assurance omits any reference to the difficulties that the Safety Committee had experienced or foresaw in its relations with the UK authorities. There is no reference to the recorded fact that the Safety Committee was 'nervous' about the proposed safety levels of contamination [RC 265, Minutes of 11 July 1956 Meeting of the UK Atomic Weapons Trials Executive]. Nor is there any reference to the fact that the Safety Committee was not prepared to 'give formal agreement to the proposed standards' before G1 although they were in fact applied.

12.7.31 Further reports were forwarded following G2; one unclassified report stated, *inter alia*,

'...From analysis of the detailed data available to us the Safety Committee has satisfaction in reporting that the safety measures were completely adequate. There was absolutely no hazard to persons or damage to live stock and other property.' [RC 527]

12.7.32 A further classified and more detailed report on both tests, signed by all members of the Safety Committee, was also sent to the Prime Minister. This report stressed that the decision to fire was a unanimous one and gave an assurance that all safety requirements had been met. It said that

'Both weapons gave rise to contamination of the mainland which was very much less than the Committee would be prepared to accept within its terms of reference.' [RC 527]

12.7.33 A map of the path of the G2 cloud was inserted in this detailed report. It was drawn before all relevant data had been received and gave a misleading impression by suggesting that no part of the cloud crossed the mainland. Furthermore, there was no indication that part of the G1 cloud ultimately tracked almost due east across the mainland. No attempt was made to ascertain the level of any collective dose to the population which might arise from the two explosions.

12.7.34 Perhaps because of the concern generated by media reports about the passage of the cloud, its actual movements were not accurately reported to the Prime Minister for political reasons. It is interesting to compare this AWTSC report with a later report, 'Radioactive Fallout in Australia from Operation Mosaic' [RC 547], in which the G1 cloud is clearly shown

traversing Australia; G2 is not. The myth that merely the stem material was dispersed across the mainland is repeated [RC 555, Appendix 25].

12.7.35 It is clear, even at this early stage, that the Safety Committee was adopting a more political role than that which had been given to it by the Government.

The Media and the Public

12.7.36 The combination of a Minister keen to make public pronouncements extolling the virtue of a testing program to which he and his Government were committed, but who was not privy to the basic data involved, caused difficulties for both the United Kingdom and Australian Governments. The even greater degree of ignorance forced upon the media and the Australian people compounded the problem. Several examples occurred during the Mosaic tests.

12.7.37 In a statement of 27 May 1956, indicating that the G1 test had been 'a complete success', Beale went on to say

'A further smaller device will be detonated in a few weeks time when conditions are favourable.' [RC 800, p.562214]

12.7.38 It is not quite clear how Beale drew this conclusion. Certainly Eden's message to Menzies made it quite clear that, if fired, the second test would be of larger yield than the first.

12.7.39 On 1 June 1956, Lloyd of the UK Ministry of Supply wrote to his colleague Dr Wheeler in Australia in the following terms:

'Press reports here of Beale's statement say that second Mosaic round will be smaller than that exploded on May 17. Converse is true as was made clear in original telegram of 16th May 1955, I hope that there is no misunderstanding by the Australians. If you think anything should be said to them please let me know.' [RC 800, p.562415]

12.7.40 On 6 June, the following reply was sent by Wheeler:

'Statement that second Mosaic round will be smaller was the press interpretation of Beale's statement which was designed to play down importance of test and try to make it seem a routine matter, in conformity with the known UK policy. It is hoped there that UK will not find it necessary to amend the statement but if this should be required prior to warning to SUPDEP is clearly essential.' [RC 800, p.562480]

12.7.41 On 8 June, a further cable was sent to Wheeler by Lloyd:

'What concerns me is that SUPDEP should be quite clear that G.2 will have a higher yield than G.1 and that they should have no complaint that we have misled them. Provided you are satisfied that they are clear on this point I do not think that any further action is necessary at this stage.' [RC 800, p.562510]

12.7.42 The British attitude here is reasonable but Beale's failure to redress the error is not. This incident may give some clue to Beale's anxiety over the passage of the G2 cloud. It is quite apparent that, from the Australian and British point of view, press and public statements about the tests were to be made in the most comforting terms.

12.7.43 Considerable concern was caused to Beale and the Australian Government by a report of radioactive cloud drifting over the mainland after G2.

12.7.44 Cabinet considered the matter on 20 June 1956 and asked the Acting Secretary of the Prime Minister's Department to 'act in conjunction with the responsible department to obtain a report on the facts and to prepare a statement for use by the Acting Prime Minister...' [RC 800, p.562796].

12.7.45 On 21 June 1956, the UK High Commission reported to London that

'Australian Government have been embarrassed overnight by press story that atomic cloud drifted inland after explosion. Beale with press party at Woomera was urged by them to issue immediate statement. His Department in Melbourne told him Australian Meteorological Bureau there had sent report to NARVIK which tended to confirm press rumour and Beale issued last night at Woomera statement that at 5,000 and 10,000 feet all significant particles had gone into sea, at 18,000 to 20,000 feet some cloud containing minute particles has drifted inland although it is now tending to drift back towards coast.

'2. Chairman of Australian Safety Committee in NARVIK subsequently sent message to Beale that cloud was safely over sea 100 miles from land that all safety precautions had been taken and that there had never been any danger for mainland.' [RC 800, p.562825]

12.7.46 A message was then sent to the Safety Committee outlining the terms of Beale's statement and asking it to make some reconciliation.

12.7.47 The Safety Committee was later alarmed and even annoyed by this governmental intervention at a time when they were still assembling data from the test which indicated that no harm would come to people on the mainland. They saw no reason to extricate Beale and his advisers from the discrepancy between the statement and the factual situation.

12.7.48 On 21 June, the Acting Prime Minister, Fadden, told Parliament that

'It cannot be over-emphasised that the whole operation was carried out without any risk to life or property on the mainland or elsewhere.' [RC 800, p.562833]

12.7.49 There were some interesting developments in the wake of these events.

12.7.50 Martell, the Operational Commander, reported to Mosex officials that there had been a real need to provide the public with elementary facts about atomic explosions and how the safety aspects were handled so that much of the 'press hysteria' could have been avoided. He felt that wrong and embarrassing statements had been made which caused unnecessary alarm and confusion, necessitating a correction by Fadden.

12.7.51 His concern was that the public would be asking whether more information was hidden than released. A more objective and sensible attitude was voiced by the Director of Meteorology.

'The unqualified statements which gave rise to unnecessary alarm after the second explosion could have been easily refuted if it were not for security restrictions on the release of precise information.' [RC 800, p.562908]

12.7.52 On 25 June 1956, the Acting Prime Minister felt it necessary to make a general statement providing broad details of the tests and settling any remaining concerns. Among other things he repeated that he had been assured that there was no risk

'...by the members of the Safety Committee who are the only persons in a position to judge the matter...The members of the Committee are given access to the details of the experiments and to the meteorological conditions. They are therefore able to secure firing conditions under which the safety of the mainland will be assured.'

12.7.53 That may have been understating the position but worse was to come:

'The Government has in the case of every atomic test in Australian territory insisted that there shall be no

firing until the Safety Committee, knowing all the essential details, is completely satisfied that the meteorological conditions are perfectly suitable and safe.' [RC 800, p.562859]

12.7.54 This statement was simply not true because there was no Safety Committee in existence at the time of Hurricane and Totem.

Conclusions

12.7.55

(a) Agreement in principle by the Australian Government for the British to use the Monte Bello Islands for tests of the size envisaged for Mosaic and at the time of the year proposed was given with the knowledge that the occurrence of suitable weather conditions would be unlikely.

(b) Although the AWTSC was established by the time of Mosaic and had an effective power of veto, it was not provided with sufficient information to discharge its function properly for the Mosaic tests.

(c) Information provided to the Australian news media and to the public was largely limited to generalised assurances on safety. Only when things appeared to be going wrong was more information provided.

12.8 Operation Buffalo

12.8.1 Planning of the Buffalo series commenced with the establishment of an interdepartmental committee in the United Kingdom in May 1955. It was dubbed the Buffalo Committee and was under the Chairmanship of the Controller of Atomic Weapons of the UK Ministry of Supply. The Committee comprised representatives of the Ministry of Supply, the Service Departments, the Department of Defence, Treasury, the Commonwealth Relations Office, the Ministry of Transport, the Lord President's Atomic Energy Office and the UKAEA. This Committee had two Australian representatives, Air Commodore Henry, the Inter-Service Technical Officer of the Australian Joint Services Staff, London, and the Senior Supply Representative, Mr Letcher.

12.8.2 The Committee appointed Penney as the Trials Director and Pilgrim as his chief planning officer [RC 800, p.550744].

12.8.3 As mentioned above, in Australia, an interdepartmental committee named the Maralinga Committee was also established. Its responsibility was to co-ordinate and direct all the work relating to the establishment of the permanent test site and the conduct of the tests [RC 800, p.550744].

12.8.4 The public was first informed of the tests when the UK Ministry of Supply issued a statement on 12 September 1955 in England and Australia giving the date of the first scientific rehearsal. It said, after referring to the Monte Bello tests,

'Following the third series of tests will be a fourth series which is to take place later in 1956, at Maralinga. This series will be under the scientific direction of Sir William Penney.

'No tests will exceed a few tens of kilotons in yield and some will be smaller...

'As in earlier tests, the decision to fire will only be made after eminent Australian scientists, nominated by the Australian Government, have made their own independent assessments of the fall-out patterns and have agreed that conditions are safe.' [RC 800, p.551379]

12.8.5 In passing, and in the light of the discussion about the establishment of the Safety Committee, the careful use of language might be noted in that press release. The eminent Australian scientists were indeed 'nominated' by the Australian Government, but those nominated were then cleared by the United Kingdom before appointment.

12.8.6 There followed a period of considerable discussion among the UK Services as to what experiments should be performed. It was also agreed that the Buffalo series should be used for the indoctrination of service personnel and for target response tests. Biological tests were also planned.

12.8.7 Beale, the Minister of Supply, presented to Federal Cabinet an AWTSC report entitled 'Problems of Safety Conditions at the Maralinga Tests Series' dated 13 August 1956 [RC 800, p.563496]. The report stated confidently

'From the purely safety point of view it is possible to lay down firing conditions which will assure that there is no hazard to humans, animals or plant life except in the immediate area of the test site - a prohibited area.'

12.8.8 It continued

'It is manifestly impossible to prevent radioactivity from falling on the mainland in the case of the Maralinga tests. The task of the Safety Committee is to ensure that the activity which does reach the ground outside the specified danger areas shall be at a level so low that it will not harm people exposed to it, or have any economic effect on plant and animal life.'

12.8.9 The program of tests was outlined in the report. Yields of 16, 1, 16 and 4 kt were nominated as was the distance of each weapon from the ground at the time of detonation.

12.8.10 The Safety Committee had been informed of the yield and the height above ground of each explosion by Penney on 22 June 1956 [RC 558, p.2424].

12.8.11 The report specifically addressed the safety of Aborigines, stating that

'Although there are very few Aborigines in the area immediately outside the prohibited zone they nevertheless constitute the limiting problem because, away from homesteads, they will still live in the tribal state - near naked - and spend virtually the whole of their time out of doors, even sleeping on the ground. They are therefore exposed, for a given fallout level, to a bigger radiation dose than normal human beings whose clothes and homes provide shielding. In order to ensure protection for these people (who also pose the added difficulty that they are migratory) the Safety Committee has determined a radiation level - "A" - which can be accepted in any region where aborigines are likely to be. This level is lower than that which would be acceptable for the white population. This will impose a further restriction on the choice of suitable firing conditions, beyond those already agreed with the UK.'

12.8.12 The AWTSC report continued in the following strong terms:

'We also wish it to be clearly understood that such a dose can be delivered only once in the Buffalo test series to any one area. That is the dose contour from test 3 at distances beyond 100 miles must not overlap that from test 1. We request the Australian Government to pass this requirement to the British Government.'

12.8.13 Later in the report, the Safety Committee reiterated its concern that the UK authorities should clearly understand that Level A was the highest acceptable for the Maralinga test program - a level which had already been set by Cabinet [RC 800, p.563499].

12.8.14 On the question of radioactive rain, the Safety Committee sought guidance from the Australian Government. If it was thought politically necessary to abandon firing opportunities because there was a possibility of rain at great distances, then an amendment to the AWTSC's terms of reference would be required. Federal Cabinet decided not to alter the terms of reference and accepted the risk (see para.12.8.16).

12.8.15 Under the heading 'Improbable and Unexpected Hazards', the Safety Committee referred to the possibility of accidents and the consequent necessity to take urgent emergency action such as the evacuation of homesteads or other measures. The United Kingdom was requested to provide whatever the Safety Committee required in the event of an emergency.

12.8.16 On 4 September 1956, Federal Cabinet noted the program of four atomic tests (Operation 'Buffalo') to be carried out at Maralinga. It approved

'(a) that the recommendation of the Safety Committee accepted by Sir William Penney regarding the level of radiation to be permitted for both aboriginal and white population be "level A" with no overlap of dose contours;

'(b) that the possibility of rain on remote areas of the cloud path as described by the Safety Committee be accepted;

'(c) that the United Kingdom be required to provide as a first priority all available resources at the request of the Safety Committee should emergency measures become necessary.'

12.8.17 In relation to (b) above, Federal Cabinet was of the view that before the first explosion, a statement should be made referring to the possibility of rain being radioactive to a small degree. The firings were not to be abandoned.

12.8.18 Federal Cabinet also noted that grounding or other control of aircraft may be desirable, and agreed that the public relations aspects of this should be kept in mind.

12.8.19 Having accepted the Buffalo series, the Cabinet Minute continues

'In relation to the proposed series of minor trials at Maralinga from February to June 1957, Cabinet agreed that before any decision is reached the Acting Prime Minister and the Minister for Supply should endeavour to obtain from the United Kingdom government a more comprehensive account of the United Kingdom programme for Maralinga and the consequent demands on Australian resources.' [RC 800, pp.563935-6]

12.8.20 An examination of the Safety Committee report to Cabinet and the Minute recording Cabinet's decision indicates that the Australian Government was appraised in considerable detail of the Buffalo program and the possible safety ramifications away from the Range.

12.8.21 The Cabinet decision was taken in an atmosphere of public opposition to the test program in Australia.

12.8.22 In a letter to Brundrett of the UK Ministry of Defence, dated 19 June 1956, the day Mosaic G2 was fired, Penney expressed concern about increasing political pressure in Australia against the future use of the Maralinga Range. He proposed a course of action to strengthen relations with Australian politicians and officials and thus minimise the likelihood of losing the Range. He proposed

(a) a press conference with Beale and himself upon his arrival in Australia for Buffalo,

(b) giving the AWTSC 'an idea about the construction of Blue Danube and Red Beard weapons and telling them how much fissile material is in any weapon to be tested on the range', and

(c) 'allowing the Australian MPs who are to observe the tests to be present at the third shot and giving them a short talk and a view of the layout.' [RC 558, p.2420]

12.8.23 By July 1956, the United Kingdom authorities were well aware that the tests in Australia had become 'highly political' issues. This had been reinforced by media reports about the passage of the G2 cloud and radioactive rain in north Queensland [RC 558, p.2522]. In a letter dated 4 July 1956 to the UK Ministry of Supply, Mr Allen of the Commonwealth Relations Office suggested

'I think we should be on the lookout henceforth for any other gestures we can make to Australian politicians, of whatever party, in order to get them on side in these matters.' [RC 558, p.2523]

12.8.24 A public relations exercise was then commenced so that the publicity which G2 attracted would not flow on to Buffalo and jeopardise future tests. Adams stated in a note dated 9 July 1956, after referring to ways in which good press could be engendered, that

'...the main concern will I think be that of guarding against an outcry after the Buffalo rounds similar to that which occurred after G2. But I do not think they will suggest that this should be achieved by altering the standards which we propose for safety.' [RC 558, p.2565]

12.8.25 The Atomic Weapons Trials Executive, at its meeting of 11 July 1956, discussed questions of publicity in some detail [RC 558, p.2582]. Background material was prepared for UK representatives to discuss with Martin in order to provide suitable statements for release [RC 558, p.2615].

12.8.26 Penney was approached to make a 'guest of honour' broadcast by the ABC. This was seen as advantageous in the effort to reassure public opinion in Australia about the tests [RC 558, p.2625].

12.8.27 The press conference proposed by Penney with Beale was to be held in Sydney on 14 August 1956 and the Buffalo executive agreed to provide the press with a statement of what Penney would say [RC 558, p.2641, Minutes of the Atomic Weapons Trials Executive Meeting, 8 August 1956].

12.8.28 Publicity material was issued to the press, for example 'A Testing Ground for Settlement' [RC 800, p.563477] and others such as 'What Happens When a Bomb is Exploded' [RC 800, p.564579], 'Radiation and Radioactivity: A Radiation Monitoring System' [RC 800, p.564586] and 'First Atomic Device Fired at Maralinga' [RC 590, p.370].

12.8.29 Notwithstanding the press releases and publicity arrangements made for Buffalo during the period of delay from 12 September to the firing on 27 September, concern was expressed in the press and in Parliament that the delay was evidence of the great danger that the tests posed. The MPs had been flown to Maralinga on 21 September but returned when the firing was cancelled. Penney claimed in his telegram of 21 September that this might have beneficial long-term effects as he spoke to them about the postponement [RC 558, p.2730]. In his cable to Cook, Penney stated

'Could not prejudice future of Range and therefore cancelled without last minute fight with Safety Committee undoubtedly ending with their veto.'
[RC 558, p.2730]

12.8.30 The efforts taken by the UK to ensure that the power of Australian public opinion did not prevent future use of the Range were extensive as the discussion above shows. When round 1 was fired, the cable to Lloyd from Wheeler specifically referred to the Sydney and Melbourne press reaction as being 'entirely satisfactory' [RC 558, p.2732].

12.8.31 Some MPs witnessed round 2 and Penney reported to Cook:

'Parliamentary party delighted with their visit and very friendly. Nothing succeeds like success.'
[RC 558, p.2793]

12.8.32 At the conclusion of the firing of rounds 1 and 2, the UK Atomic Weapons Trials Executive met on 10 October 1956. The Minutes record:

'Publicity

The Chairman expressed the view that the publicity arrangements for the Operation appeared to have been

successful. There had been little evidence of the adverse press comment and fears of the Australian public which accompanied Mosaic. This was no doubt due to the publicity given before and during the operation and to the emphasis placed on the strict regard for safety arrangements which were in Australian hands.

Mr Jehu said that there had been a definite improvement because the right publicity had been given at the right time.'

He cautioned

'It would be wrong however to assume that opposition to atomic tests in Australia had been undermined. There was still a major problem and much depended on the speed and efficiency with which rumours were scotched.'
[RC 558, p.2822]

12.8.33 The remaining firings were completed without public alarm and, on 25 October 1956, Penney wrote personally to Beale complimenting the Australian Meteorological Services [RC 558, p.2918].

12.8.34 He also reported through Beale to the Australian Government that

'...we have done these tests safely and without subjecting any people or stock to the slightest risk from radio-activity or blast. While I was always completely confident that this could be done, provided all the proper precautions were taken, none will know better than yourself the care that the Safety Committee and I took in waiting patiently for the right weather so that there would not be the slightest chance of a scare.' [RC 558, p.2919]

12.8.35 Of course by October 1956 negotiations had been under way for some time in relation to the 1957 tests and there was a need to ensure that they proceeded as planned and that public opposition would continue to be minimised.

Conclusions

12.8.36

(a) The Safety Committee was provided with adequate information and was able properly to advise the Government about the safety of the proposed Buffalo tests.

(b) The Australian Government had sufficient information to make an informed decision as to the criteria for safe firing for the tests.

(c) Significantly greater attempts were made to inform the public about the testing program with a view to allaying public concerns about safety. The public was not, however, informed of the true nature of the hazards involved.

12.9 Operation Antler

The AWTSC and the Establishment of the NRAC

12.9.1 Following the Mosaic and Buffalo tests, concern for the future of testing at Maralinga prompted Professor Martin to request a review of the function of the AWTSC. This request was made with regard to the political climate and to the possible suspension of tests, owing to a growing worldwide movement towards a moratorium on atmospheric testing.

12.9.2 At the 15th Meeting of the AWTSC on 7 December 1956, Martin proposed the establishment of a new committee 'responsible for all matters concerning the conduct of atomic weapons tests at Maralinga from the point of view of public safety' [RC 131], to be called the Maralinga Safety Committee. To supplement this, he felt the necessity for an additional committee 'which would be a national authority on radiological effects' responsible to the Australian Government.

12.9.3 An outline of the responsibilities and recommended membership of both committees was forwarded by Beale to the Prime Minister [RC 800, pp.570419-20]. Approval of the proposals was given and recruitment of members commenced. The National Radiation Advisory Committee (NRAC) was established in May and the first meeting held on 10 June 1957 [RC 800, p.571028]. Its members included eminent scientists and doctors under the chairmanship of Sir Macfarlane Burnet.

12.9.4 The Safety Committee was reconstituted under the chairmanship of Titterton with Dwyer, Stevens, and Butement with Moroney as Secretary, replacing J C Bower.

Establishment of the Board of Management

12.9.5 In late October 1956, moves were being made in Australia for greater control of the Maralinga Range. The UK authorities could not accept Australia's view, as reported by Wheeler, that Australia 'must control Maralinga fully', but were prepared to discuss the establishment of a management committee, provided that certain conditions were observed:

'(i) Committee is not linked in any way with the management of Woomera, which is an entirely separate

project, and on which Australian participation is on quite a different scale.

'(ii) Committee is an entirely different body from the Maralinga Committee, on which we think Australia is over-represented for the purpose in view.

'(iii) There is adequate UK representation.

'(iv) Committee has no power to commit UK Government to expenditure.' [RC 559, Bundle D, p.133]

12.9.6 The Australian Government's views on control arrangements and division of responsibility for the management of Maralinga by the two governments were outlined in a proposal to the UK on 2 January 1957 [RC 559, Bundle D, pp.158-9].

12.9.7 Membership and administrative function proposals were telexed to Wheeler on 15 January [ibid., pp.167-8] for consideration. Clarification of the proposals was reached after discussions between Jackson, the UK Ministry of Supply, and Australian officials and was telexed to the UK with the recommendation that they be accepted. Confirmation of UK acceptance was received on 18 February.

12.9.8 The proposals submitted on 2 January were adopted and the constitution of the Maralinga Board of Management forwarded to the Minister of Supply. Members included staff from each of the Australian Armed Services, the Australian Department of Supply and the UK Ministry of Supply [RC 800, p.570368]. The first meeting of the Board of Management was held on 29 April 1957 [RC 800, pp.570655-60].

12.9.9 The Antler test series of 1957 was conducted during a period of mounting opposition, both in Australia and world-wide, to atmospheric testing. Russian expansionism, the Suez crisis and the international debate on nuclear disarmament were influencing public opinion on the necessity of the tests.

12.9.10 The Mosaic and Antler test programs were considered to be aids in the development of the thermonuclear weapon by the United Kingdom. As will be seen by the number of changes to the program throughout the approval process, the program for Antler was remodelled as more information and results were received from the Grapple test series being conducted in the Pacific.

12.9.11 The mechanics of organising and firing the tests were by now well-established. Information from the UK was generally more readily forthcoming and the Australians had a greater understanding of their overall requirements. Nevertheless, there were still hiccups in the approval process.

12.9.12 The first formal advice of the 1957 tests, initially known as Operation Sapphire, was forwarded by the United Kingdom on 18 September 1956. At that stage, the anticipated program was

'...that there might be up to five tower tests in which there would be no target response measurements. Firing would take place in the latter half of 1957. The scientific party would be smaller than that provided for the forthcoming tests in 1956. The Australian Safety Committee would, of course, have to satisfy itself about the safety aspects of any proposed firings.

'3. The United Kingdom would very greatly welcome a repetition of the arrangements which are operating so well for the present series of tests...' [RC 559, p.101]

12.9.13 The following submission was considered by Federal Cabinet on 14 December 1956:

(D) Proposed Programme of Trials for 1957.

'This consists of:-

'(i) Minor trials - Kittens, Tims and Rats - covering the period March-October, totalling 80 trials.

'(ii) The major trials October-November. The programme has not yet been finally decided upon but the present plans are that there might be up to five tower tests on a somewhat similar scale to Numbers 1 and 4 in the Buffalo series.

'(iii) No information is yet available regarding the likely number of tests to be carried out in 1958 and in succeeding years.

'...I now propose Cabinet agree to (i) - Minor Trials - and note (ii) and (iii) on the understanding that approval of Cabinet for future major trials will be sought when the U.K. intentions are definitely known.' [RC 800, p.565450]

12.9.14 The proposal was agreed to in the following terms:

'(1) agreed that control arrangements and division of responsibility be negotiated with the United Kingdom on the lines provided for in paragraph 3(A) of the submission;

'(2) invited the Prime Minister to determine the Australian contribution to the Service task force;

'(3) noted the construction effort required at Maralinga for the 1957 trials and the Prime Minister's approval for the work to be undertaken by the Department of Works;

'(4) noted the probable programme of trials for 1957 and approved the series of minor trials required to be carried out during March-October, 1957;

'(5) noted the existing financial arrangements and approved their continuation in accord with the Memorandum of Arrangements previously agreed.'
[RC 800, p.565442]

12.9.15 Expansion of UK programs in Australia in the past had led to a request by the Australian Government for assurances on the extent of future Australian involvement in UK operations at Woomera, the Pacific, and at Maralinga. The concern stemmed from the increased expenditure, the growing number of unspecified requests and changes of organisation when details of these requests were not forthcoming. An indication of this concern was given when resolution of the manpower question was finally 'achieved on personal direction of Mr Menzies against strong resistance by Service departments...' and '...it must therefore be considered maximum' [RC 559, Bundle D, p.151].

12.9.16 The code-name for the series had been changed to Volcano in the intervening period. Australia, not happy with the new choice of name with 'its association with destruction', had requested for, and was notified of a new code-word, Antler, on 22 January 1957 [RC559, Bundle D, p.180].

12.9.17 UK Government approval for Operation Antler was given on 5 February 1957 and a cable confirming the wish of the UK Government to carry out the 1957 major trials sent on 12 February 1957 [RC 559, pp.201-2]. The request for Australian agreement to the proposed trials and a further series of minor trials was made in the following terms:

'2. We propose to fire up to six rounds but of this number the firing of two is dependent on the results of Grapple. Full details will be sent shortly by D.A.W.R.E. to the Safety Committee for their agreement. Some of the rounds will be fired on towers and the remainder from balloons if the hoist system proves practicable; otherwise towers will be substituted. Minor trials proposed consist of a further series of TIM firings numbering about seventeen and similar to those carried out during Buffalo.

'3. Proposals for command and scientific direction are now under discussion here and will be telegraphed to you when decision has been reached. For your own information Penney cannot afford time to take charge as in Buffalo although we are well aware from Jackson of the Australian views on this point and we have much in mind importance of nominating a Commander with ability to secure confidence not only of Australian authorities but also of Australian press and public opinion.

'4. Total scientific staff from the United Kingdom will number about 200 among whom we may wish to include a few Canadian personnel subject to agreement of Canadian Government.' [RC 559, Bundle D, p.201]

12.9.18 This request was followed on 27 February 1957 by a letter from Penney to Martin outlining the program as

<u>'Round</u>	<u>Site</u>	<u>Support</u>	<u>Max Yield</u>
1	Biak	100 ft tower	20 kt
2	Tadje	100 ft tower	3 kt
3	Gona	300 ft tower	30 kt
4	Milne/Lae	Balloons	80 kt
5	Buna	Balloons	80 kt
6	Milne/Lae	Balloons	30 kt

'The proposed order of firing and location of sites may possibly be varied by further considerations, but from a safety aspect such variations are unlikely to be significant. The figures quoted for maximum yield are those which would be used for fall-out forecasts. In every case they are larger than the expected yields.

'The fall-out from the first round would not be very different from those of the tower shots at Buffalo. The third shot, on the 300 ft tower, will give less fall-out than the tower shots at Buffalo. The balloon firings will give considerably less fall-out up to 200 miles than either of the Buffalo tower shots. The main requirements for these would be suitable winds at high levels, and no rain conditions on the east coast. The clouds will go very high and the debris will be very fine. With fast upper winds and no rain below, the clouds will clear Australia very quickly, and the fall-out along the east coast will be minute.'
[RC 800, p.570372]

12.9.19 Australian reluctance in granting approval for the tests was causing increased concern for the UK authorities. The Safety Committee felt unable to give consent to the trials without further information. The use of balloons with the risk of escape was a cause for concern. Before giving approval, they desired more information which until then had not been readily forthcoming. It was proposed that Titterton visit the US with a view to ascertaining what experience had been obtained there from Penney's program of large yields and the use of balloons. Lloyd's response was to suggest that Titterton first visit Penney in England to discuss the areas of concern, and then

'...Should you wish Titterton to visit America on the way back to enquire about balloons we would raise no objection but we would ask him not to give any values of our maximum or expected yield.' [RC 559, Bundle D, p.229]

12.9.20 The Safety Committee's concern over the safety factor involved in higher yields and the use of balloons stemmed from

'...the trouble created by Mr. H. Marston because of temperature inversion following the third Buffalo test. For this reason he said the Safety Committee could not consent to a firing if there was the slightest chance of a cloud passing anywhere in the vicinity of Adelaide. We wished to make it quite clear that although an inversion created a political and not a safety problem, the Safety Committee could not ignore the political implications.' [RC 800, p.571801]

12.9.21 Public and scientific pressure over the contamination of the atmosphere had promoted the setting up of committees to investigate the possibilities of disarmament at the time of planning the Antler series. Public disapproval of nuclear tests was having an effect on the future planning of testing programs and it was felt necessary for present tests to be undertaken before bans on atmospheric testing were enforced.

12.9.22 Another factor influencing the timing of the tests were Menzies' desire to complete the Antler program before Parliament reassembled towards the end of October [RC 558, p.3460].

12.9.23 On 17 May 1957, the Australian Government notified the United Kingdom of its approval for Antler as a series of six tests, on the understanding of agreement by the UK 'that usual provision must apply that Australian Safety Committee is to satisfy itself as to all safety aspects before any test is conducted'. Acknowledgement of Australia's agreement and notification of the selection of Adams as Trials Director was forwarded on 30 May 1957 [RC 800, p.570878].

TABLE 12.9.1

The Antler Program

Round	Weapon	Estimated Yield (kt)	Support	Height of Burst (ft)	Site
1	E4	20-30	Tower	300	Gona
2	E3	5-15	Tower	100	Tadje
3	E1	15-20	Tower	100	Biak
4	E5	25-30	Balloon	1000	Tufi
5	E6	50	Balloon	1000	Taranaki (Buna-Buna)

Source: RC 398, Operation Antler, Summary Plan, Section A - Introduction, p.A.1.

12.9.24 Following agreement by the Australian Government to hold the Antler series, there were several further changes to the test program. In June, AWRE produced the Operation Antler Summary Plan (Table 12.9.1).

12.9.25 When it actually took place, the series was significantly smaller than originally planned. The apparent success of the Grapple series is thought, from internal UK communications, to be a contributing factor to this reduction. The series that occurred was as follows:

14 Sep 1957	Antler 1 Tadje site	Fired on aluminium tower 31 m above ground at 1435 hours CST (0505 hours GMT) Yield 1 kt
25 Sep 1957	Antler 2 Biak site	Fired on aluminium tower 31 m above ground at 1000 hours CST (0030 hours GMT) Yield 6 kt
9 Oct 1957	Antler 3 Taranaki site	Fired 300 m above ground suspended by balloon at 1615 hours CST (0645 hours GMT) Yield 25 kt

The Press and the Public

12.9.26 Publicity, and the need for it to be controlled, was of prime importance to both the British and Australian Governments in the period leading up to, and during the Antler tests. At a meeting in late October, Menzies and Penney discussed their approach on the attendance by Members of Parliament and the press at future tests. Menzies felt, and Penney agreed, that none should be permitted to attend. This decision was met with surprise by Allen from the UK Commonwealth Relations Office, who made a request for consent to retract this agreement on the grounds that

'...It is clearly important to keep on the good side of both parties, and invitations to Maralinga seem to be a good way of securing this objective.' [RC 559, p.128]

12.9.27 Penney's response was that he must have given this impression due to the haste of the meeting and in fact was suggesting that places should be allocated sparingly.

12.9.28 In early June, the Commonwealth Relations Office recommended sending Penney to Australia a few days before commencement of the tests to give interviews to reassure the Australian public as he had done before previous tests. UK officials were of the opinion that the Australian public may have felt the tests in Maralinga were unnecessary following the success of the Grapple series of thermonuclear explosions. Further factors considered by the British in their attempts to reassure Australians of the necessity for the tests was the possibility of sensational and alarmist newspaper articles written by the press and scientists, and the opposition of Evatt and the Labor Party [RC 559, Bundle D, pp.293-4]. The idea of sending Penney was later rejected because of Penney's extremely busy schedule, and as

'...we have been trying to foster the idea that Maralinga tests are matters of routine which we try to avoid dramatising. If we send such a busy man as Sir William Penney out again to Australia, it will do much to destroy this idea that the tests are routine matters and may indeed be calculated to excite just those anxieties which we are anxious to allay. The Australian public may say that, if it is necessary to send Sir William Penney out, then there must be something uncertain and possibly risky in these tests.'
[RC 559, Bundle D, p.320]

12.9.29 A survey by **The Sun** on 13 June 1957 indicated that 49 per cent of those polled were against further testing in Australia. The UK, anxious to win back support, attempted to win the confidence of editors, with a plan to arrange a visit by senior editors and proprietors of leading newspapers to Maralinga:

'The effect of this operation would be to win the confidence of the editors and make them feel well disposed towards Antler. But to get this effect we should need to show them freely everything there was to be seen, unless you have any reservations about this, and also tell them as much as possible about what the programme would comprise even to the extent of giving them rough comparisons in size of explosion compared with last year. They would understand and respect the fact that the information was not for disclosure in the press but they are senior people and if they trouble to spare the time to come to Maralinga they will feel themselves entitled to a little more than their newgathers [sic] can get.

'Another point of importance would be that by giving the editors this amount of information they would feel themselves in a superior position in relation to their reporters and this would enable them to avoid having scare stories put across them.

'One other point is that the editors would then also be in a position to advise on the best type of publicity to develop confidence in the public mind in the event of any scares.' [RC 559, Bundle D, p.319]

12.9.30 When the decision to use balloons instead of towers was made, once the scientists had been convinced of their safety, press releases to reassure the public were considered. Press coverage was decided upon after the following considerations were made:

'Titterton is anxious to avoid any reference to the use of fighter aircraft, since in his view public fears are likely to be increased rather than allayed by suggestion that balloons might drift from their moorings and have to be shot down. He claims to have made this point in his talks with Minister of Supply.' [RC 559, Bundle D, p.312]

'Assume Titterton appreciates that it is not our intention to volunteer any information about use of fighter aircraft but to refer to them only if specifically asked what we should do if balloons drifted from their moorings...' and

'...In fact all the material contained in my telegrams Nos. 874 and 875 will be used only if specific questions are asked and we are unable to avoid answering. It is not our intention to volunteer statements on any aspects of these trials.' [RC 559, Bundle D, p.313]

12.9.31 An indication of British confidence in their ability to conduct the tests is shown when the question of attendance at the trials by Australian and overseas observers was raised by the Commonwealth Relations Office on 3 August 1957, it having resolved earlier the question of numbers [RC 559, Bundle D, pp.352-3]. Australian authorities concurred with these proposals and later consented to attendance by US officials [RC 559, Bundle D, p.391].

12.9.32 A press release announcing the forthcoming trials was issued on 29 August 1957. The usual basic press releases were issued following the successful explosions of rounds 1 and 2. Round 3 releases related to the controversial use of balloons. The Ministry of Supply proposal in a telegram to the UK High Commission to announce the success of the test and its reasons for the wording, following the communications above, was decided as

'The Ministry of Supply has been advised by Mr. C.A. Adams, Director of Trials, that the third and final explosion in the present series of atomic weapons tests at Maralinga, South Australia, was successfully made from a balloon today.

'All safety precautions are in operation and scientific records are being collected for accurate evaluation.'
[RC 559, Bundle D, p.426]

Conclusions

12.9.33

(a) The Safety Committee was provided with adequate information and was able properly to advise the Government about the safety of the proposed Antler tests.

(b) The Australian Government had sufficient information to make an informed decision as to the criteria for safe firing for the tests.

(c) The process of allaying public concern about the testing program continued throughout the Antler series but the public was again, not informed of the true nature of the hazards involved.

12.10 The Minor Trials

12.10.1 The most secretive aspects of the entire UK weapons testing program were the minor trials. As the minor trials consisted essentially of experiments on the components of atomic weapons and so were related to weapon design, few Australians - if any - participated in them. Nevertheless, at various levels and in a number of different ways, Australian approval for the 'safety' of the trials was given. The fundamental question to address is how Australian scientists could testify to their Government that the minor trials were being conducted safely if they were not participants and were denied access to basic data.

Kittens 1953

12.10.2 The intention to conduct five minor Kittens trials in conjunction with the Totem tests did not even rate a mention in the approach to the Australian Prime Minister for approval to fire two atomic weapons at Emu. The first mention - at least in the documents - occurred at a meeting between the Australian mission sent to the UK to discuss arrangements for Totem with Dr Tyte and other UK scientists at Fort Halstead from 9 to 12 January 1953. The Minutes of that meeting record that

'Dr Tyte also informed the meeting that it was desired to carry out a number of additional small trials, probably five, involving the preparation of an additional site.' [RC 800, p.530181]

12.10.3 Later, it was explained that

'An area immediately around the firing sites would become contaminated and might remain so for a period.'
[RC 800, p.530190]

12.10.4 There is no record of any formal request to the Australian Government to fire the five Kittens in 1953 and it appears from the first quotation above that it was mentioned only because the British wanted some site preparation to be carried out by the Australians.

Kittens and Tims 1955

12.10.5 On 29 May 1954, Tory of the UK High Commission in Canberra wrote to Brown, the Secretary of the Australian Prime Minister's Department, indicating that

'The Department of Atomic Energy in the United Kingdom may decide in the light of certain researches now being undertaken that it will be necessary to conduct experiments with 'initiators' some time during the year 1955...Conditions in the United Kingdom for these experiments are unsuitable and it is much hoped therefore that the Australian authorities would agree to their being conducted in this country.' [RC 800, p.540503]

12.10.6 Tory acknowledged that the choice of a site for these trials was a matter for the Australian Government but did refer in passing to the need to 'avoid prejudicing the permanent site by contamination' if the Ooldea-Watson area was to be used. It will be recalled that no formal approach had yet been made for the establishment of a permanent proving ground.

12.10.7 On 15 July 1954, following receipt of advice from the Departments of Defence and Supply, the Prime Minister's Department replied to the UK High Commission in Canberra indicating that the UK request had been considered at the official level only but that 'the prospects of approval at the Cabinet level are very promising'. The letter went on to say

'...the Defence authorities would appreciate it if the Department of Atomic Energy in the United Kingdom would provide Professor L.H. Martin, Defence Scientific Advisor, with data on weapon effects in order that he may make an independent check on behalf of the Australian Government of the safety aspects of the tests.'

and concluded with the suggestion that the tests be conducted at Emu [RC 800, p.540609].

12.10.8 McKnight of the Prime Minister's Department annotated the file copy of this letter thus:

'I have spoken to Mr Tory in terms of the above and made the additional point that, after I had informally mentioned it to PM, he said he was favourably disposed.' [RC 800, p.540609-10]

12.10.9 There is, implicit in the tone of this correspondence, a very clear inference that the 'independent check' was merely a formality.

12.10.10 Nevertheless, Martin did discuss the proposed tests with Penney and was, according to a file note of the UK High Commission dated 12 August 1954, '...satisfied that they will present no difficulties from the safety and contamination aspects' [RC 800, p.540679].

12.10.11 It is not known how much or what information Martin required to reach this conclusion.

12.10.12 Following a suggestion from the Secretary of the Department of Supply, the proposal for a further series of initiator trials was considered by Federal Cabinet when Beale's submission on the permanent proving ground was under examination. So, on 26 August 1954, Federal Cabinet agreed

'...to co-operate with the United Kingdom in the preliminary initiator tests known as Kittens.' [RC 800, p.540710]

12.10.13 As the matter was not raised in his submission, it is not known what issues may have been considered in reaching this agreement. In any event the choice of the site for the trials was left to officials to resolve.

12.10.14 In November/December 1954, a UK mission, described by the media as a 'hush-hush party of British atomic scientists' visited Australia for discussions on the permanent proving ground and the initiator tests. It became apparent that Maralinga was the preferred site for the Kittens tests. At these meetings, Australian officials were provided with a document entitled 'Operational Planning, First Statement' [RC 800, p.541017], which provided broad technical details and made a firm request for a paper giving details of the scope and radiological hazards associated with the Kittens trials.

12.10.15 On 14 December, the Minister for Supply briefly raised the matter in Cabinet and on 23 December 1954, the Secretary of the Prime Minister's Department wrote to the UK High Commissioner advising him that 'Australia agrees to the tests (Kittens) being carried out at Maralinga in May, 1955...'. Brown continued

'We will, of course, wish to have the opportunity of checking all safety aspects of the tests. Our

understanding is that Mr Wilson (Under Secretary, UK Ministry of Supply) will arrange for complete technical details to be furnished to you for transmission to me immediately on his return to the United Kingdom.' [RC 800, p.541099]

12.10.16 A document entitled 'The Scope and Radiological Hazards of Kittens 1955' was prepared in January 1955 and dispatched to Australia. It was referred to the Defence Department for consideration by Martin who indicated that he thought that the hazards were 'slight' but that it would be wise '...to establish the Safety Committee forthwith and to refer the safety aspects of the "Initiator" tests to it for advice' [RC 800, p.550198].

12.10.17 As the AWTSC had not been formally constituted in time, the question of the safety of the forthcoming Kittens trials was referred to Titterton and Martin again at the request of the Minister for Supply [RC 800, p.550677]. Beale was advised on 16 May 1955 that '...Martin and Titterton have conferred on safety aspects and are satisfied' [RC 800, p.550707].

12.10.18 On 24 March, the UK High Commissioner sought approval for two additional firings at the end of the Kittens series - these were Tims experiments. The procedures were by then fairly well laid down and the Prime Minister's Department replied that

'We see no objection to the extension of the Kittens 1955 trial by the inclusion of two additional firings but would wish to have again the opportunity of checking all safety aspects of the tests and would be glad if you would arrange to forward complete technical details as soon as possible.' [RC 800, p.550372]

12.10.19 At its first meeting, on 8 July 1955, the AWTSC considered the proposal and agreed that the Chairman

'...should write a suitable letter to the Acting Minister for Supply for the information of the Prime Minister, clearing the trials.' [RC 131]

The Press and the Public

12.10.20 An announcement that the Kittens trials were to take place was made in the UK (25 February 1955) and Australia (26 February 1955) in the following terms

'These are not atomic bomb explosions, but are detonations of high explosive charges to test techniques relating to atomic weapons. There will be some radioactivity limited to a small area in the neighbourhood of the explosion. Every precaution will be taken to ensure that there is no danger to human beings or stock.' [RC 800, p.550180]

12.10.21 The announcement in Australia continued

'Mr Beale concluded by repeating his earlier assurances that no hydrogen bomb tests or any tests of that character would be carried out.' [RC 800, p.550185]

12.10.22 On 2 March 1955, stung by some fairly trenchant criticism in the Australian press, Beale wrote to the UK Minister for Supply, Mr Selwyn Lloyd, about 'leaks' in the UK:

'...we find ourselves in an intolerable position, as our Press bitterly accuse us of betraying their interests in favour of the British Press, of not knowing our own business, of being evasive and untruthful, and so on...

'The latest report from London concerning hydrogen bomb tests in Australia illustrates our difficulties. Although the report was, of course, false, it was obviously wrongly based on information concerning the 'Kittens' project, which our two Governments had agreed should not be announced at the time. I denied the report, but now that the official 'Kittens' announcement has been made, I am being called a liar for having denied the earlier story, and it is useless to try to explain the difference between the two announcements.' [RC 800, p.550242]

12.10.23 The non-sequitur of the final sentence lends sympathy to the sort of article that Beale was complaining about. For example, on 24 February 1955, under the headline, 'People should have more facts', **The Age** referred to

'What amounts to a virtual breakdown of communication between the Government and the people...involving matters of great moment to Australia.' [RC 800, p.550181]

Minor Trials 1956

12.10.24 On 14 October 1955, Rouse of the UK High Commission wrote to Herde of the Prime Minister's Department indicating that the UK Atomic Energy Authority wished to carry out a further series of 18 Kittens trials at Maralinga, commencing in March 1956. Rouse pointed out that as the trials were 'of the same nature' as those carried out in May to July of 1955:

'...except for some variations in the permitted firing area to take account of the occupation of the range at the time, the safety aspects are covered by the document "The scope and radiological hazards of Kittens, 1955..." [RC 800, p.551944]

12.10.25 The Prime Minister was advised of the request on 19 October 1955 [RC 800, p.552018] and the Safety Committee at its meeting of 26 October 1955, agreed that

'as these tests would be of the same nature as those carried out earlier this year, they considered them simply an extension of those tests, the safety question being the same and the clearance the Committee had given for those tests was still effective.' [RC 800, p.552075]

12.10.26 On 28 October 1955, the Secretary of the Department of Defence informed his Minister that

'It is proposed, subject to your approval, to advise the Prime Minister's Department that from the Defence point of view the United Kingdom proposals might be accepted on the understanding that the Department of Supply refers the matter to the Australian Safety Committee and also examines the proposal to ensure that there is no incompatibility with existing commitments or agreements in regard to atomic trials.' [RC 800, p.552081]

12.10.27 Cabinet agreed to the proposal on 3 November and the UK High Commission was advised on 10 November 1955 that

'The Australian Government has no objection to the conduct of these trials...' [RC 800, p.552166]

12.10.28 On 4 July 1956, Rouse again wrote to the Prime Minister's Department, describing the firings intended for the Buffalo series. Included in this outline were

'About ten rounds of the HE assemblies in TIM series for timing and similar measurements.

'These assemblies contain non-fissile radioactive components and therefore give rise to a small amount of contamination. These will be closely comparable to two firings at Maralinga in July 1955...'

12.10.29 The letter also went on to explain that

'...Sir William Penney is preparing further details for transmission to the Safety Committee.' [RC 800, 563031]

12.10.30 No difficulties were raised by the Safety Committee and the trials, consisting of nine experiments, seem to have been conducted in the period September to November 1956. In addition two Rats experiments appear to have been carried out in October 1956. As there was only minimum Australian involvement at the very most and no Australian documentation it is not possible to determine what effect, if any, late variations to the

minor trials program may have had on the Safety Committee's previous clearance. In the absence of documentary evidence to the contrary, it has to be assumed that no difficulties were foreseen.

Minor Trials 1957

12.10.31 On 10 July 1956, the UK High Commissioner wrote to the Prime Minister's Department seeking the agreement of the Australian Government to a program of 32 Tims minor trials for 1957. The letter indicated that the full details of the program would be sent by Penney to the Safety Committee.

12.10.32 On 4 September 1956, Cabinet decided that

'...before any decision is reached the Acting Prime Minister and the Minister for Supply should endeavour to obtain from the United Kingdom Government a more comprehensive account of the United Kingdom programme for Maralinga and the consequent demands on Australian resources.' [RC 800, pp.563935-6]

12.10.33 It is apparent from the contemporary documents that the major Australian concern with the minor trials at this time was not safety but the amount of resources Australia would be required to commit.

12.10.34 The program was subsequently extended to contain 80 firings and it was explained that there could be some alteration in detail later. Safety arrangements to apply during the trials were also outlined. It was submitted to Cabinet under cover of a Submission from Beale and approved on 14 December 1956 [RC 800, p.565442].

12.10.35 It is not clear whether the AWTSC was invited to comment on the proposed program.

Minor Trials 1958

12.10.36 In a letter dated 7 January 1958, from the UK High Commission to the Prime Minister's Department, agreement was sought for a series of trials to be held at Maralinga between April and November. 'At present the programme is not precisely defined' the letter stated 'but is likely to be such as to involve a firing rate of two to three rounds a week'. It continued 'The nature of the proposed firings is the same as those undertaken in 1957 and foreshadowed in Rouse's letter of 10 July 1956. For these firings the radioactive contamination is known to be negligible. Established safety precautions however would be applied. Full details will be sent in due course to the Safety Committee' [RC 800, p.580085].

12.10.37 The Department of Supply indicated to the Prime Minister's Department that it had no objection to the proposal [RC 800, p.580101] and, on the 20 January 1958, the Acting Secretary of the Prime Minister's Department wrote to the UK High Commission in these terms: 'The Australian Government has no objection to these trials, the detailed arrangements for which will be worked out, presumably, through the usual channels' [RC 800, p.580128]. There was no specific reference to a concern about safety, nor it seems was the AWTSC consulted prior to agreement being given. The Minutes of the 32nd Meeting of the AWTSC held on 9 January 1958 do not record any discussion of the 1958 minor trials [RC 131]. The Marston matter dominates the AWTSC Minutes of that period.

12.10.38 The Minor Trials program for 1958 was formalised in a document published by the AWRE in February 1958 [RC 360]. The firing program is set out in Table 1 of RC 360; 29 Tims and 27 Rats rounds were expected to be exploded between April and July. The tests were divided into two periods and a detailed plan for Phase 2 was not issued until August 1958 [RC 361]. Phase 2 envisaged 30 Tims firings and 72 'small scale firings in the Tim area at Kuli' between September and November 1958.

12.10.39 A significant number of tests were planned and, as shown by the meteorological requirement before every firing, a forecast was to be made covering wind direction and strength from the surface to 5000 feet. Warnings were to be given to air traffic control and the firings were to produce fallout only in specified sectors [RC 800, p.580158].

Minor Trials 1959

12.10.40 The tests proposed for 1959 were more serious and dangerous because they involved the burning of beryllium, natural uranium and plutonium. They also had a new name. Minor trials became 'Assessment Tests', and were to be conducted with especial secrecy because of the Geneva negotiations [RC 800, p.590097].

12.10.41 A Safety Statement dated 17 February 1959 was prepared by Pilgrim [RC 371]. It stated:

'1.1 The Assessment Test Series in 1959 will take place at Maralinga from late March to November. There will be "Kittens" and "Rats" firings at Naya and Dobo respectively. "Tim" firings will be carried out at Kuli and a number of Safety Investigation Tests, known as "Vixen" will be held in the Wewak area near J12, during June and July...

'1.2 All the firings with the exception of a few "Vixen" experiments, contain High Explosives and small amounts of non-fissile radioactive materials of low activity.'

12.10.42 A cable was sent by Wheeler through the UK High Commission in Canberra to Lloyd of the UK Ministry of Supply on 19 February 1959 stating that formal approval for the tests could be expected soon, but that

'A difficulty arose because the Safety Committee whose advice was sought had been given no information on the proposed trials. Fortunately Titterton took it upon himself to agree in principle even though he had no details. I think it important that AWRE should follow the previous practice and should release to Titterton as much information as they can about the forthcoming series. Can you press them to do so?' [RC 800, p.590121]

12.10.43 Titterton is reported as having agreed 'in principle' to the tests in a memorandum to the Secretary of the Prime Minister's Department on 18 February 1959.

12.10.44 The Prime Minister was not contacted nor his approval sought until 26 February 1959. The memorandum to him was in these terms:

'The United Kingdom Atomic Energy Authority wishes to carry out a further series of assessment tests at Maralinga commencing in March 1959. It is not possible to estimate the total number of firings required, nor the duration of the programme.

'The tests are designed to facilitate the handling of nuclear warheads by the Services and ultimately by refinement of techniques to reduce weapons costs. Radioactive contamination from these tests they say, will be very small and will be dealt with by the already established safety precautions for these trials

'...Details of the tests are being passed to the Safety Committee and the Chairman of the Committee, Professor Titterton, agrees in principle to the tests.' [RC 800, p.590130].

A simple 'yes' and Menzies' initials appear at the bottom of the memorandum.

12.10.45 Two disturbing matters emerge from this series of events. First, Titterton is seen to be supporting the British application to hold the tests even though he was ignorant of their details; second, the British representative Wheeler is urging that more information be given to Titterton rather than to the Safety Committee. Titterton's pivotal role in the control of the information coming from the British is never more evident.

12.10.46 At a meeting of the AWTSC on 26 February 1959, Titterton told other members that he had made a formal

recommendation to the Prime Minister that he approve the assessment tests for 1959. The Minutes of the AWTSC record that

'In making this recommendation, the Chairman understood that the form and scope of the trials would be much the same as previous "Minor Trials Series" but to clarify this point, the appropriate documentation has been requested from the UK Ministry of Supply. The Committee formally ratified this action.' [RC 131]

12.10.47 Pilgrim's Safety Statement is dated 17 February 1959. It was discussed by the Safety Committee at its meeting on 11 March 1959.

12.10.48 It was noted in the Minutes that

'The Committee considered that this information adequately fulfilled its requirement regarding the nature and extent of the tests proposed.'

12.10.49 In retrospect that view was not shared by Pearce when he gave evidence [Trans., pp.6404, 6413]. He conceded that the 1959 Safety Statement was inadequate.

12.10.50 The nature of the assessment tests was changed in May 1959 when AWRE wished to augment the Vixen series 'by adding a few burning trials to determine the dispersion of plutonium under representative field conditions' [RC 800, p.590413]. The tactics were discussed between the UK Ministry of Supply and AWRE and it was decided that a direct approach from Penney to Titterton would be best [RC 800, p.590440].

12.10.51 Penney wrote to Titterton on 15 June 1959 stating that they proposed to burn about 200 g of plutonium in a controlled petrol fire. He said

'As you know, we have not previously used plutonium in Assessment Tests at Maralinga and since its use could easily be misinterpreted politically I am seeking your advice about how best to seek approval for these tests. If these are agreed and the results prove to be worthwhile we may well ask for further similar experiments next year. We hope the results will be of general interest, and we should, of course, make them available to Australia.' [RC 800, p.590467]

12.10.52 Titterton replied by telegram on 25 June 1959:

'Believe no serious problems in obtaining agreement to your request. Would like to put it before Safety Committee for a recommendation to the Minister. Signal if you agree to this course...' [RC 800, p.590502]

12.10.53 Titterton was still in control. He was seeking approval from Penney to put the proposal to the Safety Committee. This is another clear example of Titterton's special relationship with the AWRE.

12.10.54 Titterton received Penney's consent and raised the matter at the AWTSC meeting of 9 July. The Safety Committee agreed to a cable being sent to Penney indicating agreement. It was recommended that a formal approach be made by the UK to the Department of Supply [RC 131].

12.10.55 In a letter dated 10 July 1959, the Safety Committee wrote to the Minister

'You will recall that the entire responsibility physically and legally for health problems at the range, between major trials, is vested in the U.K. although by agreement the Health Physics Representative is an Australian, and other Australians are attached to his group.

'The Safety Committee therefore recommends that Australia agree to the holding of these two trials subject to -

'(1) agreement to the results being made available to Australia

'(2) appropriate location of the test site within the restricted area so that no material could escape beyond its boundaries

'(3) The Safety Committee being informed of the details of the planning and location of the experiments when these have been finalised

'(4) adequate meteorological support be available to enable appropriate trial conditions to be selected.'
[RC 800, pp.590570-1]

The consequences for the Range and any long-term safety hazards do not seem to have been discussed. However the Minister's attention was drawn to the 'political overtones' involved in the experiments. The program proceeded.

Minor Trials 1960

12.10.56 The name of the minor trials was changed once again in January 1960 to the 'Maralinga Experimental Programme' [RC 800, p.600039]. It was in 1960 that major problems with the process of approval arose. Those problems highlight the deficiencies and inadequacies of the flow of information up to that time.

12.10.57 Formal approval was given on 30 December 1959 for the 1960 Maralinga Experimental Programme [RC 800, p.590926] which was to be equal to or greater than the 1959 series. The plan MEP 60 which was forwarded to Australia referred only to Vixen A tests and not to Vixen B.

12.10.58 The matter of Vixen B was informally raised with Titterton in February 1960 by the UK Atomic Energy Authority and he is recorded as expressing

'...the opinion that the approval already granted by the Australian Government for the series of experiments at Maralinga in 1960 covered the type of experiment we now wish to carry out.' [RC 800, p.600119]

He did not advocate a further formal approach through the Commonwealth Relations Office because, inevitably, detailed questions would be asked about the precise nature of the experiments, and how they differ from those already approved.

12.10.59 In a letter dated 22 February 1960, Makins wrote to Playfair

'We do not specify, nor does the Australian Government enquire into, the details of our experiments when seeking formal approval. Such approval is always subject to Titterton's Safety Committee accepting a detailed Safety Statement. Titterton's view is that we will have met our obligation if details of the effects of our proposed experiments are given in the 1960 Safety Statement. This can be done without disclosing such details that could lead to confusion with full scale nuclear tests.

'...I agree, therefore, with Titterton, that we should avoid formal communications on these contentious experiments and propose that we proceed **without going through the normal channels** (our emphasis).' [RC 800, p.600119]

12.10.60 As stated above the extension of the 1960 program was first raised in February 1960, but it did not come before the Maralinga Board of Management until 6 May 1960 when the Board's approval was formally sought for Vixen B.

12.10.61 At that meeting, White of the Department of Defence

'...asked whether perhaps the Board should receive more information on the scope and nature of the tests to be carried out at Maralinga. He quoted from the Memorandum of Arrangements in which it was stated that the UK would provide Australia with all the data compiled as a result of tests on the site about the effects of atomic weapons for both defence and military purposes. He realised this was written against a

background of major trials, but he felt that the Board was hardly in a position to recommend on the programme unless it had more information on the nature and aims of the tests.' [RC 800, p.600237]

White continued

'...the Memorandum of Arrangements specifies what information Australia has a right to receive but there appears to be a very wide gap between what is actually given and the "Atomic" information which is not generally made known. It was in the provision of information within this gap that he was interested.' [RC 800, p.600237]

12.10.62 The Chairman, Knott, commented that he had doubts as to whether the existing arrangement was satisfactory and that more information should be put to the Board if the members were to manage the Range properly. The proposal for an extension of the 1960 series was agreed 'subject to the reservation that the principle of release to Australia of more information on tests at Maralinga would be examined' [RC 800, p.600238].

12.10.63 Knott then wrote to the Prime Minister's Department on 16 May 1960 stating that the Board of Management had no details of the extension to the trials program at its meeting of 6 May '...and the Board felt it could not, therefore, advise the Minister adequately in the absence of any general particulars of those trials' [RC 800, p.600261].

12.10.64 He added

'The Board feels that the information placed before it is too meagre to enable a recommendation to be made to the Minister for Supply, and I have therefore to request that the High Commissioner be asked to furnish broad general particulars of the tests proposed in order that an appropriate recommendation may be made to the Minister.'

The paucity of information placed before the Board of Management and commented upon adversely by the Board at its 10th Meeting had now been brought to wider attention in the Australian administration.

12.10.65 The UK High Commission responded to a request for further information by letter of 3 June 1960 [RC 800, p.600278]. The aims of Vixen B were stated to be to give information on hazards which could arise as a result of accidents to weapons in storage or in by transit. The experiments were described as being similar to those of the 1959 Vixen series, but more elaborate, using techniques analogous to the Rats experiments. The details of likely contamination and the precautions to be

taken were said to have been passed to Titterton for the Safety Committee. The letter concludes with a request for urgent agreement to the Vixen B series.

12.10.66 Again we can see that Titterton was in the position of having the information. The British response to a request for more details was to forward some general material, then claim to have discharged its responsibilities because Titterton, as Chairman of the AWTSC, had previously been given more detail.

12.10.67 In a memorandum from the Secretary of the Department of Defence to the Minister of Defence dated 8 July 1960 [RC 800, p.600347], the question of the adequacy of information was addressed and the history of the matter was outlined. The Secretary submitted that

'A situation could arise in which there were appreciable "political" risks, although the Safety Committee might be quite properly satisfied that the safety measures were "adequate for the prevention of injury to persons and damage to livestock and other property". For example, there is nothing in the description of the "Vixen B" trials to exclude tests of a complete weapon in its normal transit or storage configuration.'

12.10.68 He suggested that even if the risks of injury from such tests were negligible, they should not be undertaken without the knowledge of the Australian Defence Minister. He continued

'Apart from technical considerations the political implications of these trials are such that the Australian Government's information on what is being done should be carefully documented; otherwise there could be embarrassment in the absence of the Chairman or Secretary of the Safety Committee or in the event of a change of occupant of either of these posts. In making this observation, I do not imply that there is any inadequacy in the documentation at present - I merely emphasise its importance.'

12.10.69 In the memorandum, the Secretary noted that no definite procedure had been laid down for approval of minor trials and suggested that any future proposals should be submitted to the Defence Minister for approval 'as are guided weapon and other trials undertaken jointly with the United Kingdom' [RC 800, p.600349].

12.10.70 Titterton wrote to Martin on 29 July 1960 and said, in relation to the provision of information regarding Vixen B,

'The best way to clear this matter quickly would be for you to discuss it with the Safety Committee, so that the whole question can be treated at once.'

He discussed suitable times and venues, and continued in his characteristic style

'If this date should be inconvenient I could, at some personal sacrifice, come to Melbourne specially for a meeting on Tuesday morning (16th) or any time on Friday 19th; if you should be in Canberra or could come up here specially, I could also fit in Tuesday 16th any time up till 3:30 p.m.' [RC 800, p.600342]

12.10.71 Titterton wrote to the UK following a discussion with Martin which he described as 'most unsatisfactory' [RC 800, p.600415]. He asked that written details of the proposed tests be sent to him and stated 'It would perhaps be wise to make it quite clear that the fission yield in all cases is zero' [RC 800, p.600416]. This, of course, was a misrepresentation of the nature of Vixen B as Titterton well knew. The yield was expected to be small, even very small, but not zero.

12.10.72 On 24 August 1960, the AWTSC at its 65th Meeting discussed the Vixen B trials and Australian approval for them. In the Minutes [RC 131] it is recorded that Martin of the Department of Defence declined an invitation to attend an AWTSC meeting to discuss defence requirements. Relevant information in the Safety Committee's possession was however to be sent to him and White.

12.10.73 A second discussion between the Safety Committee and Defence representatives was held on 17 August [RC 800, p.600455]. The Defence representatives did not question the Safety Committee's assessment of the radiological safety of the trials, but they were concerned with the 'political safety'. They declined a general invitation to attend AWTSC meetings when trials proposals were to be discussed and indicated that a direct channel for information would be established between the UK and the Department of Defence. The AWTSC was to have no part in this information channel.

12.10.74 The power which the control of information from the British gave to Titterton was eroded by these developments. The Department of Defence had clearly decided to bypass Titterton and the AWTSC and communicate directly with the UK.

12.10.75 Notably the Defence representatives were not prepared to become a part of a somewhat informal oral communication network overseen and controlled by Titterton. They wanted adequate information in written form. As Titterton acknowledged in a letter to Levin dated 9 August 1960, 'The one thing Martin made clear to me was that he would insist on paper work and would not be satisfied by discussion' [RC 800, p.600415]. The days when an informal letter from Penney to Titterton or an assurance from Penney was all that was required for approval to be granted by the Australian authorities for tests, were over.

12.10.76 At the same meeting Titterton proposed that Knott, the Secretary of the Department of Supply, should be formally told 'of the Committee's dissatisfaction with certain aspects of the handling of the UK proposals for Vixen B' [RC 800, p.600455]. A draft letter was prepared by Titterton for the Safety Committee and endorsed at the meeting [RC 800, p.600459].

12.10.77 In this letter, Titterton vigorously defended his integrity and rejected any suggestion that the AWTSC had agreed to trials without knowing whether they were safe. He stated

'In fact such a charge is completely without foundation; as far as we are concerned the UK has always fulfilled the letter of its agreement with Australia in regard to written information; they have always answered any questions we have asked them even when these were of a "marginal" nature in terms of the agreement; and in discussion they have, in fact, provided information far in excess of that required by the terms of the agreement.

'Such irresponsible and damaging views, given wide circulation as these were could do grave harm. Not only do they undermine the excellent relations which have obtained between the Committee and the Departments with which it works but, having been made to a U.K. representative and in all probability reported back to London, they may be misinterpreted there and lead to a breakdown of the mutual trust which has always existed between the Committee and the trials organisation at A.W.R.E.' [RC 800, p.600466]

Indeed, it was the very cosy position of mutual trust between the AWRE and Titterton in particular that caused the problems with the 1960 series and led to the lasting suspicion that Titterton was more of a *de facto* AWRE member than Australia's watchdog.

12.10.78 In the first paragraph of his letter, Titterton asserted that in February he had had discussions with Martin and told him brief details of the nature of and reasons for Vixen B. In a minute to the Secretary of the Department of Defence, this conversation is referred to 'Sir Leslie Martin says that the discussions with him did not give the full story' [RC 800, p.600516].

12.10.79 The skirmish over Vixen B for 1960 seems to have marked the end of Titterton's period of control. His role and influence hereafter diminished.

Minor Trials 1961

12.10.80 Approval for the 1961 series was sought in a letter to the Prime Minister's Department dated 29 September 1960 [RC 800,

p.600580]. This letter referred to the description of Vixen B in the letter of 3 June 1960 [RC 800, p.600278]; this definition was not very enlightening. It said that the experiments were similar to Vixen A but would be more elaborate, as it was planned to use techniques similar to those previously used in the Rats experiments. No mention was made of the predicted fission yield nor of the use of a major neutron source.

12.10.81 A Safety Statement was forwarded to the Safety Committee with a covering letter dated 3 September 1960 and Titterton wrote to Pilgrim seeking additional information on 24 October 1960 [RC 800, p.600679]. In particular, he sought the name of the materials to be used in the trials. It seems that Titterton may have been responding to the criticisms outlined above. A general indication of agreement to the proposals was given.

12.10.82 On 1 December 1960, Pilgrim wrote to Titterton [RC 800, p.600825] and told him about the materials referred to in the 1961 Safety Statement. The Vixen B trials were described as

'Safety studies in which the effect of an accident to a weapon in storage or transport is examined. H.E. in conjunction with fissile material is exploded in a way which might happen in an accident. Quantities of materials are such as to ensure a low limit to any fissile reaction; the standard employed being that any fission products produced must be radiologically insignificant compared with the activity of the parent fissile material.'

Clearly, it was expected that there would be a fissile reaction.

12.10.83 Titterton telegraphed Moroney on 21 December 1960 stating 'Statement from Pilgrim is excellent and clears all our questions. They have answered everything we asked. Advise Stevens and Dwyer.' [RC 800, p.600899].

12.10.84 Approval was given to the program by the Safety Committee and the Department of Defence gave formal approval on 18 March 1961 [RC 800, p.610233].

12.10.85 On 26 July 1961, the United Kingdom wrote to the Board of Management advising that the proposed Vixen B program would not take place [RC 800, p.610589].

Minor Trials 1962

12.10.86 The proposals for the 1962 Maralinga Experimental Programme were received in August 1961. In his memorandum to the Secretary, Department of Defence, in August 1961, Knott noted that

'...very little detail has been offered by the United Kingdom; this is in line with previous approaches, but after discussions with United Kingdom representatives earlier this year, a rather more frank statement of the form to be taken by the various trials might have been expected. However the Minister has endorsed the outline programme in principle...' [RC 800, p.610637]

Knott at least was not satisfied with the amount of information provided, at that stage by the United Kingdom, but more information was forthcoming.

12.10.87 The Secretary of the Board of Management distributed to members of the Board the documents MEP 7 [RC 365] and MEP 8 [RC 367] which had been received from the UK. MEP 7 related to facilities for Vixen A and B1, Tims and Kittens and MEP 8 to facilities for Tims. These documents were out of date by the time they were distributed in September 1961, as was stated by the Secretary in his covering letter [RC 800, p.610692].

12.10.88 The Safety Statement for the 1962 program [RC 371] was sent to Titterton by Pilgrim on 5 September 1961 [RC 800, p.610698] and to the Department of Defence. It stated that the standards for safety radii were to be the same as those for 1961 however, the firing sector around Taranaki was to be increased.

12.10.89 Pilgrim stated that although he had not yet done so he would send the 'Statement of Residual Radioactive and Toxic Contamination' [RC 374] to the Australian Health Physics Representative.

12.10.90 The statement was also sent to the Department of Defence [RC 800, p.610707].

12.10.91 At its meeting of 26 September, the Board of Management endorsed the proposal subject to approval from the Department of Defence and the Prime Minister's Department.

12.10.92 The 1962 program is outlined in Attachment B to the Minutes of the meeting [RC 800, p.610740]; it called for up to 10 Vixen B firings, 30 Kittens firings and 80 Tims firings.

12.10.93 The Safety Committee wrote to the Minister of Supply on 16 October recommending approval of the 1962 series and that the extension of the firing arc at Taranaki be agreed subject to provisos relating to activity levels in that area [RC 800, p.610765]. These provisos were agreed to by Pilgrim in a letter to Titterton of 8 November [RC 800, p.610832].

12.10.94 The UK High Commission was formally notified by a letter of 14 November 1961 that the program for 1962 was approved [RC 800, p.610844]. In fact, no trials were carried out in 1962.

Minor Trials 1963

12.10.95 The 1963 series was proposed in September 1962 and the program was submitted by the UK High Commission to the Prime Minister's Department. The Head of Staff of the UKDRSS staff wrote to Knott, on 26 September 1962, enclosing a synopsis of the 1963 proposals. Six Vixen B shots were to be fired beginning in March and 12 Tims shots beginning in October. The tests were said to be 'similar in character to those carried out previously and will involve using the same kinds of radioactive and toxic materials' [RC 800, p.620450].

12.10.96 The Safety Statement for the 1963 series was completed by 8 October 1962 [RC 371] and the distribution list included Titterton (four copies) and the Secretary of the Department of Defence.

12.10.97 A letter from the UK High Commission in Canberra to the Secretary of the Prime Minister's Department on 16 October 1962 indicated a need to carry out further Tims shots as soon as possible and proposed that they be carried out concurrently with the Vixen B shots of March 1963 [RC 800, p.620506]. The Safety Statement [RC 371] reflected the change of plan and was forwarded on 18 October 1962 to the Secretary, Department of Defence, and to Titterton for the AWTSC with a covering letter from the UK High Commission [RC 800, p.620517].

12.10.98 The amount of information provided, though more substantial, was still not entirely adequate for the Department of Defence. In an internal memorandum to Kingsland, White stated

'Sir Leslie Martin expressed himself satisfied with the information given on the 1963 programme, but suggested that it would be wise for the United Kingdom authorities to be as forthcoming as possible within the agreed limits of Australian access to information ...What he had in mind is that we are still operating on assurances rather than on evidence, and that some time in the future it may be desirable and practicable to move somewhat beyond this position.' [RC 800, p.620528]

The concerns that White had expressed previously were still unresolved. The Department of Defence perceived that it was still operating on 'assurances rather than on evidence'. Without the full details, it would never be possible to make a completely informed judgment about the tests. There was of course never any chance that full details would be provided by the UK for reasons examined elsewhere.

12.10.99 On 13 November 1962, the Minister for Defence approved the 1963 Maralinga Experimental Programme

'...on the understanding that no devices will be used which, from their external configuration, might be mistaken (erroneously) for weapons; and subject to the trials being approved by the Atomic Weapons Tests Safety Committee.' [RC 800, p.620570]

12.10.100 Approval was given by the Minister for Supply on 30 November 1962 [RC 800, p.620610]. The Safety Committee indicated its approval by letter to the Minister for Supply on 5 December 1962 [RC 800, p.620630].

Conclusions

12.10.101

(a) The first series of Kittens trials, conducted in 1953, was carried out without formal Australian Government approval and without advice being provided to the Australian Government by either Australian or UK scientists.

(b) The 1955 Kittens and Tims trials were conducted after approval from the Australian Government based upon thoroughly and properly considered advice from Australian scientists.

(c) Official Government comment on the 1955 series of minor trials, as with so many other statements concerning the test program, appeared to be designed either to exaggerate the extent of Government to Government co-operation or to escape from an awkward situation rather than genuinely to provide information to the public.

(d) By 1956, procedures were in place to allow the AWTSC an opportunity to examine the proposed program of minor trials for the forthcoming year and to report to the Government through the Minister for Supply on safety aspects. It is unclear, however, what arrangements were adopted for considering late variations.

(e) The 1957 program of minor trials was submitted for consideration by the Government and the decision to approve it was taken at the Cabinet level. It is not clear what advice was provided on safety aspects.

(f) The 1958 series of minor trials was approved by the Australian Government on the basis of information submitted to the AWTSC.

(g) The Royal Commission considers that Titterton recommended to the Minister of Supply that the 1959 series of minor trials be approved by the Prime Minister, without prior consultation with the AWTSC.

(h) Through his direct channel of communication with Titterton, Penney sought advice on the best way of gaining approval for the Vixen A extension of the 1959 series, including the burning of plutonium.

(i) The long-term consequences of the use of plutonium in the Vixen A tests in 1959 were not considered in terms of safety hazards on the Range.

(j) The 1960 proposal for assessment tests, which included the Vixen B tests, caused Australian officials, particularly in the Department of Defence, to question the existing procedures for approval of the program. It was apparent that decisions which demanded a political input were being taken by the AWTSC through its chairman, without reference to appropriate Ministers. Appropriate solutions to this dilemma were eventually found by creating a channel of communication to the Minister for Defence.

(k) During discussions on the 1960 program between Titterton and the UK authorities, the Vixen B tests were misrepresented as having zero fission yield in all cases.

(l) By the time of the 1961 program, more satisfactory information was obtained, enabling a more informed decision to be made by Ministers.

(m) The continuing furore surrounding the Vixen B proposals forced the UK to provide sufficient details to the Australian Government. Informed approval was given to a 1962 program even though this program did not take place.

(n) By 1963, the procedures for approval of minor trials had become more elaborate and formalised. More departments became involved, more people needed to be satisfied and inevitably more information was disseminated. As Titterton's role diminished, the cosy and unsatisfactory atmosphere of 'mutual trust' diminished, and the flow of information was increased.

(o) The atmosphere of mutual trust between the watchers and the watched was altogether unsatisfactory and dangerous. The watchers who, after all, had the power to prevent the tests should have been considerably harder to convince and should have required much more than assurances from the British before granting approval.

12.10.102

(a) Efforts were made throughout the testing program by the United Kingdom and Australian Governments, with the assistance of scientists, to persuade the Australian public that the tests were both necessary and safe. These efforts were increased when it became apparent that the majority of people were opposed to the continuation of the tests.

(b) The AWTSC failed to carry out many of its tasks in a proper manner. At times it was deceitful and allowed unsafe firing to occur. It deviated from its charter by assuming responsibilities which properly belonged to the Australian Government.

(c) Titterton played a political as well as a safety role in the testing program, especially in the minor trials. He was prepared to conceal information from the Australian Government and his fellow Committee members if he believed to do so would suit the interests of the United Kingdom Government and the testing program.

(d) The fact that the AWTSC did not negotiate with the UK openly and independently in relation to the minor trials was a result of the special relationship which enabled Titterton to deal with the AWRE in a personal and informal manner. He was from first to last, 'their man' and the concerns which were ultimately voiced in relation to the Vixen B proposals and which forced the introduction of more formal procedures for approving minor trials were a direct result of the perceived inadequacies in the manner in which he had carried out his tasks.

CHAPTER 13

STATE OF TEST SITES

13.1 Maralinga Clean-ups and Surveys before 1967

13.1.1 At the end of the nuclear test program, Maralinga had been the site for seven major trials of nuclear weapons and about 580 minor trials. These trials left the Range contaminated by radioactive and toxic materials.

13.1.2 Some of the minor trials sites and facilities had been partially cleaned up after the trials, but only to the extent required for the safety of personnel working on subsequent rounds.

Building DC12

13.1.3 Building DC12, which was located in the DC-RB area between the Maralinga Village and the airfield, contained a heavily shielded cell, a 'hot box', in which was kept a very radioactive source of thorium-228 (half-life 1.9 years). Thorium-228 decays to produce the short-lived isotope lead-212 (half-life 10.6 hours) which was used as the gamma source for the Rats trials (see Section 10.1). There was an accidental release of thorium-228 within the hot box and some of it was swept into an extract filter between the hot box and the chimney. In late 1958, the AHPR was warned about the amount of radioactivity being released from the chimney of DC12 [RC 800, p.581153].

13.1.4 In February and March 1960, the contaminated hot box was removed and buried and the building decontaminated and modified for a new hot box. This was known as Operation Ayres 1. Loose activity was found generally throughout the laboratory and the anteroom, indicating generally poor housekeeping procedures. The contaminated hot box was buried in the active materials cemetery south of the airfield. The new hot box was designed for easy removal of components [RC 428, T13/60].

13.1.5 By mid 1961, the Rats trials had finished and it was decided to dismantle the DC12 equipment. A UK decontamination group carried out the work in 1963, between other tasks associated with the Vixen B trials. This work was known as Operation Ayres 2 [RC 379, T28/63].

Operation Clean-up

13.1.6 Operation Clean-up was organised by the Range Commander

to involve all of the Maralinga Range Support Unit (MARSU) in cleaning up the Range. Every Tuesday afternoon, commencing 25 June 1963, all present were required to participate [RC 800, pp.630508, 630532]. The clean-up included the removal of 175 tons of contaminated material from Naya 1, Naya 2, Naya 3, TM100, TM101 and Wewak (mainly VK33 and VK60) sites, and the disposal of the material into a pit in the cemetery at TM101. Sites TM4 and TM50 were left untouched; J M Coppard considered them to be a difficult problem because of the large bulk of very tiny fragments and debris which covered the surface for 100 to 200 yards around the firing pads [RC 800, p.640260].

AWTSC 1963 Review of Radioactive Contamination

13.1.7 In mid 1963, Moroney, the Secretary of the AWTSC, reviewed the radioactive contamination of the Maralinga Range and recommended measures for its control [RC 800, p.630668]. He concluded that the predominant hazard at the time was due to the plutonium used in the minor trials. For Taranaki, the existing fencing was considered to be satisfactory but further protective fencing would ultimately be needed when the site was no longer required.

13.1.8 Recommendations for minor clean-up operations and fencing were made for all the main contaminated locations in the Forward Area, and for those laboratories in which residual contamination was found. The recommendations were based on the need for long-term predictions of the state of the areas. Moroney wrote to the AWRE in November 1963 seeking more information about various areas, and specifically about the contents of the existing pits and mounds at Taranaki [RC 800, p.630770].

Operation Hercules V

13.1.9 By 1964 there were doubts as to whether there would be any future use of the Maralinga Range. There was still a desire to keep the options open, so a study was undertaken of the requirement for care and maintenance. Turner was to be transferred to the Department of Defence in Canberra and it seemed worthwhile to clean up the Range to a condition which would no longer require qualified health physics staff to be stationed permanently on the Range.

13.1.10 The AWRE reviewed the hazard on the Range and formed a small decontamination and health physics team to go to the Range to carry out the required clean-up work with the assistance of Range staff. The clean-up was called Operation Hercules V.

13.1.11 The proposed program of work was examined by the Safety Committee and 'accepted without significant amendment' [RC 800, p.640575]. It was observed that the measures being implemented as a result of the plan were 'designed to remain effective for 15 to 20 years before replacement of fences etc. or revision of boundaries'.

13.1.12 The tasks to be carried out during Hercules V were as follows:

1. Clean contaminated buildings, removing and burying any equipment that cannot be cleaned.
2. Clean or bury any contaminated vehicles and other plant and equipment not housed in buildings.
3. Reduce surface contamination in certain experimental areas where it is considered practical to do so.
4. Seal in contamination in concrete structures where it is not possible to remove it.
5. Remove all mounds of contaminated debris and bury below surface level with the specified earth cover.
6. Bury any contaminated equipment or debris remaining on the surface in the experimental area.
7. Where practical exhume debris from pits in certain areas and re-bury at Taranaki or TM101.
8. Carry out a H.P. survey of all contaminated areas.
9. Arrange for the residual contaminated areas to be fenced and marked with signs in accordance with the standards recommended by the A.W.T. Safety Committee.
10. Prepare accurate drawings showing the position of fences for the surface contaminated areas and burial pits.' [RC 800, p.640605]

13.1.13 Operation Hercules V was carried out during the period August to November 1964 by the AWRE team assisted by the MARSU. Two reports were produced on completion of the operation; Report SCRM/64 described the radiological state of the Range at the completion of Hercules [RC 374], and Report SRI/M/1/3, which was prepared for the Safety Committee, described the residual radioactive and toxic contamination of the Range [RC 385].

13.1.14 In the introduction to Report SRI/M/1/3, Pearce made the following statement about the future of the range:

'It has, therefore, been assumed that the signs and barriers which have been erected will be regularly inspected and maintained. If at some future date the decision is taken to leave the Range unmanned, the question of radioactive and toxic material still at Maralinga would necessarily have to be re-examined and, undoubtedly, different protective measures would be required. During the exercise just completed it has been constantly borne in mind that any action taken should be compatible with possible future action for the long-term protection of an unguarded Maralinga.'

13.1.15 The problems of plutonium contamination were considered in Report SRI/M/1/3 [RC 385]. An analysis of the hazard from inhalation concluded that one microcurie per square metre of plutonium distributed over the surface could result in one occupational body burden over a period of 50 years. There was no hazard from ingestion of the deposited plutonium. Hence it was decided that the Red boundary would be set at one microcurie per square metre, measured at the time of deposition.

13.1.16 This report also discussed the use of ploughing to mix the plutonium through a greater depth of soil. Turner had earlier shown that the plutonium deposited on the ground as a result of the experiments involving fires and explosions would migrate some way into the ground, but that most of it was still in the top centimetre. It was reasoned that if the top 15 cm of soil was mixed, then a dilution by a factor of 15 would be achieved.

13.1.17 The proposal to dilute the plutonium by mixing it into the soil was discussed and accepted by the Safety Committee as a means of reducing the potential for plutonium resuspension [RC 537, p.13]. Ploughing and grading were carried out during Hercules V on the plutonium-contaminated areas at Wewak, TM100 and TM101.

13.1.18 During Hercules V, some of the contents of the mounded pits at Taranaki together with the contents of the HP2 pit No. 22 were exhumed and put into two new pits, making a total of 19 burial sites located within the high chain mesh fence at Taranaki [RC 572, 0-19/69, p.11].

Negotiations for Ending the Memorandum of Arrangements

13.1.19 The Memorandum of Arrangements between the UK and Australia to establish the Atomic Weapons Proving Ground at Maralinga was valid for a period of ten years and was due to end on 7 March 1966. On 16 February 1966, the United Kingdom High Commission informed Australia that

'The British Government have come to the conclusion that they have not sufficient requirement for the continuing use of Maralinga to justify continuing to maintain it. Subject therefore to agreement with the Australian Government on the measures necessary to fulfil the security and safety obligations under the existing agreement, the British Government would propose otherwise to relinquish use of the range on the expiry of the present term.' [RC 800, p.660040]

13.1.20 Under the Memorandum of Arrangements, the UK was liable for 'such corrective measures as may be practicable in the event of radioactive contamination resulting from tests on the site' [RC 800, p.561064].

13.1.21 The British Government invited the Australian Government to agree in principle that the responsibilities of the British Government would be met by the following measures:

(i) The disc-harrowing of certain open areas of ground where there is residual radio-activity on, or close beneath, the surface, with a view to reducing the hazard to a level safe for permanent human habitation.

(ii) The sealing of certain pits with concrete plugs overlaid with sand. These pits, which take various forms, contain radio-active material or contaminated equipment. The standard of security would be such that the pits could not be entered by chance or by casual design.

(iii) The removal and burial of contaminated air trunking in buildings at Maralinga Village, and the sealing of drains containing residual radio-activity.

(iv) Certain physical clearance of non-radio-active hazards.' [RC 800, p.660001]

13.1.22 The first measure appears to show that the UK did consider that the Range could be returned to a condition suitable for permanent human habitation.

13.1.23 The British Government also proposed that the measures listed above

'...would constitute a full and final settlement of all obligations whatsoever of the British Government arising out of its use of Maralinga and Emu including liability arising under paragraph 11 of the Memorandum or Arrangements.' [RC 800, p.660002]

13.1.24 The matter was referred to the Board of Management and the Safety Committee. Moroney, in his evidence before the Royal Commission, said that the Safety Committee never took the offer

to reduce the hazard to land 'safe for permanent habitation' seriously because, in part, it believed that it was not possible to achieve that end with disc-harrowing [Trans., p.8238].

13.1.25 The Safety Committee sought from the Australian Government its views on its future plans for the Range [RC 131, 130th Meeting of the AWTSC; RC 800, p.660081]. Notwithstanding repeated requests, the Safety Committee received no response or direction from the Government. On 21 December 1966, Moroney wrote to the Department of Supply saying

'In the absence of such a decision, the AWTSC will base its decision on complete evacuation of the range.'
[RC 800, p.660527]

13.1.26 On 7 April 1967, at its 146th Meeting, the AWTSC adopted the following overall approach to long-term control of the Range:

'The overlying principle to be adopted in the final decontamination of Maralinga and Emu is to render them safe under conditions of effectively complete evacuation of the Range. The extent of hazards to be encountered as a consequence of residual contamination depends on the period of occupancy of a contaminated area. Long-term or permanent habitation of contaminated areas is improbable even in the distant future; but short-term occupancy, especially by itinerants passing through Maralinga, is possible and must be taken into account. Hence all contaminated areas are to be rendered safe for at least short-term occupancy and where more complete decontamination is practicable, it is to be carried out.

'For a period of 15 to 20 years after final decontamination, the Maralinga Range should be patrolled at intervals of about two months, and access to the Forward Area should be discouraged. Such a period of minimum manning would give time for assessment of any public interest in the Range and for development of any alternative step to control the contaminated areas. By the end of this period, it is likely that there would no longer be popular interest in Maralinga.' [RC 131]

13.1.27 In its consideration of the standards to be developed for clean-up, the AWTSC assumed that it was unlikely that the area would be populated in the foreseeable future. Moroney stated in evidence that at the time of Operation Brumby none of the members of the AWTSC was aware that these areas had been the homelands of Aboriginal groups, or that such groups were interested in returning to them [Trans., p.8251].

13.1.28 In fact, there was considerable interest in Maralinga by the Aborigines at Yalata and in 1966 Mr B Lindner, the manager of the Yalata Mission, had started to accompany traditional owners on trips back to areas of tribal significance [Trans., p.3424].

13.1.29 On 13 July 1967, the South Australian Minister of Aboriginal Affairs wrote to the Minister of Supply expressing interest in the Maralinga Prohibited Area and the buildings and equipment erected at Maralinga. He suggested that the area

'...could be developed as a training area for Aborigines. In this way, their ancestral and ceremonial areas could be preserved for them.' [RC 800, p.670453]

13.1.30 The Secretary of the Department of Supply, in forwarding the letter to the AWTSC Chairman noted

'I must assume that such an arrangement would envisage the permanent habitation of the area by Aborigines.' [RC 800, p.670534]

13.1.31 The Safety Committee considered the questions raised by the letter from South Australia at its meeting on 18 August 1967. There was no discussion about the fact that the South Australian suggestion would have meant that assumptions about unlikelihood of permanent habitation were wrong. The Safety Committee only took the short-term view, and considered that if there was regular patrolling at two monthly intervals and fences were maintained, there was no objection to Maralinga becoming a training ground. It further suggested that more frequent patrols might be necessary if a larger and more permanent Aboriginal population became established in the area.

Operation Radsur

13.1.32 At the 133rd Meeting of the AWTSC on 14 May 1966 [RC 131], it was agreed that AWRE should carry out a detailed radiological survey of the Range to supplement existing data on contaminated areas. This survey was to provide information on the state of the Range so that a major decontamination and clean-up program could be devised, to ensure that the Range would meet the standards for future safety.

13.1.33 The AWRE prepared a draft plan of operations entitled 'Operation Radsur, Radiological Survey of Maralinga and Emu. October-November 1966. Details of Proposed Measurement and Observations' [RC 800, p.660310, SRI/R/5/4]. The Safety Committee discussed and accepted the details of the proposed survey at its 137th Meeting on 8 September 1966 [RC 131]. The

plan proposed gamma and beta surveys at each major trial site along eight radial lines out to about the limit of the glazing. Soil and glazing samples from each major trial site would be analysed. The plutonium-contaminated areas of Taranaki, TM100 and TM101 were to be surveyed using detectors that were sensitive to the low energy plutonium X-rays and the americium-241 gamma rays. Soil samples were also to be collected from the plutonium areas and analysed in the laboratory.

13.1.34 The survey was carried out in the period October-December 1966 by an AWRE party assisted by six sappers from the Royal Engineers. Two reports on the results of Operation Radsur were presented to the Royal Commission: the first was an interim statement of results dated 6 February 1967 [RC 383], and the second an undated draft report by E J Chatfield, [RC 384]. The interim statement was discussed by the AWTSC at its 145th Meeting on 1 March 1967 [RC 131].

13.1.35 The Safety Committee noted that the interim statement did not contain all the results and it decided to leave discussion until the Chairman and Secretary could discuss the survey on their forthcoming visit to Aldermaston.

Conclusions

13.1.36

(a) The AWTSC was wrong to assume that long-term or permanent habitation of contaminated areas was improbable even in the distant future.

(b) The Australian Government failed to set adequate policy guidelines or give adequate direction to the AWTSC regarding future plans for the Maralinga Range.

13.2 Operation Brumby

Plans and Standards

13.2.1 The Chairman and Secretary of the AWTSC discussed the problems of decontaminating the Range with Aldermaston staff during a visit to the UK. They arrived at joint proposals which were discussed at the 146th Meeting of the AWTSC on 7 April 1967 [RC 131].

13.2.2 Appendix 2 of the Minutes of that meeting gives details of the criteria to be applied in the clean-up and the tasks for each site at Maralinga and Emu. The AWTSC considered that the following aims were attainable:

'Contaminated areas other than Taranaki and the major trials sites may be made completely safe, for more-or-less permanent habitation, in accordance with ICRP Recommendations covering radiation exposure of members of the public when the radiation source is controlled, but the population is not. These areas were substantially cleaned-up in the programme of partial decontamination of the Range completed in November, 1964, and little more work remains to be done on them.

'Taranaki and the major trials sites will be rendered safe for short to long-term but not for permanent habitation.' [RC 131, Minutes of the 146th Meeting of the AWTSC]

13.2.3 The proposal suggested that the chances of hazardous situations arising could be significantly reduced if the contaminated areas, particularly those at Taranaki and the major trials sites, could be made indistinguishable by removing all structures which might identify the site. The appearance of the whole area would be returned as far as possible to a natural state.

13.2.4 Hence the proposed clean-up involved the removal of fences and signs around the contaminated areas after they were rendered safe. The high cyclone-mesh fences around most pits and cemeteries were to be retained for 15 to 20 years. Pits were to be capped with concrete and the capping covered with soil. The regrowth of native flora was to be encouraged on all ploughed and graded areas. All road signs were to be removed and the roads marked as 'No Through Road'. Trig points would be established in perpetuity so that contaminated areas and burial sites could be located if necessary.

13.2.5 The whole concept of making the site indistinguishable was short-sighted. The first requirement should have been to remove the hazard; then, and only then, could abandonment of the area be considered. The Royal Commission also doubts that the area would return to the natural state. The disturbed soil would develop different vegetation from the undisturbed soil; the result might provide a more attractive camp site or become a source for food. It is well known that concrete pads channel rainwater and lead to more luxuriant growth than would otherwise be the case. Visitors to the site have also noted that revegetation of many areas has been much slower than the Safety Committee expected.

13.2.6 Appendix 2 to the Minutes of the 146th Meeting of the AWTSC discussed the question of the plutonium contamination at Taranaki and the standard required for clean-up [RC 131]. It was noted that Operation Radsur had found a few very high values which the Safety Committee took to indicate localised contamination. It seems clear now, that those high values

indicated the plutonium-contaminated fragments which have now been extensively mapped by the ARL (see para.13.5.2). However, at the time of Operation Brumby, the Safety Committee saw them as areas of high contamination, not as discrete particles.

13.2.7 The suggestion was made during the cross-examination of J Moroney by Counsel for the UK Government that the Safety Committee should have realised from the data provided by the AWRE that there was a very large number of hot spots and fragments at the Taranaki area [Trans., p.8398]. The suggestion was based mainly on a signal from Pearce to Moroney on 9 June 1967 in which it was reported that for three samples, 90 per cent of the activity was on particles greater than 1 mm in diameter [RC 800, p.670394]. One interpretation of this information was that much of the plutonium was concentrated in medium-size fragments and Moroney was asked why the Safety Committee did not draw this conclusion. In fact, the information could have just meant that the plutonium was uniformly distributed over the medium-size particles.

13.2.8 In his signal to Moroney, Pearce pointed out that there were three small areas at Taranaki which were more highly contaminated than the surrounding areas, and that this activity was associated with large particles unevenly distributed over the surface. These three areas totalled only about 16 per cent of the area inside the fence. Two conclusions were drawn from the observation that most of the activity was in the larger particles: first, there could be considerable variability in the measured plutonium concentration of soil samples; second, the activity on the larger particles would not cause a breathing hazard.

13.2.9 Neither the AWRE nor the AWTSC appeared to realise the number of plutonium-contaminated fragments, or the effect of the fragments on any hazard assessment. As Moroney said [Trans., p.8399],

'...I am sure my exchanges with Noah [Pearce]...were such that if he had come across a problem wherein he saw a very large number of these fragment posing a, as yet, unattended to pathway to risk, he would have told me. That was my belief. He would not have done it obliquely like this. There is nothing in that signal which says, look John, there is a major problem here which we have to re-examine.'

13.2.10 The AWRE should have looked more closely at the abnormally high readings that it found at some locations, and undertaken further investigations to determine their cause. This could have shown, prior to Brumby, the widespread distribution of plutonium-contaminated fragments and could have led to a re-evaluation of the procedures to be applied at Brumby.

13.2.11 It is apparent then that neither the AWRE nor the AWTSC was aware of the widespread distribution of plutonium-contaminated fragments in the Taranaki, TM100 and TM101 areas. The lack of knowledge about these fragments meant that Operation Brumby was based on an incorrect understanding of the hazard. Furthermore, the Australian Government was not in possession of all the facts when it was asked to accept that Operation Brumby had rendered the site radiologically safe.

13.2.12 The Safety Committee accepted the AWRE reasoning that inhalation of resuspended plutonium would be the limiting hazard for the plutonium-contaminated areas. The inhalation hazard was compared with the ICRP recommendations for continuous exposure of members of the public to an atmosphere containing invisible plutonium-239. It was estimated that the inhalation dose would be less than the ICRP recommendations if the surface deposition was less than 0.01 mCi/m^2 or if the concentration in the top 1-5 cm of soil was less than one microcurie per kilogram. The values for surface deposition and concentration were adopted by the Safety Committee as the highest values acceptable at the end of the Operation Brumby.

13.2.13 The 1964 clean-up, Hercules V, had shown that ploughing, disc-harrowing and other procedures could reduce the possible airborne concentration of plutonium by a factor of 20 or more. The Safety Committee accepted the AWRE suggestion that the whole of the Taranaki yellow and some of the red area should be ploughed and disc-harrowed area to reduce the surface soil concentrations to below the one microcurie per kilogram limit for plutonium.

13.2.14 The Royal Commission received evidence that inhalation might not be the limiting hazard because of the plutonium-contaminated fragments now known to be present in the Taranaki, TM100, TM101 and Wewak areas.

13.2.15 As Moroney said in evidence, dilution by ploughing and disc-harrowing was not the correct procedure for plutonium-contaminated fragments

'Because the dilution process is directed at controlling, reducing if you like, a hazard through the resuspension pathway and it is effective for that purpose and generally applied. It certainly was applied at that time and dilution was a health physics tool. It is still applied and will go on being applied. But with these plutonium contaminated fragments dilution is not a solution and therefore the procedure, I think, would be inadequate. You have to take them away.' [Trans., p.8180]

13.2.16 The use of ploughing and disc-harrowing to reduce the inhalation hazard was not the appropriate technique to deal with fragments. In fact the mixing of the plutonium into the soil has made any future clean-up program more complex and costly.

13.2.17 The Minutes and Appendix 2 of the 146th Meeting of the AWTSC were sent to the UK as 'a statement of the final and detailed AWTSC requirements as far as they can be advanced at this stage' [RC 800, p.670318].

The Operation

13.2.18 Operation Brumby was carried out in the period April to July 1967. At the major trial sites, the large pieces of glazing and metal debris were removed by hand. Fences and warning signs were removed. The area where glazing occurred was graded and disc-ploughed. The crater at Maroo was filled with rubbish, including target response aircraft and caravans, which were burnt and then covered with about five feet of soil. The area around Tadge was systematically searched for cobalt-60 pellets which were collected in drums and buried in concrete in the Airfield cemetery. An area of radius about 150 yards around each major test site was covered with top soil [RC 530, 0-16/68, Pearce].

13.2.19 The yellow area within the fence at Taranaki was treated by mixing to a depth of four inches (yellow areas had surface contamination exceeding 0.01 mCi/m^2). Mixing was achieved by first using a scraper then a grader. When the mean plutonium concentrations before and after treatment were compared, the reduction factor was less than two. It was thought that the disturbance of the area both at the time of the trials and also during Hercules V would have caused significant mixing [RC 572, 0-19/69]. Some areas of higher contamination could not be reduced by mixing; these were treated by covering with at least three inches of soil. The scraping and grading operation was extended to the yellow area outside the fence. Parts of the red area along the main fallout plume were treated by mixing with a scraper or a bulldozer (red areas had contamination levels between 0.001 and 0.01 mCi/m^2). This left wide areas of contamination which are still present today.

13.2.20 All the pits in the Taranaki area were capped with reinforced concrete level with the surrounding bedrock and covered with a layer of topsoil.

13.2.21 The average levels of plutonium contamination at Wewak were only marginally above the 0.001 mCi/m^2 limit, so no processing was considered necessary. Some small areas adjacent to the firing pads had higher levels and these were excavated and the contaminated materials dumped in the Maroo crater. Clean top soil was brought in to fill the holes.

13.2.22 The plutonium-contaminated areas at TM100 and TM101 were mixed to a depth of four inches using a scraper. TM100 was left unfenced and a fence was erected around each pit in the TM101 area.

13.2.23 The Dobo and Kuli areas were levelled and the firing pads covered with about one foot of top soil. The area at TM50 was cleaned up and levelled.

13.2.24 The various laboratories, offices and workshops in the DC/RB, BL, LA and XA areas were cleaned up and contaminated equipment was buried. A large number of Winchesters containing various chemicals was dumped. There was also a general clean-up of the miscellaneous debris which littered the Range.

13.2.25 Three reports describing different aspects of Operation Brumby were tendered to the Royal Commission: AWRE Report 0-16/68, 'Final Report on Residual Contamination of the Maralinga Range and the Emu Site', by N Pearce [RC 530]; 'Operation Brumby Final Report', by W Cook, [RC 413]; and AWRE Report 0-19/69, 'Decontamination Aspects of Operation Brumby', by B W Ariss and C R Thomas [RC 572].

13.2.26 The AHPR, J F Richardson, visited Maralinga twice during Operation Brumby to observe progress in the clean-up. The visits were made on 8 June and 8 July 1967 and reported by him to the AWTSC on 19 July 1967 [RC 800, p.670465].

13.2.27 At the conclusion of Operation Brumby, the site was inspected by the Safety Committee. Titterton, Stevens, Gibbs and Moroney arrived at Maralinga on Saturday 8 July 1967. On the Saturday they inspected Emu, on the Sunday Maralinga and on Monday they had discussions and then left the Range.

13.2.28 The Safety Committee reported to the Prime Minister in July 1967 that

'Operation BRUMBY has been concluded successfully and remaining levels of radioactivity are below those specified as acceptable by the AWTSC. Maralinga and Emu are now radiologically safe, with unrestricted access on a permanent basis allowable to all but a few small areas. Residual contamination of these small areas is low and there would be no hazard with short-term occupancy. It is unlikely that there would be need or desire for permanent occupancy of any of these areas in the foreseeable future.' [RC 527]

13.2.29 The Appendices to the AWTSC report provided details about the residual radioactivity at major and minor sites. The general clean-up of the ranges, the removal of bunkers, towers and old target response items were necessary activities in cleaning up the ranges. The clean-up of the major trial sites was generally successful, although glazing is still visible at the Emu sites and at Biak, Breakaway and One Tree. The clean-up of the laboratory areas seems to have also been successful.

13.2.30 The assumption that there would be no permanent habitation in the Maralinga area has already been criticised (para.13.1.36). The standards for clean-up were based on the incorrect assumption that the plutonium was not present as fragments (see para.13.2.11). The resilience of the flora was also overestimated. The AWTSC expected that after 15 to 20 years the natural regeneration of local flora would render the trials area indistinguishable from the surrounding country. This clearly has not happened. Some of the introduced soil has moved, some of the pits have become uncovered and some have attracted rabbits which have dug warrens in the softer and damper soil around the pits.

13.2.31 Because of the presence of plutonium-contaminated fragments the method of mixing the soil was inappropriate and has complicated any future clean-up. It has made it harder to determine the nature or extent of the remaining contamination. It has also made the collection of fragments very difficult, if not impossible.

Termination of the Agreement

13.2.32 On 23 September 1968, the Australian and United Kingdom Governments signed a Memorandum of Agreement, terminating the March 1956 Memorandum of Arrangements and agreed, *inter alia*, that

'(a) The United Kingdom Government have completed decontamination and debris clearance at the Atomic Weapons Proving Ground Maralinga to the satisfaction of the Australian Government.

[and]

'(c) With effect from 21 December 1967, the United Kingdom Government are released from all liabilities and responsibilities under the Memorandum of Arrangements save that the United Kingdom will continue to indemnify the Australian Government in accordance with Clause 11 of that Memorandum in respect of claims for which the cause of action occurred after 7 March 1956 and before 21 December 1967.' [RC 800, p.680067]

13.2.33 The 1968 Memorandum of Agreement was based on information and a hazard assessment that have been shown to be invalid. It is clear now that Operation Brumby did not satisfactorily decontaminate the Range. The condition of the plutonium-contaminated areas would not have met the standards of the time, and certainly does not meet the standards of today.

Conclusions

13.2.34

(a) Operation Brumby was based on wrong assumptions. It was planned in haste to meet political deadlines and, in some cases, the tasks undertaken made the ultimate clean-up of the Range more difficult.

(b) The decision to render the Range anonymous was inappropriate. The idea that if people could not find the site it was permissible to leave it in a more hazardous state is not acceptable.

(c) The operation of ploughing and disc-harrowing was the wrong procedure to control the radiological hazard in the plutonium-contaminated areas at Taranaki, TM100, TM101 and Wewak. AWRE and AWTSC should have given the problem more thought before they implemented a program of dispersing the plutonium into the soil.

(d) Neither AWRE nor AWTSC was aware of the presence of the large numbers of plutonium-contaminated fragments at Taranaki, TM100, TM101, and Wewak. The data collected during operation Radsur were suggestive of the contaminated fragments and AWRE should have investigated the anomalously high readings.

(e) It would not have been realistic to have expected Moroney or the AWTSC to interpret the information they received from AWRE about Radsur as meaning that there were large numbers of plutonium-contaminated fragments. It is clear that Pearce himself did not have this understanding when he sent the information.

(f) The UK personnel were in a much better position than the Australians to realise that there were large numbers of plutonium-contaminated fragments, and to appreciate the associated hazard. The Australians were only given a general idea of what was happening at the trials and were not allowed to be present at any time when a minor trials program was in progress. On the other hand, the UK personnel knew precisely what was going on and the likely dispersal of material. They were also present shortly after the explosion and were in a position to observe the extensive distribution of fragments.

(g) The treatment of the plutonium-contaminated areas during Operation Brumby was inadequate, based on the wrong assumptions, and left the areas in a more difficult state for any proper future clean-up.

13.3 Salvage of Equipment from Maralinga

13.3.1 The letter from the South Australian Minister of Aboriginal Affairs to the Minister of Supply on 13 July 1967 has already been mentioned (see para.13.1.29). In his letter the Minister indicated interest in the Maralinga prohibited area and the use of buildings and equipment at Maralinga by Aborigines [RC 800, p.670453].

13.3.2 The Premier of South Australia wrote to the Prime Minister on 26 June 1968 seeking the release of land at Maralinga and Woomera. He noted that 'considerable value is placed upon it by the State Authorities for various purposes' [RC 800, p.680096].

13.3.3 Almost four years later, on 13 April 1972, Prime Minister McMahon wrote that the Commonwealth would be prepared to make the buildings at the Maralinga Village available to the State on a no-cost basis provided that

'...the Commonwealth would be released from all liability and responsibility for the village from the date of the handover.' [RC 800, p.720032]

13.3.4 The South Australian Premier accepted the offer on 16 January 1973 [RC 800, p.730005]. A South Australian committee appointed to look at all aspects of the future use of the Maralinga lands recommended that the village buildings be demolished and salvaged and that the Yalata Mission be given the opportunity of submitting a list of items which it would like to acquire at no cost from the Maralinga Village [RC 800, p.730053].

13.3.5 On 15 March 1974 the South Australian Government accepted liability and responsibility for the Maralinga Village from midnight on 13 March 1974 [RC 800, p.740050]. The Superintendent at Yalata was authorised to provide 'a caretaking function at Maralinga', and to act on behalf of the Department of Community Welfare in regard to the control of all assets at the village. The extent of the salvage was also mentioned:

'You may continue to dismantle and remove those items for which you were given approval on 18/10/1973, but no other items or property may be removed from the Village by yourself or any other person without the approval of this Department.' [RC 800, p.740048]

13.3.6 On 24 April 1974, Lindner, the manager of Yalata Mission, wrote 'for and on behalf of Kalinguratja Co-operative Society' to the Department of Community Welfare making application for full salvage rights to the Maralinga Village. Salvage would not extend to buildings required by Government Departments or to buildings required by Aborigines for their

eventual use in the area [RC 800, p.740060]. The application was approved on 3 May 1974 [RC 800, p.740063] and the salvage rights were transferred to Yalata Community in late 1974 upon its incorporation.

13.3.7 The Yalata Community appointed Mr I Dutschke as manager of the project, a position he held for about five years [RC 146]. Dutschke said in evidence that he made enquiries to the South Australian Health Department as to whether it was radiologically safe to work on the buildings. He said he was assured there was nothing to worry about [RC 146, pp.8-9; Trans., p.3202]. However, the South Australian submission noted that no record could be found of this approach, and the officer in charge of the relevant Section at the time did not recall such an approach being made [SA 3, p.17].

13.3.8 The only precaution which appears to have been taken to safeguard the health of, or explain the risks to, the Aboriginal salvage workers was to show them the Ground Zeros and the fenced areas at the airfield cemetery, TM100 and Taranaki and tell them they were not to go there [Trans., p.3196]. No Geiger counters were provided or used during the salvage [RC 146, p.9].

13.3.9 Dutschke told the Royal Commission that he employed approximately 50 to 60 Aboriginal people who worked in teams of six to eight over the period of the salvage work. They were mainly from Yalata and the teams changed weekly or monthly [Trans., p.3219]. When the Aborigines came to Maralinga to work they would often bring their families with them [Trans., p.3195].

13.3.10 Those managing the Yalata salvage operation understood that they were permitted to salvage underground material. Dutschke told the Royal Commission that, apart from a considerable amount of copper wire, they excavated lathes, trailers, and hydraulic jacks from burial pits in the XA area [Trans., p.3223]. On 28 May 1976, Dutschke was told to stop all digging and re-bury the items excavated from the burial pits. This was followed by a letter from the Chief Defence Scientist, Department of Defence, to the Director General of Community Welfare of 7 June 1976, in which he concluded

'We strongly recommend that you take whatever action you can to prevent any further excavating at Maralinga and would also recommend that any materials that have been recovered already should be reburied. Enquiries are being made concerning the nature of any hazards that may be connected with items that may have been buried in the vicinity of the Maralinga Village and we will write to you again as soon as advice is received.'
[RC 800, p.760044]

13.3.11 The Yalata Community replied by letter to the Aboriginal Lands Trust on 27 July 1976, stating that

'1. It [the Yalata Community] will not engage in any activity at Maralinga which would not meet with the approval of the Area Administrator, Woomera, or the Defence Department. (There was slight doubt concerning the Department's attitude to the goods recovered, hence the matter was discussed with the Administrator when he visited.)

'2. The goods listed in the Department of Defence letter 252/1/25 have been re-buried.

'3. No further excavations will be made in DC/RB and XA areas.

'We have found several detailed maps showing where the "cemetery" areas are located, and are fully aware of the dangers in those areas. Some people have expressed concern from time to time, that Aboriginals engaged in demolition work at Maralinga may inadvertently frequent the cemetery areas.

'We wish to assure you that the relevant areas have been pointed out to the Aboriginal workmen, and they are extremely anxious to keep well away from them.'
[RC 800, p.760057]

13.3.12 The letter also sought advice on what was in various dump sites. The Community asked for confirmation that apart from the known sites at the DC/RB, XA, and LA areas, there were no radioactive materials buried within or adjacent to the village. They were particularly interested in excavating other parts that were known to contain items of obvious salvage interest, e.g. steel and copper pipe.

13.3.13 The reply from the Australian Government was almost three years in coming and by that time salvage was almost complete. On 12 February 1979, Prime Minister Fraser, in a letter to the Premier of South Australia, said

'It was never intended by the Commonwealth that materials buried underground should be considered assets of the Village and subject to salvage and I believe you will agree that this is undesirable.'
[RC 800, p.790026]

13.3.14 Three Aborigines who had been involved in the salvage program, Morley Gibson, David Edwards and Lindsay Poopidie, gave evidence to the Royal Commission at Maralinga.

13.3.15 Gibson worked on a salvage team for several months. His work involved pulling down buildings, taking cables from the ground, and taking water and brass pipes from demolished buildings. Gibson and Edwards either saw or were engaged in the excavation of objects from burial pits. Gibson was involved in

an excavation on the north side of the airfield of a cross-cut saw and car jack. This was performed with a tractor and backhoe [Trans., p.7253].

13.3.16 Edwards performed salvage work at the village and was also asked to help 'Woomera blokes' to level off an area of the airfield cemetery. He used a grader and levelled the ground so that cement could be laid over it [Trans., p.7254].

13.3.17 On the road to Kuli, Edwards saw yellow Land Rovers which had been excavated after cracks were seen in the ground indicating that there were things buried underneath. Afterwards these vehicles were re-buried [Trans., p.7256]. Edwards was subsequently able to identify the site. Edwards and Gibson said in evidence that they were ignorant of the places at which they should not dig [Trans., p.7253].

13.3.18 Brady and Palmer interviewed some Aborigines who said they were warned about dangerous places, but nevertheless people roamed freely in the area, camping out at weekends. One group visited a bomb crater [AB15, p.19].

Disposal of Buildings, Equipment and Materials

13.3.19 Records were kept by the Yalata Community of all transactions relating to the sale of salvaged buildings and material [Trans., p.3458]. Some of the buildings were taken to Yalata where they are still in use. Other buildings and equipment went to all parts of South Australia and some as far afield as Queensland [RC 146, p.10].

13.3.20 In recent years, the South Australian Health Commission has been involved from time to time in tests for radioactive contamination of material believed to have been salvaged from Maralinga and Emu. This has included buildings at Coober Pedy, Barmera, Ceduna, Loxton and Yalata, and other items at Coober Pedy, Ceduna, Yalata and Andamooka. No radioactive contamination has been found on any item examined [SA 3, Attach.1].

Conclusions

13.3.21

(a) The whole salvage operation was carried out with no supervision from health physics personnel, or from anyone with a good understanding of the locations of radioactive dumps.

(b) In view of the radioactive dumps which did exist in the area and which had been treated to make them look like the surrounding countryside, the Yalata Community should have been

provided with maps and health physics advice to prevent the salvage of contaminated material.

13.4 AIRAC 4

13.4.1 Moroney and Richardson visited Maralinga Village in November 1972 to assess the state of the work which had been carried out in 1967. They found that regeneration of native flora had been poor and that the sites stood out in stark contrast to the surrounding countryside. There had been a massive loss of soil which had been introduced to the central areas of One Tree, Biak and Tadge. The appearance of the areas in no way could be claimed to have been returned as far as possible to a natural state. Glazing remained abundant around Breakaway, One Tree and, to a lesser extent, Biak [RC 800, p.720120].

13.4.2 The Safety Committee recommended that a concrete cover be put over part of the airfield cemetery and the fences then removed both at the airfield and TM101 cemeteries. Both tasks were completed by February 1974. Caretaker staff were withdrawn from the village and replaced by just two patrols a year [RC 800, p.740025].

13.4.3 The Australian Ionising Radiation Advisory Council (AIRAC) was formed on 1 July 1973 and its terms of reference included the tasks of the AWTSC, which had been disbanded. The question of the long-term management of the former Maralinga test site was referred to AIRAC with a view to obtaining its endorsement or rejection of the AWTSC recommendations [RC 800, p.740026].

13.4.4 AIRAC considered that there was a need for more information about the dispersion and uptake of radioactivity into the biosphere. However the Council also expressed concern about some of the AWTSC recommendations:

'Members expressed serious reservations about the proposals to remove visible external features marking these sites. It is accepted that the hazard at the surface is low but it is noted that these cemeteries contain plutonium wastes. In view of the extremely long half-life and toxicity of this radio-nuclide, the re-excavation through mining, quarrying or some other activity, although unlikely in terms of today's technology and requirements, cannot be ruled [out] for the distant future. It seems likely that such areas should remain in Australian Government ownership, and be marked by permanent fences and signs visible at the surface. It is also important that records of the position of the pits, their contents and history be permanently available.' [RC 800, p.740084]

13.4.5 AIRAC set up an ad hoc committee to advise on the measurements and information required on the dispersal of radioactivity and absorption into flora and fauna at the Maralinga Range. The committee produced a detailed report on 15 June 1976 [RC 800, p.770053].

13.4.6 The resulting field study was carried out in August 1977 and the results were published as AIRAC 4 [AIRAC 1979a]. The distribution and concentration of long-lived radionuclides at the major trial sites were surveyed; the Range was surveyed for residual plutonium contamination and uptake in the biosphere and soil suspension and migration were measured.

13.4.7 AIRAC decided that non-identification or anonymity of the test sites was no longer practical. 'This was partly because nature had not yet obliged us by healing the scars, but principally because of the public interest and emotion that have developed about the issue.' The Council concluded that in fifty years or so there will no longer be any area at Maralinga where external radiation fields would exceed the limit allowed for the public. The Taranaki pits were considered to present no health or ecological risk, but some action was necessary to make the airfield cemetery pits more secure. The recommendations in AIRAC 4 included the following:

'The AIRAC report 'Radiological safety and future land use at the Maralinga atomic weapons test range' January 1979, including its annexes, should be published and made available to the public.

'The ground zeros of the seven nuclear explosions should be clearly marked as such in durable fashion, for example by a substantial concrete block into which the name is moulded. Four of the sites, One Tree, Breakaway, Tadge and Biak, should also carry a plain language radiation warning sign...

'The locations of individual burial pits should not be marked and if otherwise made evident, e.g. by subsidence, this should be rectified. Perimeter fences around areas containing burial pits should carry warning signs in plain language...

'The present security (HCM) fence in the Taranaki area should be maintained. The security fence at the airfield cemetery should be replaced, but located so that the new fence is about 50m outside the boundaries of the cemetery area proper...

'Those pits [in the Airfield cemetery] which contain Category Two (medium activity) burials of plutonium-239 (Pit B) or of cobalt-60 (Pit C) should be made more

secure, e.g. by covering with a concrete slab as at Taranaki. Category One (high activity) burials of cobalt-60 (Pit 1 K 21/22) should receive the same treatment...

'Access to the three enclosed burial grounds should be prohibited to unauthorised persons. Access to all other regions may be permitted for periods of up to seven days, or longer with special authority...

'The Range should be resurveyed for its levels of residual radiation and soil contamination, and for changes in the availability of plutonium for resuspension in the atmosphere and for inhalation not later than 1987...

'At present the airfield cemetery area, and an area sufficient to include the nuclear weapons test sites, the minor trials sites and the enclosed burial grounds, should remain under Australian Government administration...'

13.4.8 The first recommendation was important because so much that had gone on before was still classified. AIRAC also made recommendations about a pit in the airfield cemetery which held about 0.5 kg of potentially recoverable plutonium. In fact, the plutonium had been removed and repatriated to the UK by the time the report was published (see para.13.4.12 to 13.4.14).

13.4.9 The plutonium survey on which AIRAC 4 was based again relied on laboratory analysis of samples. Some of the samples had much higher levels of plutonium than others, the highest value being about 209.5 microcuries per kilogram for a sample from TM101. An attempt was made to identify the plutonium particles in two samples but the levels in them were too low.

13.4.10 AIRAC 4 also gave the results of some measurements on the level of plutonium in plants and animals. Four rabbits and one dingo were taken near Taranaki and analysed for plutonium content. The dissected organs from the four rabbits were combined before analysis which was unfortunate because it meant that information was lost. Plutonium present in skin, gut, muscles, bones and foetus of the rabbits.

13.4.11 Most of the recommendations in AIRAC 4 were implemented in November and December 1979 [AG 13].

The Repatriation of 0.5 kg of Plutonium

13.4.12 In 1977, concern was expressed about the presence of about half a kilogram of plutonium in the airfield cemetery. The plutonium was the result of six Tims trials carried out in 1961.

Each experiment involved the dispersal of about 0.1 kg of plutonium with high explosive. During each experiment, a metal container packed two-thirds full with layers of salt and sheets of glass was used to trap the bulk of the plutonium. It was estimated that about 80 per cent of the plutonium ended up in the containers. Following the trials, the six containers were sealed, placed first in thick steel bins and then in a concrete lined pit in the airfield cemetery. The pit was covered by a steel plate and backfilled with soil [RC 412, 0-24/80].

13.4.13 In April 1977, the Minister of Defence drew the Prime Minister's attention to the presence of the half kilogram of plutonium and suggested that it was effectively recoverable and so should be subject to the IAEA safeguards agreement, and it would also attract the attention of terrorists [RC 800, p.770049]. After a series of discussions the UK agreed to repatriate the residue to the UK [RC 800, p.780357].

13.4.14 The repatriation was carried out as a joint UK/Australia project in February and March 1979. The pit was opened and each bin lifted out. Full protective clothing was worn while the container was removed from the bins and prepared for transport. The drums were transported to the UK by the RAF [RC 411; RC 412, 0-24/80; AG 13].

Conclusion

13.4.15 AIRAC 4 was a useful but limited survey of the radiological state of the Maralinga Range.

13.5 1985 ARL Survey

13.5.1 The Australian Radiation Laboratory (ARL) conducted a survey between February 1984 and April 1985 in which the radioactive and toxic contamination at Emu and Maralinga was measured in much more detail [RC 531, ARL/TR070]. The survey was more extensive than any that had been done before.

13.5.2 For the plutonium survey, ARL developed portable field probes which detected the gamma rays emitted by the americium-241 which accompanies the plutonium-239. This probe enabled ARL to do a very full survey of the plutonium-contaminated areas. It became apparent that the soil activity was not uniform and that there were many localised areas of very high specific activity. These were found to be caused by fragments, generally metal, contaminated with plutonium. The nature of the fragments was quite variable, but usually they consisted of fractured pieces of steel, light alloy or other material coated on one side with plutonium. Most of the fragments were between 0.5 mm and a few centimetres in diameter and each was contaminated by more than

0.1 MBq (0.0027 mCi) of americium-241. This amount of americium would be accompanied by 0.7 MBq (0.02 mCi) of plutonium. In addition, there were a number of much smaller fragments, less than a millimetre in diameter, of high specific activity. These fragments were thought to consist of solid particles of oxidised plutonium/uranium.

13.5.3 There were large numbers of these fragments and a survey was carried out to estimate their abundance. The fragments tended to be found along the path of plumes that had been identified from the plutonium contamination. It was estimated that there were between 25 000 and 50 000 plutonium-contaminated fragments in the Taranaki area, although the number might need to be doubled if missed and buried fragments were included. The total amount of plutonium present on fragments was estimated to be 1.2 TBq (32 Ci or 0.5 kg).

13.5.4 The finding of this large number of plutonium-contaminated fragments was a surprise and changed the whole concept of the hazard assessment of the plutonium-contaminated areas. Previously, all of the hazard assessment had been carried out assuming that inhalation was the major pathway for plutonium to get into the body, and these assessments had generally shown that the ICRP standards could be met even for people living on the plutonium-contaminated areas. The presence of the fragments changed that, because many of the fragments contained more activity than an individual was allowed to ingest over a year. Wound pathways were also suggested to be important. Different assessments of the hazard are discussed in Chapter 14.

13.5.5 As well as the plutonium-contaminated fragments, the ARL survey found a continuous distribution of plutonium contamination. Data were collected both with the portable field probes and by soil analysis. The peak levels, which were inside the fence, had plutonium concentrations exceeding 0.22 MBq/kg (6 microcurie/kilogram). These values exceeded the standards for Operation Brumby by a factor of six. Even outside the high cyclone-mesh (HCM) fence there were some areas that exceeded 0.07 MBq/kg (2 microcurie/kilogram). The amount of plutonium within a distance of about 700 m from the plinth at Taranaki, excluding that on the fragments, was estimated to be 0.96 TBq (26 Ci or 0.42 kg).

13.5.6 In general, the plumes from the individual Vixen B trials at Taranaki could not be detected beyond a few kilometres from the firing sites. However, one plume extended much further and it was still detectable (using the field probes) to a distance of 18 km north-west of the firing pad. The analysis of soil samples was a more sensitive test for plutonium, and plutonium was just detectable in a soil sample collected from the plume centre line at 37 km. This plume extended across West Street and into the area that had generally been thought to be uncontaminated. Beyond West Street the concentrations were less

than 740 Bq/kg (0.02 microcurie/kilogram) which is a factor of 50 less than the standard applied during Operation Brumby. There would not be any significant plutonium-contaminated fragments at this distance. The total amount of plutonium in the north-west plume was estimated to be 1.14 TBq (31 Ci or 0.5 kg).

13.5.7 The total amount of plutonium distributed on the surface around Taranaki, including the fragments and the north-west plume was 3.3 TBq (89 Ci or 1.4 kg). This is only 6.6 per cent of the total amount of plutonium used at Taranaki. Even allowing for the uncertainties in the estimates of the total amount of plutonium from the survey data, it suggests that over 90 per cent of the 22 kg (50 TBq) of plutonium used at Taranaki ended up in the pits.

13.5.8 As well as Taranaki, ARL also surveyed the plutonium contamination at TM100, TM101 and Wewak. Again plutonium-contaminated fragments were found in these areas, although their density was less and they covered a much smaller area.

13.5.9 Temporary fences were installed at all four sites in July 1984 to identify the areas of contamination outside the main HCM fences. The recent survey shows that areas enclosed by these fences will have to be enlarged.

13.5.10 All of the major trial sites were again surveyed to determine the levels of radiation, and soil samples were collected for analysis by high resolution gamma-ray spectrometry. The soil analysis showed that the fission products caesium-137, and europium-155 and the activation products cobalt-60, barium 133, europium-152 and europium-154 were present around the Ground Zeros of each site. There was a continuing steady decline in the radiation levels and it was estimated that all sites except Tadge would be suitable for continuous occupation by the year 2030. At the time of the survey the dose rates were up to a factor of 16 above the recommended dose rate for continuous exposure.

13.5.11 Tadge was separately surveyed because of the presence of plutonium near Ground Zero and to the north. The highest level of plutonium contamination was 25 kBq/kg (0.7 microcurie/kilogram) which is less than the standard applied at Brumby.

13.5.12 Samples of glazing were collected from Biak, Breakaway, One Tree and Totem 1 for analysis. A typical piece of glazing of about 100 g was found to contain 4 kBq (0.1 microcurie) of fission and activation products and about 40 kBq (1.0 microcurie) of plutonium.

13.5.13 Apart from Taranaki, TM100, TM101 and Wewak which have already been discussed, the minor trials sites were all surveyed for residual radioactive materials. The short-lived radionuclides polonium-210 and thorium-228 have generally decayed

to insignificance. However, there are still significant amounts of enriched, natural and depleted uranium at some sites. Uranium was found along the Rats lanes at Naya 1, Kittens lanes at Naya 2, trials sites at Naya 3, TM50 and Kuli, and a small firing site on the way to Kuli. No radioactivity was detected at the Wewak sites VK26 and VK31, the site of the resuspension trials, or at Dobo, the site of the Rats trials.

13.5.14 A survey was also carried out for beryllium. Beryllium is a toxic substance with a non-occupational limit of 0.01 microgram per cubic metre. However, it is not radioactive and chemical methods of detection are not very efficient. A total of 104 samples were collected from likely locations but only four from a small area at the TM50 site showed significant levels of beryllium. One piece of beryllium was found at the Kuli site. ARL suggested that beryllium was dispersed as small metal fragments which would not cause an inhalation hazard.

13.5.15 The ARL also commented on the risk of the levels of contamination that they found. Discussion of this is deferred until Chapter 14.

Conclusion

13.5.16 The discovery of the large number of plutonium-contaminated fragments on the Range changed the hazards that had to be considered in any discussion of the future uses of the Range. Although it would have been better if the fragments had been discovered earlier, it was only with the development of stable portable instruments that reliable field measurements could be taken. Furthermore, the amount of americium-241 which was used as an indicator of plutonium has been steadily building up in concentration, making it easier to detect. It was not until the ARL survey that enough effort and appropriate equipment were put into surveying the contamination at Maralinga to allow a proper assessment of the state of the Range.

13.6 Emu

13.6.1 Two major trials and five Kittens trials were carried out at Emu. The major trials produced local fallout and activation products around Ground Zero.

13.6.2 The five Kittens trials were high explosive initiator experiments which dispersed a short-lived radioisotope, polonium-210, and less than 36 g of beryllium. Polonium-210 has a half life of 38 days and by now has decayed to an insignificant level.

13.6.3 The site was occupied by security guards until 1955. In January 1955, Dale and Saxby produced a report 'Radiation Hazards at Emu - 1st February 1955' [RC 342, HP13/342], in which they estimated the hazard at the Emu site at 1 February 1955 and made recommendations for the future safety of personnel.

13.6.4 The activity levels in the Kittens area were still expected to exceed the level of 'slight risk' in the immediate vicinity of the firing pads and on asbestos wool which could have been more widely distributed. A level of 'slight risk' was considered to be contamination which would give a dose of 50 rep, of which the gamma dose could not exceed 10 roentgens, over an exposure of 112 hours. The exposure was not to be repeated within a year. However, this activity was expected to decay by a factor of 100 in the following 30 months, after which all of the Kittens area could be considered 'zero risk'. 'Zero risk' was considered to be a dose of 6 rep over 112 hours of which the gamma dose was to be not more than 3 roentgens [RC 342].

13.6.5 The external gamma radioactivity around the Ground Zeros was expected to exceed the 'slight risk' level out to a distance of about 75 yards. However, provided heavy boots were worn and direct contact of parts of the body with the ground was avoided, a stay of 50 hours at the centres of the Ground Zeros would be necessary to produce an exposure up to the limit of 'slight risk'. 'No loitering' areas were also mapped out around Ground Zero and for some distance along the fallout plume. Dale and Saxby recommended the erection of fences and signs to control the access to the various areas [RC 342].

13.6.6 In 1967, as part of Operation Brumby, the major test sites were hand-scavenged to remove metal debris and large pieces of glazing, and the fences and warning signs were removed. Pearce reported that an area of about 140 yards radius was graded and disc-ploughed at each site. There is some doubt if this was done because during a visit to the site by the Royal Commission it was observed that the vegetation is the same as that at greater distances and some of the glazing does not appear to have been disturbed. The rubbish and abandoned equipment were also cleaned up during Operation Brumby.

13.6.7 In November 1978, the Australian Radiation Laboratory, with assistance from the South Australian Health Commission, carried out a detailed study of the distribution and soil concentrations of long-lived radionuclides remaining at Emu [AIRAC 7, ARL/TR012]. They found four radionuclides present in the soil samples - europium-152, cobalt-60, caesium-137 and americium-241. The europium and cobalt are activation products and were restricted to the immediate vicinity of the Ground Zeros. Caesium and americium were distributed throughout the fallout areas. The levels of external radiation exceeded the limit then recommended for continuous exposure for members of the public for a distance of 175 m from Totem 1 Ground Zero and 150 m

from Totem 2 Ground Zero. From the rate of decay of the radiation it was estimated that the dose rate would decrease to the limit by the year 2025.

13.6.8 Plutonium was present in the fallout from both Totem tests. The level of plutonium near the Ground Zero of Totem 2 was such that it was possible to produce dust which exceeded the recommended limit for continuous exposure. The allowed occupancy factor was calculated to be 0.2, or 1750 hours per year.

13.6.9 In a report to the Minister for Science and the Environment on 19 October 1979, AIRAC said

'At these dose rates, an individual would need to remain continuously at the ground zero for three to four weeks to reach the maximum recommended dose limit for one year. This is a highly unlikely event and these levels, which are about one half of those met in similar circumstances at Maralinga, are not a hazard to health. Radiation doses from plutonium and other constituents of fallout are even less significant. No other routes of exposure are of any importance.'
[AIRAC 1979c]

13.6.10 AIRAC recommended that the Ground Zeros should be clearly marked in a durable fashion and that public access should be allowed. Plinths were placed in May 1979.

13.6.11 The levels of radiation at Emu were again measured during the ARL survey in 1984-85. The external radiation dose had reduced further. The estimated date for continuous occupancy was still about 2025.

13.7 Monte Bello Islands

13.7.1 The Monte Bello Islands were the site of three nuclear explosions, one during Operation Hurricane on 3 October 1952 and two during Operation Mosaic on 16 May and 19 June 1956. There were no minor trials on the Monte Bello Islands.

13.7.2 The Hurricane device was located in HMS Plym, which was moored about 300 m off the headland between Main and Cocoa beaches, Trimouille Island. The device was mounted forward of the bridge at a depth of 2.7 m below the waterline and about 9 m above the seabed. At the time of firing, HMS Plym was anchored on a heading of 156 degrees [RC 823, pp.1, 13].

13.7.3 The radiation field on Trimouille Island following the explosion was surveyed in October 1952 and November 1953 [RC 438, Tla/54]. The fallout showed that the cloud had travelled to the north-west of the explosion, with the centre line of the fallout going over Bluebell Island.

13.7.4 Steel and other metal fragments from HMS Plym were blasted to the north and north-west, with many pieces landing on Trimouille Island. Most of the identifiable pieces came from the stern of the ship. The steel from the ship was radioactive as a result of neutron activation. The fallout over Trimouille Island was characterised by a black deposit which was found to be mainly composed of oxides of iron and hence was the remains of HMS Plym. The main long-lived radionuclides in the close-in fallout were cobalt-60, produced by the activation of the cobalt in steel, and europium-152 produced by the activation of europium which occurs naturally on the seabed [RC 823, p.13].

13.7.5 The contamination on Trimouille Island remaining from Hurricane was checked by the Radiological Group when it arrived for the Mosaic test. The general pattern followed the previously measured distribution and indicated that weathering had not had any great effect. There was no significant contamination at either of the sites selected for Operation Mosaic [RC 291, T21/57].

13.7.6 The first Mosaic test, G1, was fired on 16 May 1956 at a site on the north-west of Trimouille Island. The contamination around Ground Zero was surveyed in the week following the explosion [RC 291, T21/57]. The G2 test was fired on 19 June 1956 on the north-eastern part of Alpha Island. There was no survey of the contamination following G2.

13.7.7 The Safety Committee asked that the highly-contaminated areas left after Mosaic should be fenced off with cyclone fencing and 'amply placarded'. However, the request was questioned on the grounds of practicability and the difficulty of erecting the fence by the Chairman of the Mosaic Working Party, the Operational Commander, and Adams, the Scientific Director for the trial. The matter was left to be discussed when the Safety Committee was at the Monte Bello Islands for Mosaic [RC 131, 4th to 7th Meetings of the AWTSC].

13.7.8 After the Mosaic tests, one short safety fence was erected across the 'neck of Trimouille Island and signs were erected within three days of firing G2 on all the beaches likely to be used for landing on eight islands which were contaminated to some degree. The signs had "DANGER - RADIOACTIVE. KEEP OUT" in English, Greek, Malay, Chinese and Japanese' [RC 233, p.261].

13.7.9 Entry to the Monte Bello Islands was first prohibited by section 5 of the Defence (Special Undertakings) Act 1952 wherein an area of 45 miles (72 km) radius around Flag Island was declared to be a prohibited area. This was revoked on 27 March, 1957 and replaced by a declaration under section 8 of the same Act to the effect that the Monte Bello Islands and their territorial waters were prohibited areas.

13.7.10 HMAS Fremantle visited the Islands in September 1957 to conduct a radioactivity survey and replace warning signs as required. Various pieces of metal on Trimouille Island were

found to give readings of 0.1 mr/h. Radiation levels were also measured on the beaches near to each of the explosions. The highest reading was 0.6 mr/h near the G2 site. All signs were in good order and there was no evidence of illegal landing [RC 581, p.751]. Further checks on the Islands were made by the RAN in September 1958, March 1959, September 1959 and April 1961 [RC 581, pp.756-83].

13.7.11 In response to a Safety Committee request, the AWRE provided estimates of the levels of radiation which were likely to still exist on the Islands in 1961 [RC 800, p.610887]. A full survey of the Islands was carried out between 28 May and 7 June 1962. The report from Captain R T Power noted, *inter alia*, that

'3. Isolated steel fragments are scattered throughout the islands but none showed any activity above the normal background, with the exception of those on Alpha Island where the readings were comparatively higher...

'5. Warning notices in general have withstood the ravages of time with the exception of those placed on Burgundy Beach (Alpha Island).' [RC 800, p.620303]

13.7.12 Searches were made for 'glazing' and millimetre-size fallout pellets similar to those found at Maralinga and Emu, but none were found. The lack of glazing and pellets was explained by the calcareous nature of the soil. Glazing only occurs where aluminosilicates are the dominant constituents of the soil [RC 535, ARL/TR049, p.11].

13.7.13 The Safety Committee reviewed the results of the survey and noted that

'i. Radiation levels have diminished significantly. Of the land areas on which radiation debris fell, the minor islands and most of Trimouille and Alpha are now showing dose-rates well below 1 mr/hr.

ii. An area between 2000 and 4000 [square yards] on Trimouille Island, including, and to the west of G1, has a radiation level of 2 to 3 mr/hr. Levels diminished rapidly outside that area and within tens of yards they are less than 1 mr/hr.

iii. On Alpha Island, disposed about G2, an area of some 20,000 [square yards] has dose-rates of 5 to 6 mr/hr; the dose-rate at Ground Zero is higher at 10 to 15 mr/hr. As expected, this region shows the highest radiation levels of the Islands; dose-rates fall off radially from Ground Zero, with some circular symmetry, until levels below 1 mr/hr. are reached at about 200 yards.

'It was concluded that the Islands now constitute no more than a minor radiation hazard which does not warrant the continued declaration as a Prohibited Area.

'The Secretary was instructed to inform the Department of Supply of this conclusion, pointing out that should the area be derestricted, it would be essential to fence in G2 and to maintain suitable multi-lingual notices on the few beaches suitable for landing.'
[RC 131, 102nd Meeting of the AWTSC]

13.7.14 The final report on the Monte Bello Islands survey was presented to the Safety Committee in September 1964 [RC 800, p.640627].

13.7.15 News of oil exploration at nearby Barrow Island led the Safety Committee to re-assess the radiation hazard at Monte Bello [RC 800, p.640433]. The Safety Committee decided to recommend that the areas around G1 and G2 be fenced and additional warning signs be installed [RC 800, p.640716].

13.7.16 The fences were erected in March 1965 in 'Operation Cool Off' [RC 800, p.650106].

13.7.17 A further survey was carried out between 8 and 11 February 1968 by a party from HMAS Diamantina under instruction from the AWTSC. At this time, although some corrosion was evident, fences were generally in good order. As well as measuring the dose rates on Trimouille and Alpha Islands, a number of the minor islands were also surveyed [RC 535, ARL/TR049].

13.7.18 In 1972, a field team from the Division of National Mapping was on the islands for work associated with the Australian Geodetic Datum and they were asked to carry out a radiation survey and collect some soil samples. The radiation survey covered only Trimouille and Alpha Islands. By this time, corrosion had damaged or destroyed the posts for all fences and signs. The fence across Trimouille Island no longer existed and there were only a few signs standing on the beaches. The fences around G1 and G2 were largely intact [RC 535, ARL/TR049, p.12]. The highest radiation doses were at the Ground Zeros and were found to be 2.7 and 4.5 mr/h for G1 and G2 respectively [RC 485, ARL/TR010].

13.7.19 In the early 1970s, the WA Health Department became aware of persons visiting the Monte Bello Islands. There were also suggestions that a considerable quantity of scrap metal had been removed. In October 1974, Mr L M Davis, Dr B M Hartley and Mr B E King of the WA Health Department visited the Islands to assess any possible hazards. They concluded that it would be prudent to maintain the fences and warning notices on Trimouille and Alpha Islands, and to discourage members of the public from visiting these islands [RC 485].

13.7.20 A second survey in August 1977 was made by Hartley and Murell. They were concerned about the lack of fences and the lack of effective surveillance of the area. They suggested that the control of the area be returned to the Western Australian Government [RC 485; RC 800, p.770204]. The Premier of Western Australia submitted a proposal to the Prime Minister that the Monte Bello Islands be returned to the control of the Western Australian Government [RC 800, p.780038]. The Commonwealth considered that more technical information was required on the radiological risks presented by the test sites, and asked AIRAC to advise on a suitable survey [RC 800, p.780054].

13.7.21 In October 1978, a team from the Australian Radiation Laboratory (ARL), the WA State X-Ray Laboratory, the WA Museum and the Australian Army carried out the survey. The results of the survey were published in Australian Radiation Laboratory Report ARL/TR010 [RC 485] and were used as the basis for the recommendation that AIRAC presented to the Minister for Science and the Environment in AIRAC No. 5 [AIRAC, 1979b].

13.7.22 The highest radiation levels close to the Ground Zeros were 1.7 mr/h and 2.9 mr/h for G1 and G2 respectively. AIRAC noted that the area at G2 where the dose exceeded one millirem per hour was less than two hectares and a visitor would not be excessively exposed unless he remained within the area for at least three weeks. It was estimated that the dose rate would be less than 0.06 millirem per hour by the year 2040 [AIRAC, 1979b].

13.7.23 The only conceivable inhalation hazard was the plutonium fallout at the Alpha Island site. The average concentration of plutonium over an area of 300 m in diameter was about 0.5 microcuries per kilogram. It was suggested that this level is usually taken to be acceptable.

13.7.24 The levels of radioactivity found in some samples of oysters and clams were considered in AIRAC 5 to be insignificant and to present no hazard [AIRAC, 1979b].

13.7.25 AIRAC 5 concluded that

'Considerations of radiological safety do not preclude return of the Monte Bello Islands to the administrative control of the Western Australian Government nor their designation as a national park. If there are no other reasons to the contrary, the islands should be so returned.' [AIRAC, 1979b]

13.7.26 AIRAC 5 also commented on the ecological impact of the tests on the Islands:

'It has been claimed that the nuclear explosions destroyed the native fauna, but the truth appears to be that the native mammalian species were destroyed long before the nuclear tests, presumably by introduced rats

and feral cats which are still present on the islands. The sites of the two land based explosions are still clearly apparent in aerial photographs, but there has been some regeneration. It cannot be said that the nuclear explosions have had very much overall effect on the appearance and ecological features of the islands other than some residue of litter and debris.' [AIRAC, 1979b]

13.7.27 As a result of the survey, and even before publication of the AIRAC 5 Report, a rehabilitation program was undertaken in May 1979 by the Royal Australian Engineers. The program of work was called 'Operation Capelin'. The work undertaken included

- . erection of warning signs in eight languages;
- . treatment of G1 and G2 Ground Zeros by digging and covering by new material to reduce the radiation levels in these areas by a factor of about ten;
- . burial of contaminated debris;
- . removal of rubbish and fences;
- . destruction and removal of one bunker at Main Beach which was in danger of collapse; and
- . erection of concrete plinths at G1 and G2 Ground Zeros [RC 800, p.790242].

13.7.28 The Report of Proceedings for HMAS Acute records that two yachts 'were surprised' when the ship visited the Islands on 4 July 1982. The yachts were instructed to leave the prohibited area [RC 800, p.820192].

13.7.29 A survey was carried out in May 1983 by a team from the Australian Radiation Laboratory and the WA State X-ray Laboratory. The highest level of radiation near to Ground Zeros was 2.5 and 7.7 microsievert per hour (0.25 and 0.77 mrem/h) respectively. The levels of radionuclides in oyster flesh were again measured and found to be insignificant and to present no hazard to health [RC 535, ARL/TR062].

13.7.30 The radiation from various pieces of metal scattered over the Islands was measured. There were still a large number of metal fragments ranging in mass from less than one to several hundred kilogram. It was concluded that

'Under certain circumstances such as the unrestricted removal of material by souvenir hunters, the larger metal fragments could represent a potential radiation hazard. Depending on the nature of future management regimes consideration should therefore be given to the collection and burial of the radioactive metal.' [RC 535, ARL/TR062, p.7]

13.7.31 In August 1984, the radiation field on Trimouille and Alpha Islands was again surveyed, mainly to cover the areas away from the more contaminated regions that had been surveyed in 1983. None of the metal fragments remaining from the Hurricane explosion was considered to pose a radiation hazard, but it was felt to be desirable to clean up those that can be readily moved. Moroney suggested that the larger items, if properly identified, would be informative relics of the trials.

Salvage from Monte Bello Islands

13.7.32 From the statements and oral evidence given to the Royal Commission, it is clear that the declaration of a prohibited area was ineffectual as a means of stopping people visiting the Islands and of discouraging the salvage of materials. I V Blair, who was the Sergeant of Police at Onslow from 1959 to 1966 gave evidence that he was not given any instructions or warnings by anyone about the Monte Bello Islands [RC 588]. He said

'In fact I went there myself and I never had any idea it was out of bounds.' [Trans., p.9787]

13.7.33 He subsequently made three expeditions to the Islands collecting heavy armour-plated copper wire almost up to the Ground Zero. Blair said that there is now little of salvageable value left on the Islands.

13.7.34 W A Millar told the Royal Commission at its Karratha sitting that he had salvaged metal, high octane fuel, corrugated iron and aluminium piping in about 1960. He did not salvage material from the areas which were indicated to be radioactive [RC 513]. Both Blair and Millar gave evidence that many boats have been fishing around the Monte Bello Islands and that many people have been on the Islands [RC 588; Trans., p.7548].

13.7.35 Most of the salvageable material would not have been near Ground Zero but from the various control centres, particularly on Hermite Island. Only a comparatively small amount would have been in the contaminated areas and anyone salvaging material from the contaminated area would probably have had to go past warning signs. Hence it seems likely that most of the salvaged material presented no radiation hazard. There seems to be no record of what material was abandoned or where.

13.7.36 The surveillance of the Islands was inadequate to provide timely warning that illicit salvage had been carried out. At the very least, the local police should have known of the restrictions applying to the Monte Bello Islands.

Conclusions

13.7.37

(a) The surveillance and control of the Monte Bello Islands have been inadequate to provide protection for visitors from inadvertent radiation exposure.

(b) In view of the likelihood of persons engaging in salvage operations, the AWTSC and the Government should have ensured that none of the abandoned material presented a radiation hazard.

(c) Nevertheless, the Royal Commission concludes on the evidence presented that no one received a hazardous exposure to radiation, either by visiting the Islands or by salvaging abandoned material.

CHAPTER 14

FUTURE MANAGEMENT OF THE RANGE

14.1 The Hazards at Maralinga and Emu

14.1.1 Five major radiological and toxic hazards remain at the test sites:

- (a) plutonium fragments and contamination at Taranaki, Wewak, TM100 and TM101;
- (b) plutonium buried in the pits at Taranaki and TM101;
- (c) uranium at Naya, Wewak, Dobo, Kuli and the small firing sites;
- (d) beryllium contamination at Kittens, Naya, Wewak, Kuli and TM50; and
- (e) radiation levels at some of the major trial sites.

14.1.2 In addition, the following hazards need to be considered and evaluated:

- (a) glazing at Biak, Breakaway, One Tree, Totem 1 and Totem 2;
- (b) plutonium contamination in the north-west plume;
- (c) plutonium contamination at Tadge; and
- (d) material in the airfield cemetery.

14.1.3 The options for future management of the Range were discussed in three reports which were tendered to the Royal Commission. Each of the reports was produced in a very limited time, so that the information would be available to the parties represented before the Royal Commission and for the Royal Commission's own deliberations.

14.1.4 On 20 May 1985, the Australian Atomic Energy Commission (AAEC) was asked by the Department of Resources and Energy to prepare a document that provided advice on the following matters:

- (a) The limit of contamination of the soil and ground cover by plutonium-239, uranium-235 and americium-241 which may be considered as permitting the unrestricted land use of the former nuclear weapon test sites at Emu and Maralinga by Aboriginal groups.

(b) The options available to achieve the objective set out in (a) above.

(c) The indicative costs of these options.

The study was to be completed no later than 12 July 1985.

14.1.5 The report AAEC/DR20 'Options for Clean-up of the Maralinga Test Site', edited by D R Davy, was tendered to the Royal Commission on 11 July 1985 [RC 574].

14.1.6 The AAEC report and the ARL report on the levels of contamination on the Range were sent by the Royal Commission to Dr R Osborne of Chalk River Nuclear Laboratories, Atomic Energy of Canada Limited (AECL), and to Mr B W Church, Nevada Operations Office (NVO), US Department of Energy, for review and comment. Both organisations provided extensive reviews and comments by the end of July. These two reviews were distributed to all parties, and then tendered at the sitting of the Royal Commission on 18 September; the AECL report is Exhibit RC 821, and the NVO report is RC 822.

14.2 The Future Use of Maralinga Lands by Aborigines

14.2.1 To assess the risk presented by the test sites and to develop criteria for clean-up, it is necessary to consider the lifestyle of the people who are likely to be exposed.

14.2.2 The Maralinga Tjarutja Land Rights Act, which was proclaimed on 6 December 1984, returned to the Aboriginal traditional owners 76 420 square kilometres of land surrounding the Maralinga and Emu test sites. Prior to the proclamation of this Act, Emu had been on State Crown Land which formed part of the Woomera Prohibited Area, whereas Maralinga was (and remains) on land known as Section 400 granted by the State of South Australia to the Commonwealth for defence purposes on 12 December 1957.

14.2.3 The Maralinga Tjarutja Land Rights Act provided for the granting of the whole or any part of the lands described in the First Schedule of the Act to Maralinga Tjarutja, the body corporate which was created and empowered by the Act to administer the lands on behalf of the traditional owners. The proclamation of the Act brought into effect a land grant which gave to Maralinga Tjarutja the whole of the land specified in the First Schedule subject to the following two excisions:

- (a) an area of 510 square kilometres surrounding Emu (Section 1486); and
- (b) an area immediately to the west of the western border of West St (Section 1487).

14.2.4 A copy of the land grant containing a map of the excised portions appears in the Appendix to the Final Submission on behalf of the Aboriginal Groups and Individuals [RC 862].

14.2.5 The South Australian Government has stated a firm intention of transferring title of all of the unoccupied Crown Land at Maralinga to the Aboriginal people [RC 800, p.840343]. Presumably the intention applies to the two excisions but it could apply equally to Section 400 when it is returned from Commonwealth control to South Australia. The two excisions were made to allow time for the hazard presented by the radioactive contamination to be properly assessed.

14.2.6 The traditional owners of the Maralinga lands lived at Yalata throughout the test series. At Yalata, the Aboriginal community lived in a Big Camp, in which a large collection of **wiltjas** (humpies of branches and tarpaulins) was loosely ranged around a water tank. The Big Camp was serviced by a school bus and supplies from the central administration area. The Big Camp moved several times a year to a new part of the reserve. The most common reason for moving was the death of an adult camp member. Pitjantjatjara people say that they no longer want to live at Yalata, but want to return to the Maralinga lands [Trans., p.7245; AB 15, p.15].

14.2.7 In 1982, the Yalata administration made it physically possible for the Aborigines to return on a permanent basis to the Maralinga lands by providing a truck, a water truck, provisions and encouragement. Approximately eighty adults and children settled in the Lake Dey Dey region and this outstation has continued at various locations up to the present [AB 15, p.14]. Over the past three and a half years, the camp has moved to approximately eleven different locations as follows:

- . three different camps at the Lake Dey Dey area,
- . two or three different camps in the sandhills north of Watson,
- . at the start of the Lake Dey Dey road,
- . two kilometres up the Lake Dey Dey road,
- . south of Ooldea on the west side,
- . south of Ooldea on the east side, and
- . north of the transcontinental railway line at Ooldea [RC 862, p.434].

The average stay at any one location was about four months.

14.2.8 Aborigines now utilising the outstation development on the Maralinga lands are living in a largely traditional manner, with minimum usage of European goods and services. Their diet contains a high proportion of food hunted and gathered in the surrounding area. Bush foods mentioned to the Royal Commission include kangaroos, rabbits, birds, snakes and lizards, witchetty grubs, kalgurta (a green fruit eaten raw) and mallee hen eggs. Their access to European foods has not diminished the Aborigines' interest in and enjoyment of bush food [AB 15, p.20]. Hunting is opportunistic. If Aborigines saw a kangaroo or emu near the range area, it is unlikely that they would stop to consider where they were and the possible implications [Trans., p.9695]. Food is cooked and eaten according to specified methods, particularly in the case of red kangaroo which must be disembowelled and prepared in a customary fashion according to law. Cooking methods utilise sand, earth and ashes. Although people possess cooking utensils, the bulk of bush food is cooked in the camp fire [RC 862, p.443].

14.2.9 Living is accomplished close to, and on the ground. People own mattresses and blankets and live in low wiltjas. Water is limited so that there is very little washing of bodies, blankets and clothes. The camp sites become very dusty.

14.2.10 The United Kingdom's Final Submission argued that the sites of the tests were unsuitable as camping places for Aborigines. That

'There is no water, little firewood, and no ready supply of food in vegetable or animal forms. They have the additional disadvantage for Aborigines of having been polluted in a physical, and for them, a spiritual sense.' [RC 865, p.693]

14.2.11 This conclusion was disputed in the Final Submission on behalf of Aboriginal groups and individuals and by witnesses before the Royal Commission. The AAEC in its report on clean-up options, considered the factors that determined the choice of campsites by the Pitjantjatjara and other tribes in the arid areas; these included presence of water, supply of firewood, open vista, texture of ground, proximity of game and vegetable foods. The AAEC report concluded that the Maralinga test sites 'would not be preferred camp sites but would simply form part of a much more extensive area for food foraging'. [RC 574, p.A25]. This conclusion was supported by Professor A Hamilton's evidence [RC 586].

14.2.12 It is clear from the evidence that people do occupy and utilise areas such as Taranaki for varying times and for a variety of reasons. There may, for example, be opportunistic hunting of kangaroos or rabbits which involves pursuing the animals over wide areas by car and on foot, in which case people travel distances of up to 30 kilometres a day [Trans., p.10063a]. Rabbits inhabit the area as do dingoes and kangaroos. Firewood,

game and water 'are all available and none are individually, and so far as one could guess, collectively limiting' [Trans., pp.10061, 10072-3].

14.2.13 Aborigines on hunting trips travel in groups and they may carry water with them. There may be reasons of convenience or necessity which could bring about a halt at a particular spot; for example they may chase a particular animal across country and decide to camp, or a vehicle may break down and necessitate repairs on the spot.

14.2.14 On the other hand, permanent outstations are sometimes established. Some outstations established in the early 1970s in the far north-west of South Australia are still in existence [RC 861, pp.472-3].

14.2.15 The AAEC report attempted to estimate the hazard to a traditional Aborigine living off the land. The report assumed that the most exposed group would be camped at an ephemeral water hole reputed to exist 9 km north of the Taranaki site. The campsite could be used for perhaps three weeks of the year. From this site, food would be collected from Taranaki and the land covered by the north-west plume of plutonium contamination; it was assumed these areas would provide a third of the food supply during the sojourn at this camp site [RC 574, p.15].

14.2.16 The United Kingdom's Final Submission considered these assumptions 'arbitrary and quite unreal' [RC 865, p.696]. It is not clear from their submission if this complaint is because the exposure to plutonium was thought to be too high or too low.

14.2.17 The Royal Commission considers the description of the lifestyle of a traditional Aborigine in the Taranaki area used in the AAEC report to be realistic and a reasonable basis for estimating the health effect on Aborigines living a traditional lifestyle.

14.2.18 Further calculations should be made for other possible groups. For example, Taranaki is at the end of a good road and could be the site for an outstation which depended on supplies of food and water from the outside. Such a group would not be dependent on bush food but would be exposed through several of the plutonium intake pathways. The experience with the present outstation on the Maralinga lands suggests that a stay of four months once in four years is probably a maximum. To be conservative and to avoid restrictions on lifestyle, the hazard assessment should assume that the people sleep on the ground, tolerate very dusty conditions and rarely wash.

14.2.19 The aim of a clean-up should be to allow the Aborigines access to the test sites without restriction. They might never camp on one of the contaminated areas, but it is likely to happen at some time, and it is not acceptable to hope to be able to maintain restrictions into the distant future.

Conclusions

14.2.20

(a) The Maralinga Range is not acceptable in its present condition and it must be cleaned up.

(b) The aim of the clean-up should be to allow Aborigines access to the test sites without restriction.

(c) The Maralinga test sites, although not preferred camp sites, could form part of a more extensive area for food foraging for Aborigines living a traditional lifestyle. They could also form a possible outstation for an Aboriginal community dependent on rations and water from outside.

(d) The assumptions made in the AAEC report on clean-up options about the traditional lifestyle were realistic and a reasonable basis for estimating the hazard to Aborigines from the contamination. However, hazard assessments should be carried out for other possible lifestyles including a group establishing an outstation at Taranaki. Such a group would depend on food and water brought in from outside, and should be assumed to live on the ground in dusty conditions and rarely wash.

14.3 Compensation for Loss of Use of Lands

14.3.1 The Terms of Reference require the Royal Commission in inquire into

'(a) The measures that were taken before and at the time of the tests for the purpose of protecting persons in and about Australia...against exposure to the harmful effects of ionising radiation, and against contact with radioactive substances and other toxic materials used in or produced by the tests;

'(b) "In conducting your inquiry to have particular regard to...Aboriginals in the general regions of the test sites".'

14.3.2 One of the measures taken before, during and since the tests was the blocking of access by Aboriginal people to the Maralinga Prohibited Area. The Royal Commission echoes the sentiments of Backhouse expressed almost 140 years ago:

'(the Aborigines) being without strength to repel invaders, had their lands usurped, without any attempt to purchase by treaty or any offer of reasonable compensation...' [Backhouse 1837]

14.3.3 As shown in Chapters 6, 8 and 9, the British nuclear test program required that a means had to be found to keep people from travelling north of the trans-continental railway line. Construction of the Maralinga proving ground in particular meant that the former residents of Ooldea who had been moved to Yalata had to be discouraged from moving back to Ooldea and to places further north.

14.3.4 The method of discouraging movement, which MacDougall introduced in 1955, existed at Yalata until the commencement of the first outstation on the Maralinga lands in 1982. In November 1955 MacDougall wrote to the Superintendent, WRE, that

'The Yalata property was thoroughly investigated as country suitable for semi tribal natives...Several old shed tanks were visited and it was decided to establish them as periodical ration depots thus forcing the older natives to resume their wandering way of life and lessening the tendency to travel north towards their old hunting grounds.' [RC 819, p.555]

14.3.5 As has been discussed above, the complete movement of people could not be stopped. Ties to kin and land were too strong for this. Nevertheless, the Big Camp was established at Yalata.

14.3.6 Big Camp was basically a large collection of family groups housed in *wiltja* loosely ranged around a water tank. The Aborigines had access to European rations and at the same time their movement and location could be controlled by the Lutheran missionaries [RC 805].

14.3.7 This set-up may have suited MacDougall and the Lutherans but it caused great distress to the Aborigines. Under the notion of Big Camp they had some freedom of movement and some freedom to re-locate their camps, but this was all within the confines of Yalata.

14.3.8 Aboriginal people frequently respond to stress by re-locating their camps. This provides them with new neighbours and gives them more breathing space [RC 805]. It also enables them to get away from the source of the stress.

14.3.9 Options for movement within Yalata were constrained by the physical limits of the property. At the same time, Yalata itself was an alien environment which caused great distress to the people relocated there. People were in a situation of stress from which there was little or no escape.

14.3.10 People's ability to deal with unwanted violence or trouble with their children by effective relocation had been denied them. People's ability to escape the social problems of Yalata, such as heavy drinking, petrol inhalation, and offences against property and person also had been denied them.

14.3.11 The Royal Commission does not attempt to attribute to a single cause the social problems of the Yalata people. However, it is clear that the dearth of appropriate living conditions certainly contributed to a state of dependency and deprived the people of a viable means of dealing with unwanted behaviour. It is equally clear that the social disruption in the past stems from their forced re-location to an alien and therefore highly stressful environment.

14.3.12 It is clear that the Pitjantjatjara did not want to live at Yalata [Trans., p.7245; AB 15 p.15]. Many do not want to live there now and have chosen to locate themselves at considerable distances from it where their traditional lands have again become the focus of their lives.

Development of the Outstation

14.3.13 Since 1966, Yalata people had been making some bush trips north. These were facilitated by the mission superintendent, Lindner, and the alacrity with which people went on them is evidence of their desire to visit and see their country [Trans., pp.3424-6].

14.3.14 In 1981, Yalata people visited the Great Victoria Desert and in part this was to seek a suitable location for an outstation. Prior to this the Yalata people, through geographical isolation and social disruption, had not had the opportunity to consider developments occurring to the north, such as the outstation movement and the granting of land rights [AB p.15]. The 1981 visit resulted in the Lake Dey Dey area being selected as a possible outstation location.

14.3.15 In May 1982, the Yalata administration made it physically possible for people to return to their homelands. They provided a truck, a water tank, provisions and encouragement to initiate the move [AB 15, p.14]. The response was overwhelming. Despite no guaranteed water supply, with a precarious supply of provisions, and despite the remoteness of the location, about eighty Yalata people moved to a camp at Lake Dey Dey where, on and off, they have remained since (see para.14.2.7).

14.3.16 Although the older residents from Yalata had been absent from their country and their special sites and waterholes, they have retained a remarkable attachment to them. From the time of Lindner's bush visits, considerable emphasis has been placed on taking young men into the bush so that they can become familiar with the sites, myths and rituals associated with the country [AB 15].

14.3.17 Outstations on the Maralinga lands will enable the Aboriginal people to continue to re-contact sites of significance that until now they had been unable to visit as frequently as

they wished. As Professor Hamilton said in evidence, the inability to check on and care for sites is a great source of anxiety [Trans., p.9703].

14.3.18 Right up until the removal of the Aborigines to Yalata in 1952, locations were being visited in the Ooldea-Maralinga area [Trans., pp.7210, 7215]. MacDougall had noted in 1952 that older men showed 'considerable interest' in ceremonial grounds north of Ooldea [RC 819, p.130].

14.3.19 Jack Baker [Trans., p.7245] and Hugh Windlass [Trans., p.7246] told the Royal Commission that living in closer association with 'related' country means that the people can strengthen their law and reconfirm their beliefs in the dreamings.

14.3.20 T Queama and others [Trans., pp.7236-7], J Baker [Trans., p.7245], S Minning [Trans., p.7264], Rene Sandimar [Trans., p.7271] and M Watson [Trans., pp.7210-11] referred in their evidence to the continuing importance of the Maralinga lands while they were at Ooldea. They told how they visited the country and looked after the sites.

14.3.21 The Aboriginal men and women named some of their sites and further evidence was received by the Royal Commission on the location of sites and the tracks of mythological beings. The Royal Commission accepts that the sites and tracks, and the lands on which they are located, are of the utmost significance to the traditional owners of those lands.

14.3.22 Evidence was received of Aboriginal attitudes to the nuclear tests and their effects on the country [AB 15]. Some rockholes and sites are now said to be 'finished' or 'dead'. They are not to be trusted any more. There is also fear that the 'poison' which has contaminated the land may be blown to areas where people now camp [Trans., pp. 7243, 7285].

14.3.23 The possibility that sites have been and will continue to be unclean must cause considerable anxiety to their custodians. Under Aboriginal law, custodians of particular sites are required to take responsibility for their care and maintenance. It is not surprising, as Professor Hamilton pointed out, that the Aboriginal people are adamant that the Range be cleaned up [RC 586].

14.3.24 The Report of the Select Committee of the South Australian House of Assembly on the Maralinga Tjarutja Land Rights Bill 1983 (delivered on 16 November 1983) concluded that

'The Aboriginal people at Yalata and from other places with an interest in the Maralinga land are firm in their claim to their attachment to that land, and strongly reject any suggestion that they are any less

tribal than the northern Aboriginal people, with any lesser traditional rights and obligations to their land. There is a further important dimension to this Bill. It will enable a group of dispossessed people who were forcibly removed from their lands nearly thirty years ago, to return at last to their cultural home lands with a sense of dignity and purpose. At present, the majority of these people live at Yalata. That Community is not a happy one. The lands do not have any cultural attachment for the people and the social dislocation which has occurred over the past thirty years, particularly in relation to alcohol, has seriously damaged the whole Community. Some of the people have already returned in a small homelands movement onto the Maralinga lands. Your Committee had the opportunity of consulting with a large number of people from the Yalata Community at a special meeting held on the lands at 'Old Maralinga' where they gave evidence of their attachment to the land, their knowledge of its special characteristics and their desire to return there to live and care for the land. Your Committee was privileged to view, confidentially, secret artefacts and a map of significant sites which indicated the ties of these people to this area. The vigour and depth of the aspirations of the traditional people are real and vital; that is they wish to return to their homelands with dignity and with a strong law that will enable them to manage and care for the lands in a manner which also meets the needs and wishes of the wider society they live in today.' [RC 800, p.830227]

14.3.25 Because of the British nuclear tests, the Aboriginal people were restricted from the lands on which are sites which they were accustomed to visit, and through which they were accustomed to travel. As the area from which they were blocked contained water holes and travelling routes, this action also denied people travel to other places as well and not just to the Maralinga Range.

14.3.26 Passage of the Maralinga Tjarutja Land Rights Act in 1984 diminishes the significance of the restrictions from now on. Already, Aboriginal people have fled the appalling social and material conditions of Yalata and currently more than 170 people are camped in the Lake Dey Dey area. But the 1984 Act does not overcome the restrictions in relation to Section 400 and the statutory excisions. Nor does the Act in any way attempt to make restitution for the denial of access over the past thirty years. The Royal Commission deems it appropriate that this issue be addressed.

14.3.27 Rather than attempt to place a monetary value on the loss of lands caused by denial of access, it is appropriate that there be a form of compensation which will enable the Maralinga-

Tjarutja people to live as and where they wish with a reduced level of hardship. If Aboriginal people wish to form one or more outstations then these outstations should be provided with, for example, water supplies, medical aid posts, schools, stores, shelter and communications. If Aboriginal people wish to return to a semi-nomadic lifestyle, water bores should be located at those places which Aboriginal people regard as necessary and suitable.

14.3.28 Aborigines are experts in the everyday reality of their own situation. This reality includes identifiable basic needs. Aboriginal people have been unable to meet certain basic needs because they have been denied access to their lands and thus to the means of satisfying their needs. Adequate compensation requires that relevant and appropriate modern technology be made available in order that at least some of the needs can now be met as rapidly as possible.

14.3.29 Aboriginal people are able to identify, order and articulate their needs. Currently they are receiving some assistance towards establishing an outstation from the South Australian Government. While such assistance is welcomed, it is nevertheless inadequate to re-establish the people's relationships with their land rapidly and with minimal hardship. Effective compensation requires that the latter be achieved. As Muir has put it:

'Because we watched the wrong
Last too long
With non-committal faces
.....Oh this is the taste
Of evil done long since and always, quickened
No one knows how
.....
We must shape here a new philosophy.'
[Muir 1975, pp.27-8]

Conclusions

14.3.30

(a) The traditional owners of the Maralinga lands were denied effective access to these lands for over thirty years as a result of the British nuclear test program. This denial has contributed to their emotional, social and material distress and deprivation.

(b) The traditional owners of the Maralinga lands are eager to re-establish their traditional relationships with their lands and are responding keenly to attempts to make this possible.

(c) It is appropriate and fair that after the loss of use of their lands the Aboriginal people be compensated. Effective compensation would enable them, where and as they wish, to re-establish their links with the land as rapidly as possible and with as little hardship as possible.

(d) The Royal Commission concludes that responsibility for compensation to those people who have been denied use of their lands because of the nuclear test program should be assumed by the Commonwealth Government.

14.4 Hazards to Aborigines Using the Range

14.4.1 The radiation levels at the Ground Zeros can be measured and the doses to individuals at those locations accurately assessed. Measurements in 1984 showed that the radiation levels at the One Tree Ground Zero were larger than at any of the other major test sites. The higher radiation level at One Tree would cause a dose rate to an individual 16 times higher than the dose rate recommended for continuous exposure to a member of the public [RC 531, p.25]. In other words, a person should not spend more than three weeks in any one year at that spot.

14.4.2 The area around Ground Zero that exceeds the dose level for continuous exposure by members of the public has a radius of about 200 m at One Tree. Each of the Ground Zeros is now marked by a concrete plinth on which a warning against staying at the location for an excessive length of time is written. The warning notices were appropriate to the level of hazard presented by the radiation levels in 1979.

14.4.3 The radiation levels at the Ground Zeros are decreasing all the time as the radioactive isotopes in the soil decay. It is estimated that the radiation will have decreased to a level of no significance in about 45 years [RC 531, p.25]. This is well within the lifetime of younger members of the Aboriginal groups returning to the Maralinga lands.

14.4.4 The most significant hazard to Aborigines using the test sites is from the plutonium contamination resulting from the Minor Trials. Unfortunately, it is also the most complex and least well understood of the hazards present on the Range. Furthermore, the long half-life of plutonium means that left as it is, the hazard would be present into the distant future.

14.4.5 A number of attempts to quantify the hazard for plutonium contamination were presented to the Royal Commission. The range of different pathways considered and variability in the values of the dose estimates provided reflects the uncertainty of the lifestyles of Aborigines who might use the Range area and a lack of basic data on the important pathways. Prior to the

ARL 1985 report, it was generally accepted that inhalation was the main exposure pathway. However, other evidence tendered suggested that ingestion of bush foods could be more hazardous than inhalation for Aborigines living a traditional lifestyle [RC 574]. The risks from wound contamination were also considered to be important and possibly the limiting pathway in some areas [RC 574]. Another report tendered raised the hazard of particles larger than a respirable size which lodge in the pharynx [RC 821].

14.4.6 The different assessments of the exposure pathways are considered in more detail in the following paragraphs.

Inhalation

14.4.7 Inhalation was considered to be the limiting pathway defining the criteria for Operation Brumby. Provided the plutonium concentration in the top 1.5 cm of soil was less than one microcurie per kilogram, the dose from inhaled plutonium was calculated to satisfy the 1965 ICRP recommendations for members of the public.

14.4.8 Pearce said in evidence that for a person living in an area with less than one microgram of plutonium per kilogram of soil, to exceed their allowable plutonium intake by inhalation was

'...extremely unlikely, because in order to achieve that you will have to breathe so much dust that you would be in an environment which was barely tolerable because of the dust, let alone the plutonium.'
[Trans., p.6419]

The hazard assessment was based on a dust loading of 10 mg/m^3 which was considered to represent a 'heavy dust cloud'. A dust loading of 100 mg/m^3 was reckoned to be 'barely tolerable'. It was estimated that 80 hours' exposure to a dust loading of 100 mg/m^3 per year would be necessary to produce the ICRP recommended maximum permissible dose to individual members of the general public [RC 800, pp.670081, 670271].

14.4.9 The inhalation dose was also determined by Dr K Lokan in his Calculation No. 3 which he described when giving evidence on 27 May 1985 [RC 531]. Lokan considered that the average dust loading through the year could be as high as 1 mg/m^3 , of which perhaps one per cent would be in the respirable range:

'...we had in mind there, for example, the average dust loading that one might encounter in that Aboriginal camp that we saw at Maralinga where it is obvious that it is...a dusty environment to the extent that the activities of people in the camp raises a lot of dust -

the children play in the dust and throw it up; vehicle movement brings up a lot of dust, and people are living very close to the ground.' [Trans., p.8006]

His calculation produced an estimated committed effective dose equivalent of 1.01 mSv, which is equal to the recommended annual limit for long-term exposure to members of the public.

14.4.10 There was general agreement in the evidence tendered to the Royal Commission that resuspended dust under the wind conditions prevailing at Maralinga was not a significant radiological hazard. The AAEC report [RC 574] went on to consider further dust-raising activities including children digging for grubs and worms, movement of dogs in close proximity to sleeping humans and the consequences of setting grass/shrub fires as an aid to hunting. The children 'playing' at food gathering appeared to be the most restrictive pathway, and produced a derived limit for a uniformly contaminated soil of only 1.4 kBq/kg [RC 574, p.A67] which is a factor of 30 less than the standard used at Operation Brumby. However, the AECL suggested that this figure was derived using unreasonable dust loads and periods for the activity. The AECL concluded that the dose obtained by the AAEC could be an overestimate by a factor of between 100 and 1000 [RC 821, p.31]. This would make the inhalation risk for children playing at food gathering similar to the inhalation risk determined for dust raised by wind and general camp activities.

14.4.11 The AECL pointed out that the large particles in dust also present a hazard:

'The most significant deposition in the more contaminated areas may be of large particles in the nasal pharynx so consideration of only small "respirable" particles may underestimate the hazard. A correct interpretation and application of ICRP recommended models and parameters would have provided a consistent and accurate enough dosimetry.' [RC 821, p.iv]

14.4.12 More information is needed to resolve the different conclusions expressed in the reports. Data are needed on the particle size distribution of the plutonium-contaminated material, so that the relative importance of the doses to the lung and the nasopharynx can be properly assessed. Information is also needed on the range of dust loadings produced by the activities which might occur at an Aboriginal camp or outstation.

Ingestion

14.4.13 The dose from ingestion is now considered to be an important, perhaps the most important, hazard caused by the plutonium on the Range. In AIRAC 4, Ellis concluded that the

risk from ingestion was trivial because at that time plutonium was thought to be very slightly absorbed from the gut, the accepted transfer only being about one part in a million.

14.4.14 In his statement [RC 571], Fuller said that the NRPB now recommends a value 500 times higher for dietary plutonium, and even the ICRP figure for insoluble plutonium is now ten times higher than the figure Ellis used. Hence Ellis' estimates for dose from ingestion would now be considered a factor of between 10 and 500 too low. When these new values were used, Fuller concluded that the maximum allowed intake of plant material from the contaminated area would be between 30 and 500 g per year.

14.4.15 Lokan presented two calculations relating to the ingestion risks. In Calculation No. 2, he assumed that a fragment containing 1 MBq of plutonium in an insoluble form was ingested. The committed dose equivalent was estimated to be about 92 mSv which greatly exceeds the recommended annual dose of 1 mSv, and even exceeds the recommended lifetime dose for an individual [RC 531]. The AECL in its comments on the calculation say that the results are an overestimate because it is extremely doubtful if 0.001 per cent of a 0.4 mm particle of plutonium could solubilise in the gut let alone cross the gut/blood boundary. The AECL also noted that it was inconsistent for the americium in the particle to be available for uptake while the plutonium was in an insoluble form. If the americium was not leached out of the particle, the estimated dose would be reduced by a factor of five.

14.4.16 In Calculation No. 4, Lokan assumed that a member of the public residing permanently at Taranaki ingested one gram of soil a day. The committed effective dose from one year's intake of contaminated soil was 0.7 mSv, slightly less than the permitted dose for members of the public [RC 531].

14.4.17 The AAEC report [RC 821] contains estimates of the ingestion risks for Aborigines eating a range of local animals and plants. By reason of its time restraints, the analysis had to depend on the limited amount of data on plutonium in plants and animals at Maralinga reported in AIRAC 4, and some data from the US Testing Ground in Nevada. The derived limit for the ingestion pathway was 9.4 Bq/kg for uniformly contaminated land. For the notional traditional Aborigine, about two per cent of his annual intake of food was assumed to come from the contaminated land. Hence the derived limit for surface contamination was 500 Bq/kg, a factor of 100 less than the standard used at Operation Brumby.

14.4.18 The high gut absorption figure used in the AAEC dose estimates was criticised in the AECL report, where it was suggested that the standard figure for gut absorption for plutonium was a factor of 100 lower than that used by AAEC,

[RC 821, p.32]. Davy vigorously defended the AAEC's choice of gut absorption factor in a letter to the Royal Commission [RC 826].

14.4.19 In view of the importance of the ingestion pathway in determining the ultimate clean-up standards, Mr B Church of the US Department of Energy suggested that it would be worthwhile to collect experimental data on the gut absorption factor using plant material collected at Maralinga. He also said that the experience at Nevada and the Pacific testing grounds had shown that 'real data related to specifics of a given location and lifestyle must be acquired to validate any dose prediction model' [RC 822, NVO Report, p.3].

14.4.20 Interpretation is needed of the range of plants and animals eaten by the Aborigines in the area, and more data are needed on the levels of plutonium in plants and animals found in and around the contaminated areas.

Injection

14.4.21 This pathway had not been considered in any detail prior to the AAEC report. Much of the plutonium contamination at Taranaki is on metallic fragments which by their very nature are likely to produce cuts and gashes to the feet of barefooted people and to the bodies of children playing on the ground. The metallic fragments could deposit plutonium particles deep in the wound. Plutonium could also be deposited in wounds by sharp sticks and stones. In the nuclear industry, all plutonium pellets from 30 micrometres upwards in a wound would usually be surgically excised. Most of the plutonium-contaminated fragments identified by ARL (see para.13.5.2) would warrant surgical excision if they were injected into a wound [RC 574].

14.4.22 The AECL report includes an attempt to quantify the risk of plutonium injection in a wound and the resulting dose. Using a rough estimate for the various parameters it finds that a reasonable standard for clean-up of the Range would be 660 Bq/kg [RC 821, p.36], which is very similar to the result in the AAEC report for the ingestion pathway.

14.4.23 The Aboriginal practice of healing wounds by packing them with soil could also introduce plutonium into the body [Trans., p.10033] and should be properly evaluated.

14.4.24 The AAEC report recommended that about 4.7 square kilometres of land would need to be cleared of pellets in order to remove the injection hazard [RC 574, p.9]. The AECL report was critical of this conclusion because it was considered to be impractical and not supported by a proper assessment of an acceptable residual contamination.

Buried Wastes

14.4.25 There are a number of pits around the Range that have been used for the disposal of radioactive and other wastes. Of most concern for the future are the plutonium-contaminated wastes buried at Taranaki and TM101. The pits at Taranaki contain about 20 kg of plutonium distributed through 830 tonnes of debris, which includes steel plates, steel girders, lead bricks, concrete blocks and cable, mixed with 1640 tonnes of soil. The two pits at TM101 (Nos 22 and 23) contain 4.75 Ci (0.08 kg) of plutonium in over four tonnes of debris [RC 530, 0-16/68, p.21].

14.4.26 As the ARL report [RC 531, p.57] says

'Disposal of radioactive waste of this nature in this manner cannot be considered acceptable current practice.'

14.4.27 The pits were covered by concrete caps during Operation Brumby. However, since that time rabbits have established burrows alongside the covers. It is not known if the burrows actually go into the waste in the pits. Evidence was presented to the Royal Commission that the concrete covers were cracking and the wastes were subsiding. The plutonium in the pits is neither immobilised nor protected [RC 574, p.A85].

14.4.28 There is no external radiation hazard from the pits and, apart from the rabbits, they do not present a hazard to people in the area for the near future. However with time, the lack of immobilisation of the waste in the pits means that the plutonium could be transported into the biosphere.

14.4.29 The airfield cemetery near Maralinga Village contains thorium-228, cobalt-60 and plutonium-239. Since the repatriation of 0.5 kg of plutonium to the UK in 1979, there are only millicurie quantities of plutonium remaining. Between 1959 and 1964 about 120 Ci of thorium-228 was buried at the airfield cemetery. Thorium-228 has a half-life of 1.9 years so the amount of thorium-228 remaining in the pits in 1985 would be only about 0.05 Ci. The 1 Ci of cobalt-60 will have decayed to 0.05 Ci over the same time. The cobalt-60 activity is still significant and the pits containing the cobalt-60 still need to be protected from exhumation. The airfield cemetery also contains some low-level radioactive waste, which includes a small quantity of plutonium.

Beryllium

14.4.30 About 100 kg of beryllium was also dispersed on the range (see para.10.1.21), consisting mainly of 75 kg at Kuli, 17.6 kg at Taranaki and 4.2 kg at Wewak. The beryllium was used

in the minor trials and was dispersed by high explosives (see Table 10.1.2).

14.4.31 Beryllium is a toxic material and the main hazard is from the inhalation of the dust of beryllium and its salts. Beryllium is not absorbed through the unbroken skin but can enter the body through wounds and abrasions. Such skin contamination is slow to heal and ulcer formation is common [RC 677]. Inhalation of finely divided beryllium material can lead to medical problems such as pneumonia and bronchitis [RC 531, p.50].

14.4.32 In Australia, the recommended threshold limit value for occupational exposure of beryllium in air is 2 micrograms per cubic metre [NHMRC 1980, quoted in RC 531, p.50]. For comparison the derived air concentration for plutonium for occupational workers corresponds to an air concentration factor of 60 000 times less than that for beryllium. Hence if similar masses of beryllium and plutonium are distributed on the ground, the hazard from the plutonium is much greater than that from the beryllium. This is the condition at Taranaki.

14.4.33 The other location where significant amounts of beryllium were used was at Kuli, where Tims trials were carried out at the TM11, TM16 and TM50 sites. The ARL found beryllium in four samples from TM50 from a region which also showed elevated levels of uranium. The Royal Commission did not receive enough information on the distribution of the beryllium to be able to decide if the beryllium presented a hazard. More information is needed before it is possible to assert that there is no hazard. Probably a clean-up which removes the uranium would take care of the beryllium at these sites. The amount of beryllium at the other sites is thought not to present a hazard.

Uranium

14.4.34 About 7.4 tonnes of uranium was used in the minor trials and over six tonnes of it is dispersed at the various sites at Kuli. Most of it is depleted uranium and was given in the Minor Trials Schedule as uranium-238. The amount of uranium at the various minor trial sites is given in Table 10.1.3.

14.4.35 It is easy to locate lumps of uranium on the surface at Kuli [RC 531, statement from Australian Safeguards Office 13 August 1985]. The AECL report comments that 'The large number of uranium fragments present near Kuli could be a cause for concern' [RC 821, p.10].

14.4.36 No evidence was tendered to the Royal Commission giving an assessment of the hazard to either traditional Aborigines living on the site or to souvenir hunters. Nevertheless, the present state of the Kuli site is not acceptable and the uranium lumps must be removed.

Conclusions

14.4.37

(a) The hazard from radiation at the Ground Zeros is not excessive. The concrete plinths with their warning messages are an adequate indication to people not to camp permanently at these sites. The level of radiation will decay to one of no significance during the lifetime of the younger people now returning to the area.

(b) The most significant hazard to Aborigines using the test sites is from the plutonium contamination. The hazard from the inhalation of dust raised by winds appears to be acceptable. However, three other pathways - inhalation by children digging and playing, ingestion through bush foods and injection of plutonium - do produce unacceptable levels of risk. From the range of estimates of the level of this risk in the evidence tendered to the Royal Commission, it is clear that more information is needed on the possible Aboriginal lifestyles in the area, the dust conditions in Aboriginal camps, the types and amounts of specific food items and the amounts of plutonium in these food items. Information on the particle size distribution of plutonium contamination is also very important and needs to be determined.

(c) The plutonium-contaminated areas must be cleaned up. However, more work is needed to develop realistic hazard assessments so that criteria can be derived for the clean-up; otherwise it is impossible to specify what areas must be cleaned, to what depth and to what level of residual contamination.

(d) The uranium contamination at Kuli is unacceptable. The uranium at or near the surface must be collected and either buried in proper pits or removed from the site.

(e) The pits containing plutonium waste at Taranaki and TM101 must be treated by either immobilising the plutonium in the debris or by removing the material from the pits.

(f) It will be necessary to carry out research to characterise the exposure pathways in order to determine what areas need to be cleaned up. A comprehensive and well co-ordinated research program is needed.

(g) Insufficient evidence is available for the Royal Commission to be able to assess with confidence that there is no hazard from beryllium at Maralinga and Emu.

14.5 Clean-up of the Maralinga and Emu Sites

The Maralinga Site

14.5.1 The Maralinga site is not acceptable in its present condition. The level of radioactive contamination on the Range requires the continuing presence of patrols to ensure that people are not inadvertently or intentionally exposed to excessive levels of radiation or contamination. Fences are a temporary solution. The hazard from the plutonium on the surface at Taranaki, TM100, TM101 and Wewak will continue into the distant future. The site must be cleaned up.

14.5.2 Maralinga should be cleaned up to a condition that would allow unrestricted access by Aborigines living a traditional lifestyle, establishing outstations or building houses (see para.14.2.20).

14.5.3 The main hazards identified during the Royal Commission hearings are (in order of decreasing concern)

- (a) plutonium contamination at Taranaki, TM100, TM101 and Wewak,
- (b) pits containing a total of about 20 kg of plutonium at Taranaki and TM101,
- (c) uranium and beryllium contamination at Kuli, and
- (d) external radiation levels at the Ground Zeros.

14.5.4 Hazards (a), (b) and (c) must be dealt with before the Range can be considered suitable for unrestricted access. The remaining hazards discussed in Section 14.1 are of less concern. They should be carefully assessed to confirm or disprove the preliminary impression gained from the evidence that they are either acceptable now, or will be acceptable within a reasonable length of time.

14.5.5 The AAEC provided the Royal Commission with a range of options for cleaning the Range and the estimated costs of each option. Because of the timescale allowed to produce the report, the estimates must be considered preliminary and should be subjected to more detailed costing. Nevertheless, they are useful because they show the magnitude of the different tasks. The individual options and tasks are discussed in the following paragraphs.

Retrieval of Plutonium-contaminated Fragments

14.5.6 An 'emu parade' of two-man retrieval teams should collect plutonium, plutonium-contaminated fragments and other debris from the 530 hectares at Taranaki and the smaller areas at TM100, TM101 and Wewak. A team of people would survey the whole area, locating fragments with radiation probes and collecting the contaminated material. The estimated cost depends on how the collectors' time is charged and the method for disposal of the collected material. All the cost estimates are less than \$100 000. However, the cost could be much less if the operation is treated as a military exercise, conducted under appropriate health physics supervision.

Fences

14.5.7 Fences are needed to encompass all of the area with significant plutonium contamination to warn all-comers of the existence of the hazard. The plutonium-contaminated areas should be surrounded by 1.8 m chain wire fences. The estimated cost of 24 km of such a fence is \$800 000 [RC 574, p.A84]. A fence should also be erected around the uranium-contaminated area at Kuli.

Burying the Plutonium-contaminated Soil

14.5.8 It seems almost certain that some form of treatment will have to be carried out on the plutonium-contaminated soil at Taranaki, TM101, TM100 and Wewak. If all material having a plutonium contamination which exceeds 500 Bq/kg is removed, then an area of 460 hectares would need to be treated with an estimated mass of 460 000 tonnes. This would include material from the north-west plume to a distance of 7 km. There would be a further 20 000 tonnes of material from TM100, TM101 and Wewak. The cost of collecting this mass of soil is estimated to be \$10 million [RC 574, Figure 5].

14.5.9 The AAEC report considered various options for treating the collected material. The simplest and cheapest would be to dump it in a large burial pit nearby and cover it with two metres of clean soil. The top of the pit would be level with the surrounding country. The cost of burying the soil was estimated by the AAEC to be \$4 million [RC 574, Figure 5]. The AECL considered that deep burial, i.e. a cover of 10 m thick, should also be considered. AECL estimated the cost of deep burial to be \$33 million [RC 821, p.55].

14.5.10 The excess limestone from excavating the large burial pit could be used to provide a thick cover over the Taranaki disposal pits, or could be spread over the Ground Zeros to reduce the radiation levels.

14.5.11 These costs are directly proportional to the amount of soil collected and buried and depend on the criteria used to determine which soil must be treated and which can be left.

Treating the Plutonium-contaminated Soil

14.5.12 The AAEC proposed various chemical and physical treatments that could be used to extract the plutonium from the soil. Segregation into higher and lower activity fractions could enable rehabilitation to be more effectively used. The method of sorting involved screening to separate different size particles, radioactive sorting to separate high and low activity material, electrostatic separation, magnetic separation, and heavy media separation to collect material with a higher density. The AAEC considered that screening and radioactive sorting had the highest potential [RC 574, p.A102].

14.5.13 Chemical treatment methods were also considered. However, because of the unknown properties of the Maralinga soil, it was not possible to specify the plant design. Estimates of costs for chemical treatment were based on costs at existing plants currently performing similar tasks. The capital cost of a plant to treat the 460 000 tonnes of soil would be between \$60-\$150 million, and its recovery efficiency would be only 50-70 per cent [RC 574, Figure 5].

14.5.14 After noting that the plutonium contamination on the soil, including the fragments, is much less than low-level plutonium waste that would be acceptable in the US for disposal by shallow land burial, the AAEC report noted

'There seems no incentive to attempt a partial chemical or physical decontamination of the soil, other than removal of contaminated fragments and minispheres, particularly if the product of the decontamination still requires disposal by burial.' [RC 574, p.A120]

The Disposal Pits at Taranaki and TM101

14.5.15 There is estimated to be 20 kg of plutonium in the disposal pits at Taranaki and TM101. Something must be done to immobilise or remove the plutonium in these pits. Several options were presented to the Royal Commission in the AAEC report.

14.5.16 The simplest option would be to stabilise the waste in each pit by a concrete grout. The aim of the grout would be to fill all the voids and cut off potential water ingress, provide stronger encasement and support the cap. The cost of grouting all the pits is estimated to be \$2 million [RC 574, p.A86]. All the concrete covers would need to be inspected and a wall system installed to provide a second barrier for contamination, at a cost of about \$1 million. The pits would then be covered with clean fill to an, as yet, unspecified depth.

14.5.17 It can be argued that the method of disposal in the pits is unsatisfactory for the long term because it amounts to shallow burial. Exhuming the pits is a difficult task with its own set of hazards. The AAEC estimated the cost of exhuming the pits and crushing and cutting the waste to be \$8 million [RC 574, Figure 5].

14.5.18 The material from the pits could then be shipped out or treated on the spot. A suitable recovery plant would cost about \$20 million and have a recovery efficiency of 80-90 per cent. Even after treatment, the 1640 tonnes of material would still contain 2-4 kg of plutonium. This material would still require disposal by burial. Even here treatment does not seem warranted, and it would be better to plan for the proper burial of the debris exhumed from the pits without treatment.

Uranium and Beryllium Contamination at Kuli

14.5.19 No costs were tendered for this operation, possibly because there is little information available on the area contaminated. The area must be surveyed and a clean-up strategy developed.

The Overall Clean-up Strategy

14.5.20 The Royal Commission has neither the resources nor the time to enable it to consider properly all of the options and possibilities for cleaning up the Maralinga Range. Any clean-up is a complex process, requiring well defined standards, criteria and detailed planning. Church of the Nevada Operations Office mentioned some of the problems he had experienced in a dozen site clean-ups:

'1. We never seem to have as much radiological information prior to executing a clean-up program as would be desired. Even though at several of the clean-up operations a vast amount of resources and time have been applied to gathering preliminary radiological intelligence, it always seemed to be found wanting as you go about the detailed execution of a remedial action operation.

'2. Even with experience, we seem to underestimate the cost and time required for clean-ups.

'3. The establishment of clean-up criteria is a constant battle. Plutonium criteria seem to be more of a problem than other radionuclides.

'4. One of the difficulties of assessing the need for any clean-up or remedial action is to justify that action on the basis of radiation exposure saved and projecting into the future the saving of potential harm (i.e. cancers)...'[RC 822]

Emu Site

14.5.21 The two major trial sites at Emu have radiation levels which exceed the levels acceptable for permanent occupation. Hence surveillance of the area must be continued, or the area cleaned up. On the evidence tendered, the minor trial sites at Emu are not a significant hazard.

A Maralinga Commission

14.5.22 The Royal Commission is concerned that a clean-up of the Maralinga site will go ahead in the immediate future. It does not want to see the problems of the site lost in a bureaucratic maze in Canberra or London. A Maralinga Commission should be appointed immediately to determine clean-up criteria, oversee the clean-up tasks and co-ordinate all future management of the Maralinga Range and the Emu site. The Maralinga Commission must include representatives of the traditional owners, the Australian Government, the South Australian Government and the UK Government.

14.5.23 It is vital that the development of clean-up criteria and decisions on the clean-up program be made with the agreement of the traditional owners and no clean-up work should proceed unless the traditional owners agree.

14.5.24 The Maralinga Commission would be responsible for the following:

- (1) Policy matters relating to Maralinga and Emu.
- (2) Preparation of a comprehensive clean-up proposal bringing together what is known about the Range, the lifestyles of Aborigines returning to the area, possible future lifestyles, risk assessments, options for clean-up and a recommended clean-up strategy with costs.

(3) Contracts for research to cover any information required to answer questions or provide information for the clean-up proposal.

(4) Oversight of the erection of additional fencing around the plutonium contaminated areas as recommended by and in consultation with the Australian Radiation Laboratory.

(5) Information to be given to the local Aborigines about the hazards in the area and what can be done about them.

Sections 400 and 1487 and the Emu Site

14.5.25 At the completion of the clean-up, or when all the parties agree, the land forming Sections 400 and 1487 and the Emu site should be transferred to the Aborigines and included in the land grant, subject to whatever additional arrangements for surveillance and inspection are agreed to by Maralinga Tjarutja and the two Governments.

AIRAC Advice on Future Management - Maralinga and Emu

14.5.26 On 4 April 1984, The Hon Barry Cohen, Minister for Arts, Heritage and Environment asked AIRAC to undertake a review of the Emu and Maralinga test sites. The ARL survey (see Section 13.5) was carried out in response to the Minister's request. AIRAC has now completed its review and its advice was made available to the Royal Commission by letter from the Minister for Arts, Heritage and Environment to the President of the Royal Commission on 27 September 1985. AIRAC's advice is in the form of a letter from Professor A M Clark, Chairman of AIRAC to the Minister dated 12 September 1985. The Royal Commission received this advice after the close of the public hearings.

14.5.27 AIRAC concludes that:

'1. The minor trial sites Taranaki, TM100, TM101, Wewak and Tadge and the areas surrounding each to a few kilometres at Taranaki and a few hundred metres at the others, are unsuitable for return to the traditional Aboriginal owners. These areas should remain under Australian Government control.

'2. The major test sites are currently unsuitable for return to the traditional Aboriginal owners. They will remain so for at least another 40 years. For at least that period they should remain under Australian

Government control. In the intervening period the areas should be resurveyed with the emphasis on the radioecology of the long lived fission products, strontium-90 and caesium-137.

'3. Irrespective of recommendations (1) and (2), we recommend the collection, to a degree that is practical, of all visible fragments from the vicinities of the trial sites in order to reduce the risk associated with souveniring.

'4. Irrespective of recommendations (1), (2) and (3), the burial pits at Taranaki and the ones at the TM101 site should remain under Australian Government control in perpetuity.

'5. A thorough geological/geophysical survey of the Taranaki site should be implemented.

'6. The status of the burial pits at Taranaki should be improved by (a) installing an effective barrier against rabbit ingress, (b) in-situ stabilisation of the buried waste, and (c) the making good of the concrete caps.'

14.5.28 On the Taranaki burial pits,

'AIRAC believes that with strict attention to technical details, the practice of shallow ground burial of low level plutonium waste in an arid environment is acceptable in principle. However, it is unlikely that the disposal would meet present day practices.'

14.5.29 The AIRAC conclusions on the risks presented by the range generally agree with the conclusions of the Royal Commission. However, the Royal Commission does not support the conclusions that various areas should necessarily remain under Australian Government control. This would be a matter for the proposed Maralinga Commission and the final decision must take into account the interests of the Australian Government, South Australian Government and traditional owners.

Conclusions

14.5.30

(a) The following hazards must be dealt with before the Maralinga Range can be considered suitable for unrestricted access by Aborigines:

(i) plutonium contamination at Taranaki, TM100, TM101 and Wewak;

(ii) pits at Taranaki and TM101 containing plutonium-contaminated debris; and

(iii) uranium and beryllium contamination at Kuli.

(b) The following hazards need further assessment to determine whether further action is required:

(i) external radiation levels at the Ground Zeros at Maralinga and Emu;

(ii) plutonium at Tadge;

(iii) uranium and beryllium at other minor trial sites;

(iv) glazing at some of the major trial sites;

(v) waste buried at the airfield cemetery; and

(vi) plutonium levels at the Emu sites.

(c) Various options for clean-up were considered but the Royal Commission has not been able to make detailed recommendations because insufficient data were tendered on the levels of risk, options for clean-up and the associated costs. Nevertheless, the Royal Commission would suggest that any clean-up should include additional fencing in the short term, an 'emu parade' to collect plutonium-contaminated fragments, the removal and burial of the plutonium-contaminated soil at Taranaki and action to immobilise or exhume the waste pits at Taranaki.

(d) The standard for clean-up should be to allow future unrestricted access to the site by Aborigines living a traditional lifestyle, establishing outstations, or building houses.

(e) A Maralinga Commission should be established to determine clean-up criteria, oversee the clean-up and co-ordinate all future Range management. The Commission should include representatives of the traditional owners, the UK and Australian Governments and the South Australian Government.

(f) Sections 400 and 1487 and the Emu site should be transferred to the traditional owners on the completion of the clean-up, or by agreement of all parties.

14.6 Who Should Pay for the Clean-up of Maralinga?

14.6.1 The Memorandum of Arrangements between Australia and the UK which established the atomic testing ground at Maralinga provided, *inter alia* that 'the United Kingdom Government accepts

liability for such corrective measures as may be practicable in the event of radio-active contamination resulting from tests on the site' [RC 800, p.561057].

14.6.2 In a conventional legal context, the essential difficulty with the obligation which the UK accepted would be to determine the measures which may be 'practicable'. As was detailed previously, following the decision to close the Range, investigations were undertaken to determine the nature and extent of the contamination of the Range. A decision was then taken which the Royal Commission criticises for a number of reasons (see Section 13.2).

14.6.3 Three fundamental problems remain with the contaminated areas. First, the presence of contaminated fragments; second, the wide dispersal of fine particles of plutonium; and third, the presence of plutonium and plutonium-contaminated items in pits. The present necessity for fencing and patrolling of the areas must be eliminated. It would have been and remains practicable to achieve this objective. It is the belief of the Royal Commission, that the UK was and is obliged to accept responsibility for achieving this objective under the terms of the Memorandum of Arrangements.

14.6.4 The Memorandum of Arrangements was purportedly terminated on 23 September 1968 when a release was executed. It provided, *inter alia*, that

'(a) The UK Government have completed decontamination and debris clearance at the Atomic Weapons Proving Ground Maralinga to the satisfaction of the Australian Government.

'(c) With effect from 21 December 1967, the United Kingdom Government are released from all liabilities and responsibilities under the Memorandum of Arrangements...(with some exceptions not presently relevant).' [RC 800, p.680067]

14.6.5 A further Agreement was executed on 4 January 1979 which eventuated because of the desire to repatriate half a kilogram of plutonium that was buried at Maralinga. It provided that

'(a)The Australian Government accepts, on the basis of the joint Australian/British assessment of the position at Maralinga, represented by the agreed record of discussions 26th October to 1st November 1978, and as set out in the 1968 Pearce Report, that there is no question of the United Kingdom having further responsibility to repatriate waste from Maralinga. The United Kingdom would however be willing, as we have always been in the past, to provide technical advice if requested on any further

on-site operations which may be undertaken by the Australian Government at Maralinga to reduce surface contamination.' [RC 800, p.790002]

14.6.6 Both the 1968 and 1979 agreements were intended to operate as a general release of the UK with respect to the obligation imposed under the original Memorandum. As such, their effect may be limited and will only operate with respect to the matters in the contemplation of the parties at the time when the release is given.

14.6.7 In **London and South West Railway Co v. Blackmore** (1870) LRHL 610, Lord Westbury said

'The general words in a release are limited always to that thing or things which were specially in the contemplation of the parties at the time when the release was given. But a dispute that had not emerged, or a question which had not at all arisen cannot be considered as bound and concluded by the anticipatory words of a general release.' [p.623]

14.6.8 This decision was followed by the High Court of Australia in **Grant v. John Grant and Sons Pty Ltd** (1954) 91 CLR 112. See also **In Re William McPherson** (1913) SALR 207.

14.6.9 In the opinion of the Royal Commission, it is clear that, at the time of the execution of both releases, matters now relevant were not in the contemplation of the parties. It would appear that no one was aware, and certainly not the Australian authorities, of the nature and extent of the contaminated fragments. This was almost certainly due to the technical difficulty of detecting them. Furthermore no one seems to have appreciated the significance of the movement toward the granting of land rights to Aboriginal peoples. It is certain that no thought was given to the problem of establishing the safety of the land over many thousands of years. All that appears to have exercised the minds of the decision makers at the time of execution after release was an immediate need to alleviate the obvious problem. No one gave thought to the control of that problem beyond a period of about twenty years.

14.6.10 As a consequence, neither of the purported releases would operate to excuse the UK from a responsibility to eliminate the present problems. In the opinion of the Royal Commission, the UK remains liable for the total cost of rendering the contaminated areas safe without fences or patrols.

14.6.11 The Royal Commission also believes that there is an overwhelming moral obligation on the UK. It has become clear to everyone that Operation Brumby was neither prudent nor effective. It was poorly conceived, carried out without proper consideration being given or a decision made with respect to its objective. It exacerbated the hazard rather than alleviated it.

14.6.12 It would, in the opinion of the Royal Commission, be grossly irresponsible of the UK Government if it did not now accept that it has a continuing obligation to clean up the contaminated areas so that they are acceptable for unrestricted access. No one can foresee how the area will be used over the coming thousands of years. It is incumbent on the UK to accept the responsibility which it undertook in return for being allowed to use Australian land for its weapons development program.

Conclusions

14.6.14

(a) The cost of clean-up of the Maralinga Range should be borne by the UK Government because the previous clean-up in 1968 was clearly inadequate and based on insufficient information.

(b) The UK included the Emu site in Operation Brumby. If any further clean-up of Emu is found to be necessary by the Maralinga Commission, then the cost of this treatment should be met by the UK Government.

14.7 Future of Monte Bello Islands

14.7.1 Three major trials were carried out on the Monte Bello Islands but there were none of the minor trials which caused the type of contamination which is of most concern at Maralinga. The following hazards remain on the Islands:

- (a) Areas around the G1 and G2 Ground Zeros where the levels of radiation exceed the recommended level for the continuous exposure for members of the public.
- (b) Plutonium levels in the soil near the G2 Ground Zero.
- (c) Steel and other debris on the Islands.

From the evidence presented, none of these areas presents an acute hazard.

14.7.2 The activity at the Ground Zeros will continue to decay. It is estimated that the highest radiation levels will decay to 0.114 microsievert per hour by the year 2040 for G1 and by 2060 for G2. This is the currently recommended dose rate for continuous exposure of members of the public over an extended time. It is less than the value recommended at the time of the 1979 Monte Bello Survey. Hence, for the next 60 to 80 years the sites need to be controlled to ensure that no one lives permanently at either site. However, there is no significant hazard to casual visitors.

14.7.3 The levels of plutonium at G2 seem to be low enough not to present a hazard. However, a survey should be carried out to determine the physical and chemical state of the plutonium in the soil. Specifically this should include the particle size distribution of the contamination and the availability of the plutonium for uptake by plants.

14.7.4 None of the steel left on Trimouille Island appears to present a radiation hazard, although the small pieces should be collected to avoid them being removed as souvenirs. The large structures remaining on Trimouille Island that are the remains of experimental apparatus could remain for historic interest.

14.7.5 At the present time, the Monte Bello Islands are a Prohibited Area under the Defence (Special Undertakings) Act 1952 and access is controlled by the Commonwealth, through the Naval Officer Commanding West Australia Area (NOCWA).

14.7.6 The Commonwealth in its Final Submission described the present status and future plans for the Monte Bello Islands as follows:

'It has been agreed between the Australian and Western Australian Governments that control of the Monte Bello Islands should be returned to Western Australia at the earliest opportunity provided that agreement could be reached on management arrangements for the former atomic test sites. Commonwealth Departments are in general agreement with draft management proposals prepared by Western Australia, copies of which have been made available to the Royal Commission, and a draft form of indemnity has been forwarded to the Western Australian Government for consideration. No final agreement will be reached however until the findings and recommendations of the Royal Commission are known.' [RC 875., p.132]

14.7.7 The Western Australian proposal is that the Monte Bello Islands be made reserves for conservation of flora and fauna, at the same time proclaiming the Islands Crown Lands to allow the petroleum potential to be assessed. A biennial program of radiation monitoring was also proposed [RC 800, p.820241].

Conclusions

14.7.8

(a) The Royal Commission sees no reason why the control of the Monte Bello Islands should not be transferred by the Commonwealth to the Western Australian Government under conditions agreed to by both Governments.

(b) Regular monitoring of the radiation levels on Alpha and Trimouille Island should continue. The physical and chemical state of the low level of plutonium contamination at the G2 site should be investigated to confirm that it presents no significant hazard under any likely land use.

(c) The cost of clean-up of the Monte Bello Islands should be borne by the UK Government. The problem there is not so much radiological as aesthetic but nevertheless the Royal Commission's view is that treatment is necessary. The primary responsibility falls upon the UK Government to meet the cost of this treatment although the matter was never covered by a formal agreement.

CHAPTER 15

CONSIDERATION OF THE AIRAC 9, KERR AND DONOVAN REPORTS, AND THE SOUTH AUSTRALIAN HEALTH STUDIES

15.1 Airac 9

15.1.1 In September 1980, the Australian Ionising Radiation Advisory Council (AIRAC) was asked by the Minister for Science and the Environment to investigate certain matters related to the British nuclear tests. The request was initiated by a letter from the Minister for National Development and Energy to the Minister for Science and the Environment dated 8 September 1980 [RC 165]. It sought AIRAC's assistance for an expert review of two matters:

(a) The effects on the Australian population of radioactive fallout resulting from the tests.

(b) Whether the occurrence of 'black mists' in Central Australia was due to the tests, and if so, their possible health effects.

The letter stated that

'...a review and assessment of information on the nature and distribution of radioactive fallout from the British tests by an independent expert body such as AIRAC would help to clarify the situation regarding health effects on the Australian population. Special mention is made of the need to investigate the black mist allegations.'

15.1.2 The request was communicated to AIRAC by the Minister for Science and the Environment by a letter dated 18 September 1980. AIRAC accepted the request, agreeing that its report should be based on all available documentation. Moroney and Richardson were interviewed at the 43rd Meeting of the Council held on 28 October 1980. AIRAC sought an expansion and clarification of the terms of reference; this in fact, occurred.

15.1.3 A file entitled 'Environment Branch - AIRAC - Effects of Radiation Exposure Arising from British Weapons Tests in Australia' [Department of Home Affairs and Environment, 1980] contains the correspondence on the Minister's request. Among its contents is a document, acknowledged to have been prepared by a member of AIRAC, which reveals the initial attitudes of at least some members of the Council. It contains the following statements which indicate a preconceived view of the matters that they were required to investigate. The Royal Commission's view

is that the statements indicate that at least some of the members of AIRAC did not approach their investigations with an open mind. Of particular concern are the following statements:

(a) 'The black mist question appears to be a myth in the making.'

(b) '...it may be impossible to deal with it (the "black mist") convincingly other than by evidence at first hand from responsible persons...'

(c) 'AIRAC has no reason to question the adequacy, from the point of view of public safety, of AWTSC control of test firings of nuclear weapons in 1956-57 by the British authorities, nor that of the British authorities who had sole control of the three tests which took place before formation of the AWTSC.'

'However, a statement intended to allay public concern on such matters, as expressed in the media in the last year or so, cannot be convincing if it is simply a rehash of already published material...' [RC 800, p.810014]

15.1.4 By describing the allegations of the Black Mist as a 'myth in the making', the first statement clearly suggests that the author of the document did not consider that allegation. The second statement is of interest in two respects. By indicating a need to 'deal with it' by evidence 'from responsible persons' it may be inferred that the writer saw a need to discredit the allegation. Furthermore it was contemplated that first-hand evidence on the matter should be sought. This was not done by AIRAC.

15.1.5 The third statement suggests that AIRAC saw that the task was to prepare a report which would allay public concern. This view was written before any investigative work had been undertaken and clearly suggests a predetermined attitude.

15.1.6 After discussion with the Minister, the terms of reference accepted by AIRAC were

'(a) To review the scientific basis of operational safety measures for the protection against radiation injury of Australian personnel involved in the UK nuclear test program in Australia and express an opinion on the effectiveness of these measures, and

'(b) to determine to the extent now possible the nature and the distribution of fallout from the nuclear tests, identify the potential harmful effects of this fallout,

and express an opinion on the effectiveness of the arrangements made to protect the health of the Australian public during the nuclear tests.' [AIRAC 1983, p.3]

AIRAC did not consider any aspect of the minor trials.

15.1.7 AIRAC asked one of its members, Dr Watson, to carry out the basic research work and prepare a draft of the report. He proceeded to do this by examination of documents available in Australia. AIRAC also spoke with Titterton who was given the opportunity of editing the transcript of his interview. A draft of the report was prepared and circulated to members. It was also forwarded to the United Kingdom for comment [RC 337] as well as to the Australian Departments of National Development and Defence. After this had been done, the Council, at the special request of the Minister, spoke to Rickard who propounded many criticisms of the safety measures taken at Maralinga. It later spoke with Turner, Richardson and Page about Mr Rickard's allegations.

15.1.8 The report was published as AIRAC 9 in January 1983 [AIRAC 1983]. It was supplemented by a letter of 2 August 1984 with respect to indoctrinees [RC 67], and by the report AIRAC 10 [RC 577, AIRAC 1985].

15.1.9 The Royal Commission acknowledges that much of the material published by AIRAC is competently researched and capably considered in AIRAC 9. The task was considerable given the resources at its disposal. However, there are a number of important respects in which AIRAC 9 is deficient and the Council must be criticised.

Criticisms

15.1.10 AIRAC did not interview or seek out persons who might from their own recollections have been able to assist with the understanding of any allegations of mismanagement, breaches of regulations, the Black Mist or other alleged problems. It did not seek even to interview those who had been making the allegations. AIRAC apparently decided to carry out its task by reviewing written material, although it did speak to the persons mentioned above. With the exception of Rickard, it did not speak to any person who alleged that there was a problem with the test program. The reasons are given by Watson in his evidence. It was thought by AIRAC that the complaints were either inherently incredible, had been investigated by Moroney who was a former member of the Atomic Weapons Test Safety Committee, or did not require investigation because they were the complaint of an individual [Trans., p.9801].

15.1.11 It should be noted that Watson conceded that AIRAC should have sought out Macaulay [Trans., p.9857] and anthropologists [Trans., p.9862]. A similar concession is made in AIRAC's submission [RC 863, p.2.2].

15.1.12 The explanation given by Watson is not acceptable in the light of conclusions 1.12, 1.14, 1.18 and 1.20. These are as follows:

'1.12 Operations at the test ranges and associated areas were governed throughout by a requirement to comply with the radiation safety standards and dose limitations recommended by the International Commission on Radiological Protection (ICRP). The same Recommendations are the basis of legislation for radiation protection in Australia. The United Kingdom authority was responsible for this compliance. There is no evidence that there was any departure from compliance with those standards with respect to Australian personnel.'

'1.14 A limited number of air crew may have been exposed to transient concentrations of radioactive substances exceeding the derived levels recommended for continuous exposure over a 13-week period, but not to total radiation exposures in excess of the recommended limits. This would be regarded as acceptable under current ICRP Recommendations. There is no evidence that any members of ground crews received radiation exposures in excess of the recommended limits.'

'1.18 The precautions taken to ensure that Aboriginals living in the area were not endangered by the nuclear tests were carefully planned and executed, and AIRAC has found no evidence that any Aboriginals were injured by the nuclear tests.'

'1.20 The measures taken to protect the public, and the personnel involved in the nuclear test programs from radiation injury attributable to the tests were well-planned and almost certainly were effective. The possibility of incidents, e.g. unauthorised entry to a contaminated area, that may have led to serious unrecorded exposure cannot be completely excluded, but no evidence has been found that any such incident occurred.'

It is suggested in the above conclusions that no evidence of relevant problems was found. That conclusion is, on face value, unacceptable unless at the least qualified by a statement that AIRAC did not speak to the people who were alleging the problems.

15.1.13 AIRAC has suggested in its submission that in using the phrase that 'there was no evidence' it was using it in its scientific rather than its legal sense. No doubt the proper

distinction is that between the term as it is used by scientists and its common usage. This response is not acceptable because AIRAC was writing for a general audience and not exclusively or even primarily for scientists. So much is obvious from the fact that a Minister sought the report. AIRAC says

'The Minister envisaged that this report would be presented in terms readily comprehensible to the layman.' [RC 863, pp.3-4]

15.1.14 The AIRAC 9 report gives two conclusions on the safe firing of the major trials:

'1.15 The primary criteria for a safe firing were that persons living relatively close to the ranges should not be exposed to more radiation than was considered acceptable by the ICRP, and that fallout at greater distances, where such levels could not occur, should be minimised.

'1.16 The criteria for safe firing were met in all tests.'

These criteria are discussed in Chapter 10 of AIRAC 9. The discussion is, to say the least, superficial. Watson in his evidence sought to give a meaning to the term 'criteria' which is not persuasive. AIRAC did not seek to evaluate means by which the existence of safe firing conditions could be determined in advance of a decision to fire. The real position is that the criteria developed before the trials for acceptable levels of deposited activity were not met either for Totem 1, One Tree, or Breakaway (It should be noted that the document A32 [RC 247] was apparently not available to AIRAC. See the discussion in Chapter 12 of this Report).

15.1.15 Whatever may be the health consequences of the deposition of various levels of fallout, the simple position is that specific firing criteria were devised for each test. The criteria involved a consideration of the anticipated yield of the explosion, prospective weather conditions and acceptable levels of activity in nominated areas. Only if the prescribed levels of activity in nominated areas were below levels previously agreed to be acceptable could it be said that the safe firing criteria had been complied with. AIRAC's consideration of this aspect is superficial and the Royal Commission considers it wrong. It would appear that, as expressed, the conclusions were intended to allay public concern.

15.1.16 AIRAC 9 discussed Totem 1 and the allegation of the Black Mist. It would be a conventional objective approach to such a question to collect, narrate and analyse the available evidence before seeking to express conclusions. AIRAC failed to do this. It was content to look primarily at media accounts. It never sought out anyone with first-hand knowledge. It

highlighted the inconsistencies in these accounts, making no allowance for any difficulties of time, language or media presentation. It appeared to test the veracity of the allegations by examination of the radiological consequences without appreciating the fact that for Aboriginal people the occurrence of the physical phenomenon may be as significant as its possible consequences.

15.1.17 On page 17 of AIRAC 9, when considering the ICRP and the reliance placed on it by those in control of the tests, the following statement is made:

'The ICRP has always been accepted as an independent and well-informed body with no axe of its own to grind.'

15.1.18 In his evidence, Watson qualified this categorical statement by saying 'I knew that some criticisms had been made' and 'well, I just mean it has been generally accepted by most people' [Trans., p.9844].

When asked whether he thought that the critics of ICRP should have been mentioned, Watson said, 'I just do not think that was necessary' [Trans., p.9844]. Criticism of ICRP was given to the Commission by Professor Radford [Trans., p.4754], and in a detailed submission from Greenpeace entitled 'The Controversy Over Low Dose Exposure to Ionising Radiations' [RC 471]. It is clear that the ICRP has not always been universally accepted as an independent body with no axe of its own to grind. However, it has been accepted by most national radiation protection authorities, who have based their radiation protection legislation on its recommendations. The statement made in AIRAC 9 is clearly too dogmatic and should have been qualified.

5.1.19 Conclusion 1.18 was reached without speaking to any person who was actually involved in Aboriginal patrols or their co-ordination. Watson conceded in his evidence that adequate inquiries were not made in this respect [Trans., p.9857]. He also conceded that the searches were not fully effective [Trans., pp.9824-5]. In response to the following question,

'Would a more accurate way of formulating the latter part be AIRAC was not supplied with any evidence which would enable it to decide one way or the other whether Aborigines received excessive doses of contamination?'

Dr Watson answered,

'I would agree so far as a summary is concerned that would be correct.'

15.1.20 The investigation of the safety measures taken with respect to Aborigines by AIRAC was both inadequate and unscientific. The conclusion expressed by AIRAC could not be

rationally supported from the information available to the Council and was entirely inappropriate.

15.1.21 In Conclusion 1.9 of AIRAC 9, it is stated that the Safety Committee was made up of 'persons with experience appropriate to that task'. This statement is not correct. Elsewhere in this report the formation of the NRAC is discussed. It is reasonable to infer that this was done for two reasons: so that an expert body was available with biological expertise, and to ensure that the body advising the Government with respect to acceptable levels of radiation was independent of and had no interest in the success of the testing program. The AWTSC did not have the requisite expertise, nor was it comprised of people who could contribute all the experience necessary for it to effectively carry out its task.

15.1.22 On page 19, para.6.8 of the report, AIRAC concluded that there is no evidence

'...that any person exposed to radiation within the limits imposed by ICRP Recommendations at any time has suffered any ill effect from his exposure.'

This is similar to Conclusion 1.17 which reads

'1.17 In one test (the first of the two tests at Emu in 1953) the fallout at inhabited locations about 160 km from the range, while not exceeding the requirements of the ICRP at that time, may have slightly exceeded the current ICRP Recommendations on dose limitations for members of the public. If that limitation was in fact exceeded, the excess would have been small and there would be no detectable effect on persons exposed then nor would there be recognisable effects at any later time.'

Apart from the obvious criticism that AIRAC failed to carry out any investigations which would support this conclusion, it suffers from other difficulties. If the hypothesis of no threshold is accepted, some persons probably have suffered adverse health consequences as a result of exposure within ICRP limits. The limits are not predicated on an assumption of no effect but on an assumption that the effects are acceptable having regard to the other hazards of life. This fact should have been stated. In our view it is unacceptable for any report by scientists to have expressed this unqualified conclusion.

15.1.23 On page 24, para.8.7, it is stated

'The evidence indicates that the precautions for radiation safety were generally effective.'

15.1.24 A similar view is expressed in Conclusion 1.20. Again the Royal Commission believes that this conclusion could not be expressed by AIRAC since it failed to carry out any investigation

of allegations to the contrary of the proposition. When questioned about the use of the words 'generally effective' Watson said he did not have any particular instance in mind:

'I just put it, I think, on the practical experience that nothing is ever perfect.' [Trans., p.9848]

15.1.25 In these circumstances this conclusion is unacceptable. The failure to investigate is one weakness and the failure (which necessarily follows) to be able to specify problems which might be identified is another.

15.1.26 In para.13.6 of the report, AIRAC also concluded that:

'Taking into account both the safety procedures required at the test ranges, as described in this section, and the possibility of injury from radioactive fallout, AIRAC is satisfied that the precautions taken to ensure that Aborigines were not harmed by the tests were adequate and effective and it has found no evidence that any Aborigines were injured by the execution of the tests.'

15.1.27 Apart from the fact that Dr Watson would now concede that the relevant precautions may not have been adequate and effective, AIRAC was wrong to make the statement that 'it has found no evidence'. The simple fact is that AIRAC did not look for the evidence and consequently had no justification for such a conclusion. This and other similarly dogmatic statements undermine the credibility of the total document.

15.1.28 Notwithstanding the considerable effort put in by Watson in the preparation of this report, and the considerable scientific expertise which he brought to it, it is inescapable that the report lacks scientific integrity and impartiality. It came into being with a preconceived notion in the mind of its major draftsman that no problems existed with the test program. The use of unqualified and dogmatic language when qualifications and doubts were appropriate can only give rise to the conclusion that the report cannot be accepted as an objective and impartial assessment of the situation.

Conclusions

15.1.29

(a) AIRAC 9 is not an adequate scientific account of the testing program. In particular AIRAC failed to make adequate inquiries before offering its conclusions. This failure may have been due to an agreement with the relevant Minister to limit its inquiries. If so it should have indicated this in its report. Rather than give the impression of a thorough investigation it should have clearly indicated that it had not investigated and sought out evidence of ineffective controls.

(b) AIRAC with one exception spoke only to persons with an interest in advancing the view that the safety measures taken were adequate and effective. This had led to an apparent bias in the material before it. As a consequence the report cannot be described as an objective and impartial assessment of the situation.

(c) The following conclusions expressed by AIRAC are contrary to the evidence which was available to AIRAC: 1.9, 1.16, 1.17, 1.18 and 1.20.

(d) The following conclusions should not have been expressed by AIRAC or should have been expressed with a qualification that AIRAC had not investigated or sought to find out whether there was evidence to the contrary: 1.9, 1.12, 1.14, 1.16, 1.17, 1.18 and 1.20.

15.2 The Kerr Committee Report

15.2.1 The Minister for Resources and Energy established the Kerr Committee on 15 May 1984. The Committee was required to report by 31 May 1984. In general it was required to review the available data on atmospheric fallout arising from the British nuclear tests in Australia. It had sixteen days in which to carry out its work, a totally inadequate time given the size of the task [Kerr et al. 1984].

15.2.2 The Kerr Committee was able to identify a number of the problems in the AIRAC 9 report. However, given its time frame it was not able to resolve any of the problems which were identified. Some of the criticisms of AIRAC are now accepted, at least by Watson. In our opinion it is a pity that the Kerr Committee chose, at times, extravagant language with which to express its doubts with respect to AIRAC 9. Otherwise the report should be seen as a catalyst for the setting up of the present Royal Commission.

15.3 The Donovan Report

15.3.1 Concern about possible health effects of the atomic tests on the Australian participants resulted in a survey being carried out by the Department of Health and his report, **Health of Atomic Test Personnel**. This report is often referred to as 'The Donovan Report' [Donovan et al. 1983]. The report consisted of two parts: the first is an analysis of the answers given to a questionnaire sent to all identifiable participants; and the second is an analysis of the causes of death on the certificates of those who had died. The main aim of the survey was to identify any associations between atomic test program involvement and subsequent illness.

15.3.2 Twenty-five radiation indicators were used in the survey to cover the tasks performed, health physics activities, and potential ways in which personnel may have been exposed. The indicators included, operation of support facilities, surveys of radioactive areas, visited signposted radioactive areas, issued with film badges, required to undergo decontamination, measured non-zero radiation dose, believed exposed to radiation, flew through cloud and visited blast area. Most of the indicators depended on the participants' recollections of what they did at the tests.

15.3.3 The health survey did find a number of significant correlations between various radiation 'indicators' and the incidence of malignant melanomas, infertility, cataracts, skin cancers and other cancers. Twenty-three significant associations were found, compared with the 6.5 associations which would have been expected by chance alone (Donovan in his evidence [Trans., p.9203] agreed that the number of chance associations given in the report as 14 was wrong and should have been 6.5.).

15.3.4 Furthermore, most of the illnesses showed a higher incidence with increasing radiation indicators: 15 were high, compared with four low (four were not interpretable). It is not possible to accept the conclusion of the Donovan Report that most of the associations could be ascribed to chance. For many of the illnesses there was a clear association between the prevalence of the illness and some of the radiation indicators.

15.3.5 Nonetheless, a significant association between the reported illnesses and the reported radiation indicators does not prove that there is an excess of radiation-induced illness. The answers to the questionnaire were very subjective and it seems likely that some respondents with poor health and concerned about their health, would be more likely to report that they had taken part in activities related to radiation exposure. Without proper objective evaluations of illnesses and radiation exposure, it is not possible to say whether the associations between the radiation indicators and the illnesses were 'cause and effect' or produced by some other interaction.

15.3.6 The report argues that in each case the associations were not significant, were not possible, or were not credible. The results would be more acceptable if the authors of the report had also put in the alternative viewpoint, that the results could not exclude some significant association.

15.3.7 The conclusions of the Donovan Report should not have been restricted to the conclusion that there was no effect. Not only did the analyses

'...give no grounds for concluding that...[the participants]...suffered significant adverse health effects.'

but equally the analyses gave no grounds for concluding that they did not suffer the adverse health effects.

15.3.8 The death survey avoided the difficulties of the subjective reporting of illnesses by comparing the death certificates of the participants with other death certificates from the same location. The results from this survey are swamped by the large number of people who were not involved with radiation. Of the 1560 test participants for whom death certificates were obtained, only twenty-one were recorded as having been exposed to radiation as measured by film badge or dosimeter. Hence although the report concludes

'...that there was no excess mortality which might have been due to exposure to ionising radiation.'

the converse is also true; the results do not prove that there was no such excess mortality.

15.3.9 In our opinion, the health survey was a valid and useful survey to investigate the claims of dramatically increased incidence of cancers and infertility. However, because of the difficulties of self-reported illnesses and activities, and the large number of participants who were not exposed to radiation, definite conclusions cannot be drawn. The results show that there was no massive increase in illness or death, but cannot provide a clear answer to whether there was some increase in illness or mortality. The conclusions of the survey should have been more balanced, drawing attention to the possibility of no effect, but also accepting that it was not possible to say that there was no radiation-induced illness or mortality.

Conclusion

15.3.10 Because of the paucity of relevant information on which it is based, the Donovan Report cannot be regarded as an adequate epidemiological study.

15.4 The NRPB Study

15.4.1 The National Radiological Protection Board (NRPB) is carrying out, on behalf of the UK Ministry of Defence, a study of the health of UK participants in the UK atmospheric nuclear weapons tests and subsequent clean-up operations. This study includes participants in the UK tests at Malden Island and Christmas Island in the Pacific Ocean, as well as UK participants in the tests in Australia.

15.4.2 Evidence on this study was given to the Royal Commission by Dr J A Dennis, an assistant director at NRPB who is in charge of the multi-disciplinary team that is carrying out the

study. The protocol for the study was submitted to the Royal Commission in the form of a published NRPB report [NRPB, 1983; RC 425, Annexure].

15.4.3 The study encompasses approximately 40 000 people, of whom about half were participants at the tests and the remainder comprise a control group matched as closely as possible to the participants. Radiation dose records are available for about 12 000 of the 20 000 participants. Details of deaths and cancers in the two populations are being obtained.

15.4.4 It would have been very valuable for the Royal Commission to have available the results of the UK study. However, the study is not completed; Dr Dennis anticipated that the results should be available some time in the latter half of 1986. It is hoped that further analysis of the data be undertaken, and that if further data can usefully be added in later years, this too should be done.

15.5 The US Nuclear Veterans Study

15.5.1 From 1946 to 1962, the United States conducted an extensive program of atmospheric nuclear weapons tests. Most of the tests were held at one of two sites, one in Nevada and the other on a group of islands in the Pacific Ocean. More than 200 000 people from various branches of the US armed services participated.

15.5.2 After a preliminary report in 1979 by the Centers for Disease Control that veterans present at one particular test, code-named Smoky, showed an increased incidence of leukaemia when compared with men of similar ages in the general population, a more extensive study was ordered.

15.5.3 The Defence Nuclear Agency requested the Medical Follow-up Agency of the US National Research Council to undertake a study to determine whether veterans at other tests also had a higher incidence of leukaemia or other cancers than would be expected.

15.5.4 The study selected a sample of nearly 50 000 people (including 3741 Smoky participants) who took part in one or more of five test series. Approximately equal numbers participated in Nevada and in the Pacific tests.

15.5.5 The results of the study, carried out by Robinette, Jablon and Preston of the Medical Follow-up Agency, were reported in the document DOE/EV/01577 in May 1985 [RC 570].

15.5.6 The study confirmed the excess mortality from leukaemia among participants at Smoky which had been noted in the earlier study. However, no significant excess of leukaemia was found among participants at any test series other than Plumbbob, which

included the Smoky test. Nor was there a significant excess of leukaemia among Plumbbob participants who were not present at Smoky. For no other form of cancer was there a consistent excess among the participants at the several test series.

15.5.7 The authors acknowledge that several details of the study design limit the scope of conclusions which can be drawn. Hence their final conclusion was that

'The total body of evidence we have reviewed cannot convincingly either affirm or deny that the higher than statistically expected incidence of leukemia among Smoky participants...is the result of radiation exposure incident to the tests. However, when the data from all the tests are considered, there is no consistent or statistically significant evidence for an increase in leukemia or other malignant disease in nuclear test participants.' [RC 570, p.44]

15.6 South Australian Health Studies

15.6.1 An attempt was made by the South Australian Health Commission in 1981 to study the potential health effects of radiation from the tests on Aboriginal people. The report, published in February 1981, was entitled: 'A Survey of Diseases That May Be Related to Radiation Among Pitjantjatjara on Remote Reserves' [SA 3, Vol.2]. As the authors themselves noted, any conclusions which might be drawn from the study are of doubtful validity. The authors identified four major problems:

(a) The Aboriginal population at risk could not be defined precisely, neither with regard to total size nor to age-sex distribution. Any disease rates calculated for those people would be likely to be inaccurate.

(b) There was no comparable population in the State to use as a control group.

(c) There were almost no health records available for the relevant period and what records later did exist were of dubious accuracy.

(d) Vital statistics such as birth records are of doubtful accuracy.

15.6.2 The study was able to identify 21 cancer deaths for the period 1973-1980 of which 12 were on the North-West Reserve and nine were at Yalata. A further six cancer deaths were identified at the North-West Reserve for the period 1969-1972. Three cancers were identified in living persons. Of a total of 30 cancers, two were in thyroids and two were leukaemias.

15.6.3 The report indicated that the number of cancer deaths exceeded the number that would be expected from State-wide mortality rates and suggested that the matter required further monitoring.

15.6.4 It is clear that if any conclusion should be drawn from this study it would be that an increased incidence of cancer had been shown. The better conclusion is that the study does not enable any conclusion to be drawn [Trans., pp.8151-2, 6744]. It is regrettable that in these circumstances the then South Australian Minister for Health, Mrs J Adamson, stated in a press release on 27 March 1981:

'There is no evidence that Aborigines living in remote areas of South Australia were suffering radiation induced illness following the atomic tests at Maralinga in the 1950's.' [SA 3, Vol.2]

15.6.5 The problem was looked at again in 1983-1984 by the South Australian Government and a further study, funded jointly by the State and Commonwealth Governments was commenced. It was initially intended that the author of the study should continue as a consultant to the Royal Commission. This did not occur. Instead the Royal Commission sought a report on these problems from the South Australian Health Commission. The report entitled 'The Feasibility of Demonstrating Long Term Somatic and Heritable Health Effects of Ionising Radiation on Local Aboriginal Populations' [RC 536] was written principally by Dr R Somers of the South Australian Health Commission.

15.6.6 The report assesses the feasibility of three different types of epidemiological study: prospective studies, retrospective case-control studies, and cross-sectional studies. It concludes that it is unlikely that standard epidemiological techniques could be applied successfully to the problem of attempting to demonstrate adverse long-term effects of radiation among Aborigines.

15.6.7 The size of the Aboriginal population potentially at risk is too small compared with the numbers which would be needed to demonstrate, by statistical means, any increased frequency of the expected health effects. None of the expected health effects can be linked with certainty to radiation exposure, as each can arise from many different causes. Furthermore, as was noted in the earlier South Australian study, the historical records of illness, medical care, births, deaths and population censuses are of insufficient quality to support most epidemiological approaches.

15.6.8 The report suggested, however, that in the context of the Royal Commission's enquiries, evidence of adverse health effects may be less important than evidence of exposure to radiation **per se**, or indeed of **risk** of exposure [RC 536, p.ii].

15.6.9 It may be feasible to show that selected Aboriginal groups were exposed to unusually high levels of ionising radiation at some time in the past. Studies of chromosome aberrations in lymphocytes from circulating blood are now widely accepted as a means of determining whether there has been exposure to radiation, and, less accurately, as a means of assessing the radiation dose. Such chromosome aberration studies are tedious and require specially trained personnel; they are normally only carried out in specialised laboratories.

15.6.10 There is more confidence in the chromosome aberration assessment when the dose involved is relatively large, the assessment is made soon after exposure, information is available on other factors such as medical X-rays which themselves may induce chromosome aberrations, and the conclusions are applied to groups rather than to individuals.

15.6.11 In preparing its report for the Royal Commission, the South Australian Health Commission sought advice from five eminent cytogeneticists in the UK, USA and Japan, as well as from local experts, on the likely usefulness of the chromosome aberration technique in attempting to validate a suspected radiation exposure to Aborigines 30 years ago.

15.6.12 At the present time, it cannot be said that chromosome aberrations in somatic cells such as lymphocytes adversely effect a person's health, or incline a person to disease in the future. Hence if any increase in aberrations was found in Aborigines, it could not be linked directly with an increase in disease.

Conclusion

15.6.13 Because of the deficiencies in the available data, there is now little prospect of carrying out any worthwhile epidemiological study of those involved in the tests nor of others who might have been directly affected by them.

CHAPTER 16

RECOMMENDATIONS

16.0 Introduction

16.0.1 Claims for compensation of Australians who were Commonwealth Government employees at the time of the British nuclear tests in Australia are dealt with by the Compensation (Commonwealth Government) Employees Commission which was established by the Compensation (Commonwealth Government Employees) Act 1971. In 1983, the office of the Commission issued the following statement:

'Claims arising subsequent to 1 September 1971 have been dealt with under the Compensation (Commonwealth Government Employees) Act 1971. In cases where the incapacity or medical treatment first occurred prior to that date, the transitional provisions of the Act apply, and it is necessary for the employee to establish that on the balance of probabilities, the condition was due to either:

(a) personal injury by accident arising out of or in the course of the employment by the Commonwealth (vide section 9 of the Commonwealth Employees' Compensation Act); or

(b) a disease due to the nature of the employment (vide section 10 of the Commonwealth Employees' Compensation Act).

'Where claims are made involving incapacity or medical treatment which first occurred subsequent to 1 September 1971, the general provisions of the Compensation (Commonwealth Government Employees) Act 1971 apply.

'Section 29 of the 1971 Act is the main disease provision. For a claim to come within the provisions of section 29 it is necessary to show that any employment by the Commonwealth was a contributing factor to the contraction, aggravation, acceleration or recurrence of a disease. If this is established, the disease (or aggravation) is deemed (section 29 (2)) to be a personal injury to the employee arising out of his employment by the Commonwealth and the Commonwealth is then liable under section 27 (1) to pay compensation in accordance with the Act.

'Regulation 12 and the First Schedule to the Compensation Regulations relate to section 30 of the Act. In general terms, section 30 provides that when an employee suffers from a disease specified in the first column of the First Schedule and has been employed by the Commonwealth in employment of a kind specified in the second column of the schedule referring to that disease, that employment, unless the contrary is established, is deemed to have been a contributing factor to the contraction of the disease. Sections 29 (2) and 27 (1) then operate in the manner described above.

'It might be noted that the First Schedule refers to any pathological condition caused by radium or another radioactive substance, or x-rays, and specifies employment involving exposure to or contact with those substances or x-rays as the causal factor for the purposes of section 30.

'Section 31 gives cover under the Act where the incidence of particular conditions is significantly greater in certain types of employment or in particular localities than in employment generally.

'The practical effect of sections 30 and 31 is to shift the onus of proof from the claimant to the Commonwealth for those diseases which can be shown to be generally associated with certain types of employment.

'The Office of the Commissioner for Employees' Compensation deals with each case on its individual merits and has indicated that it will rely on specialist medical opinion to determine future cases as they arise, as has been done in the cases dealt with to date.

'It might also be noted that the Commissioner (or delegate) has both the power and the obligation to satisfy himself that he has all of the relevant facts before making a determination. The decision maker is not obliged to determine a case only on evidence which is submitted by either of the parties - i.e., the claimant or the Commonwealth.' (Reprinted in Annual Report of the Commissioner for Employees' Compensation 1982-83, pp.18-19)

16.0.2 The Act covers Commonwealth Public Servants, members of the Australian Defence Forces, Australian Federal Police Officers, personnel of prescribed authorities (for example Australia Post and Telecom), and people employed by the Northern Territory Government or an instrumentality of that government.

16.0.3 Most of the people exposed to ionising radiation at Emu, Maralinga and the Monte Bello Islands are thus covered by this Act. However, it is possible to identify other groups of people who are not so covered. These are people who worked at the test sites during and after the nuclear program and who may have been exposed to ionising radiation and who were not in the above categories of employment. This would include, for example, some day workers of the Kwinana construction company who remained at Maralinga after the explosion at One Tree and people employed in salvage operations. A further group of people includes some who were exposed to the Black Mist following the Totem 1 explosion, and the Milpuddie family.

16.0.4 The Royal Commission believes that access to the benefits of the Compensation (Commonwealth Government Employees) Act 1971, including the shifting of the onus of proof from the claimant to the Commonwealth imposed by sections 30 and 31, should be extended to include civilians not presently covered by the Act who were at the test sites at the relevant times, and to Aborigines and other civilians who were exposed to the Black Mist.

16.0.5 The Royal Commission has accepted that in the present state of knowledge it must be assumed that any exposure to ionising radiation, however small the dose, gives rise to an increased risk of a cancer or heritable defects. This increased risk, of course, does not apply selectively and only to employees of the Commonwealth Government. Thus it is only fair and appropriate that those people placed at increased risk, either knowingly, such as university scientists at the tests, or unknowingly, such as the Milpuddies and the Wallatina people, should be afforded the same access to compensation as those people who currently enjoy those rights.

16.0.6 By their very nature, the diseases and injuries upon which claims will be based, will be life-threatening or will have resulted in fatalities. Justice demands that such claims be processed as expeditiously as possible. To achieve this, the Royal Commission believes that the Commissioner for Employees' Compensation should have access to a data base as complete and as accessible as is possible. Consequently, it believes that a national register should be compiled of nuclear veterans, Aborigines and other persons who may have been exposed to the 'Black Mist' or exposed to radiation at the test sites during or after the tests.

16.0.7 The conclusions upon which Recommendations 3-7 are based are set out in brackets after each.

Recommendation 1

The benefits of the Compensation (Commonwealth Government Employees) Act 1971, including the shifting of the onus of proof from the claimant to the Commonwealth should be extended so as to include not only members of the armed forces who are at present covered by the Act, but also civilians who were at the test sites at the relevant times, and Aborigines and other civilians who may have been exposed to the Black Mist.

Recommendation 2

To assist the Commissioner for Employees' Compensation in the performance of the additional duties recommended in Recommendation 1, a national register of nuclear veterans, Aborigines and other persons who may have been exposed to the Black Mist or exposed to radiation at the tests should be compiled.

Recommendation 3

Action should be commenced immediately to effect a clean-up of Maralinga and Emu to the satisfaction of the Australian Government so that they are fit for unrestricted habitation by the traditional Aboriginal owners as soon as practicable (see Section 14.4).

Recommendation 4

A Maralinga Commission, comprising representatives of the traditional owners, the UK, Australian and South Australian Governments should be established to determine the clean-up criteria, oversee the clean-up and co-ordinate all future Range management (see Section 14.5).

Recommendation 5

Action should be taken immediately to ensure that all areas of the Monte Bello Islands where the radiation levels are above the limits recommended for continuous exposure of members of the public are suitably signposted until safe for permanent occupation. Small pieces of debris should be collected to avoid them being removed as souvenirs. The large structures remaining on Trimouille Island that are relics of the test programs could remain for historic interest (see Section 14.7).

Recommendation 6

All costs of any future clean-ups at Maralinga, Emu and the Monte Bello Islands should be borne by the United Kingdom Government (see Section 14.6).

Recommendation 7

The Australian Government should make compensation to those persons and descendants of those persons who have a traditional interest in sites at the former Maralinga Prohibited Area for loss of use and enjoyment of their lands since the beginning, and as a result of the atomic tests program. This should take the form of technology and services which Aboriginal people regard as necessary for them to re-establish their relationships with their land as rapidly as possible and with minimal hardship (see Section 14.3).

APPENDIX A

ABBREVIATIONS, ACRONYMS, UNITS AND PREFIXES

Abbreviations and Acronyms

AAEC	Australian Atomic Energy Commission
AB	Exhibit, Aboriginal people
ABM	Australian Bureau of Meteorology
ACOGP	Australian Committee on Guided Projectiles
ACS	Air Construction Squadron (RAAF)
ACT	Australian Capital Territory
ACXRP	Advisory Committee on X-ray & Radiological Protection (US)
ad	Aerodynamic diameter
AERE	Atomic Energy Research Establishment, Harwell, UK
AFHQ	Air Force Head-Quarters (Aust.)
AFV	Armoured fighting vehicle
AG	Exhibit, Australian Government
AGPC	Australian Guided Projectiles Committee
AHP	Australian Health Physics
AHPR	Australian Health Physics Representative at Maralinga
AIRAC	Australian Ionising Radiation Advisory Council
ALARA	As low as (is) reasonably achievable
ALI	Annual limit on intake
AN	Exhibit, ANVA (NSW)
ANTEX	Antler Executive (UK)
ANU	Australian National University
ANVA(NSW)	Australian Nuclear Veterans' Association (NSW)
ANVA(Qld)	Australian Nuclear Veterans' Association (Queensland)
ANVA(SA)	Australian Nuclear Veterans' Association (South Australia)
ANVA(WA)	Australian Nuclear Veterans' Association (Western Australia)
AQ	Exhibit, ANVA (Qld)
ARDU	Australian Radiation Detection Unit
ARL	Australian Radiation Laboratory
AS	Exhibit, ANVA (SA)
ASIO	Australian Security Intelligence Organisation
AWRE	Atomic Weapons Research Establishment, Aldermaston, UK
AWTC	Atomic Weapons Tests Committee (Aust.)
AWTSC	Atomic Weapons Tests Safety Committee (Aust.)
Be	Beryllium
BEIR	Biological Effects of Ionizing Radiations Committee (US)
BOM	Board of Management (Maralinga Operations in Australia)

BV	Exhibit, The Nuclear Test Veterans of Britain
C-in-C	Commander-in-Chief
CAS	Chief of Air Staff
CBL	Convective boundary layer (meteorological)
CDC	Combined Development Committee (for uranium production)
CDT	Combined Development Trust (US, UK, Canada)
CLR	Commonwealth Law Reports
CNS	Chief of Naval Staff
Co	Cobalt
CPC	Combined Policy Committee (US, UK, Canada)
CRDU	Canadian Radiation Detection Unit
Cs	Caesium
CSIRO	Commonwealth Scientific & Industrial Research Organization
CST	Central standard time (Aust.)
CTF	Combined Task Force
CTF4	Combined Task Force - Hurricane Operation
CXRL	Commonwealth X-Ray & Radium Laboratory (Aust.)
D+1 (day)	One day after detonation
D-1 (day)	One day before detonation
D-day	Day of detonation (for more than one detonation in the same series, they were labelled D1-day, D2-day & so on)
DAC	Derived air concentration
DAWRE	Director, Atomic Weapons Research Establishment
DC/HP	Decontamination & Health Physics (Maralinga)
DC/RB	Decontamination & Radiobiological (Maralinga)
DCAS	Deputy Chief of Air Staff
DCNS	Deputy Chief of Naval Staff
DGMS	Director General of Medical Services (RAAF)
DHAE	Department of Home Affairs & Environment (Aust.)
DHC	Department of Housing & Construction (Aust.)
DNDE	Department of National Development & Energy (Aust.)
DOD	Department of Defence (Aust.)
DOS	Department of Supply (Aust.)
DRE	Department of Resources & Energy (Aust.)
DSIR	Department of Scientific & Industrial Research (UK)
EST	Eastern standard time (Aust.)
ETA	Estimated time of arrival
FCO	Foreign & Commonwealth Office (UK)
FRC	Federal Radiation Council (US)
FRS	Fellow of the Royal Society (UK)
G1	First test, Mosaic series (Monte Bello Islands)
G2	Second test, Mosaic series (Monte Bello Islands)
GOC	General Officer Commanding
GWR	Guided Weapon Range
GZ	Ground Zero - location of point of detonation
GZA	Time origin used for Totem meteorological analysis - nine minutes after detonation
H+1 (hour)	One hour after detonation
H-1 (hour)	One hour before detonation

H-bomb	Hydrogen bomb
HCM	High Cyclone-Mesh
HE	High explosive
HER	High Explosive Research Laboratory, Fort Halstead, UK
HF	High frequency
HMAS	Her (His) Majesty's Australian Ship
HMG	Her (His) Majesty's Government
HMS	Her (His) Majesty's Ship (Royal Navy)
HMSO	Her (His) Majesty's Stationery Office (UK)
HP	Health physics
HUREX	Hurricane Executive (UK)
I	Iodine
I-Force, IF	Indoctrinee Force (Maralinga)
ICR	International Congress of Radiology
ICRP	International Commission on Radiological Protection
ICRU	International Commission on Radiation Units & Measurements
ICXU	International Committee on X-ray Units
IDC	Inter-Departmental Committee (Aust.)
ILO	International Labor Office
IXRPC	International X-ray & Radium Protection Committee (later Commission)
JSTU	Joint Services Training Unit (Aust.)
LAC	Leading aircraftsman
LCA	Landing craft auxiliary
LRHL	Law Reports, House of Lords
LRWE	Long Range Weapons Establishment (Salisbury, SA)
LRWER	Long Range Weapons Establishment Range (Woomera, SA)
LRWP	Long Range Weapons Project (Aust.)
MAC	Maximum allowable concentration
MARSU	Maralinga Range Support Unit
MBWP	Monte Bello Working Party
MEP	Maralinga Experimental Programme
MEP 60	Maralinga Experimental Programme for 1960
MEP 60E	Extended Maralinga Experimental Programme for 1960
MM	Exhibit, Monte Bello & Maralinga Atomic Ex-Servicemen's Association
MMESA	Monte Bello & Maralinga Atomic Ex-Servicemen's Association
MO	Medical Officer
MOD, UKMOD	Ministry of Defence (UK)
MOS, UKMOS	Ministry of Supply (UK)
MOSEX	Mosaic Executive (UK)
MPC	Maximum permissible concentration
MPE	Maximum permissible exposure
MRC	Medical Research Council (UK)
MRL	Motor refrigerator lighter
MWL	Motor water lighter
NAS	National Academy of Sciences (US)
NCO	Non-commissioned officer

NCRP	National Committee on Radiological Protection (US)
NHMRC	National Health & Medical Research Council (Aust.)
NIH	National Institutes of Health (US)
NOCWA	Naval Officer Commanding West Australia Area
Np	Neptunium
NPO	Native patrol officer
NRAC	National Radiation Advisory Committee (Aust.)
NRPB	National Radiological Protection Board (UK)
NSW	New South Wales
NT	Northern Territory
OHQ	Operational Head-Quarters
OIC	Officer-in-Charge
OP	Observation Post
PABE	Panel on Atomic Biological Effects (UK)
PM's Dept	Prime Minister's Department (Aust.)
Pu	Plutonium
PVC	Polyvinyl chloride (plastic)
Qld	Queensland
R&D	Research & development
RAAF	Royal Australian Air Force
RAE	Royal Australian Engineers
RAE(UK)	Royal Aircraft Establishment (Farnborough, UK)
RAEME	Royal Australian Electrical & Mechanical Engineers
RAF	Royal Air Force (UK)
RAMC	Royal Army Medical Corps (UK)
RAN	Royal Australian Navy
RAN ABC	Royal Australian Navy Atomic, Biological & Chemical Warfare School
RC	Exhibit, Royal Commission into British Nuclear Tests in Australia
RCAF	Royal Canadian Air Force
RE	Royal Engineers (UK)
REME	Royal Electrical & Mechanical Engineers (UK)
RH Group	Radiological Hazards Group (UK)
RL	Radiochemical Laboratories
RN	Royal Navy (UK)
RNZAF	Royal New Zealand Air Force
RPU	Radiation Protection Unit (Canadian)
RS GROUP	Radiation Safety Group
SA	South Australia
SA	Exhibit, South Australian Government
SAAPB	South Australian Aborigines Protection Board
SALR	South Australian Law Reports
sd	Standard deviation
SHPR	Superintendent, Health Physics Research (UK)
Sr	Strontium
SSTD	Superintendent, Scientific Trials Division (UK)
T1	First Test, Totem series (Emu)
T2	Second Test, Totem series (Emu)
TAA	Trans Australia Airlines
TIM	Timing Trial - UK Minor Trials

TNT	Trinitrotoluene, a highly explosive compound
TOTEX	Totem Executive (UK)
Trans.	Transcript
U	Uranium
UAM	United Aborigines Mission
UK	United Kingdom
UKAEA	UK Atomic Energy Authority
UKDRSS	UK Defence Research Services Staff (in Aust.)
UKHC	United Kingdom High Commissioner for Australia
UKHCNZ	United Kingdom High Commissioner for New Zealand
UKMOSS(A)	UK Ministry of Supply Staff in Australia
UKSLS	UK Services Liaison Staff Office (in Aust.)
UN	United Nations
UNSCEAR	United Nations Scientific Committee on the Effects of Atomic Radiation
US, USA	United States of America
USAEC	United States Atomic Energy Commission
USAF	United States Air Force
USSR	Union of Soviet Socialist Republics
VHF	Very high frequency (radio)
Vic	Victoria
WA	Western Australia
WAST	Western Australian standard time
WHO	World Health Organization
WRE	Weapons Research Establishment (Salisbury, SA)
X200	Code name for the Construction Operations at Emu; also used for the actual site at Emu
X300	Code name given in 1953 to the site 40 miles north-west of Ooldea surveyed for the permanent proving ground; later renamed Maralinga
XRPC	X-ray & Radiation Protection Committee

Units

Bq	becquerel
C	degree Celsius
Ci	curie
cm	centimetre
d	day
deg.	degree (heat, arc, latitude, longitude)
F	degree Fahrenheit
ft.	foot
Gy	gray
h	hour
ha	hectare
in.	inch
K, kts	knots
km	kilometre
kt	kiloton, kilotonne
m	metre
min	minute

mm millimetre
Mt megaton, megatonne
nm nautical mile
r, R roentgen
rad former unit of absorbed dose
rep former unit of radiation dose
s, sec second
Sv sievert
t ton, tonne (metric ton)
yd yard

Metric Prefixes

Prefix	Power of 10	Symbol
exa	10 ¹⁸	E
peta	10 ¹⁵	P
tera	10 ¹²	T
giga	10 ⁹	G
mega	10 ⁶ = 1 000 000	M
kilo	10 ³	k
hecto	10 ² = 100	h
deka	10 ¹	da
deci	10 ⁻¹	d
centi	10 ⁻²	c
milli	10 ⁻³	m
micro	10 ⁻⁶	
nano	10 ⁻⁹	n
pico	10 ⁻¹²	p
femto	10 ⁻¹⁵	f
atto	10 ⁻¹⁸	a

APPENDIX B

GLOSSARY OF TERMS

Aboriginal People: The homelands of a number of Aboriginal peoples border or cross the Maralinga and Emu Ranges and the Woomera Guided Missile Range. Those mentioned in this report are the Ngalea whose lands lie directly west of Maralinga; the Pitjantjatjara who are to the north in a region which includes the Thomson and Manning Ranges, the Olgas and Ayers Rock; and the Yankunytjatjara to the east of the Pitjantjatjara in the Musgrave and Everard Ranges. Although not referred to specifically in the report, the Andagiringja have lands to the east of the Yankunytjatjara which include Welbourn Hill, Mt Willoughby and Oodnadatta. Further south, the Guguda have homelands that include Maralinga, Mt Eba and Coober Pedy. Finally the area on the Nullabor from Ooldea to Haig is occupied by the Mirning and to the east and south of Ooldea are the Wirangu.

Aboriginal words: Some Aboriginal words used in evidence are mamu (q.v.), puyu (q.v.) and wiltja (q.v.).

Absorbed dose: Some of the energy of ionising radiation is transferred to the matter through which it passes. The absorbed dose is the amount of energy transferred to a unit mass of material (1 gray (q.v.) = 1 joule per kilogram).

Absorber: Matter which absorbs radiation; material used as a radiation shield to reduce the intensity of radiation at the point of interest, such as concrete and lead for gamma rays or boron and cadmium for neutrons.

Activation: Some of the neutrons released in fission are captured by atoms in the surrounding materials, e.g. soils, structural materials or atmospheric gases. Many of the resulting atoms are radioactive and are known as activation products. This process of producing radioactive materials is known as activation, producing 'induced radioactivity' (q.v.).

Air burst: A nuclear explosion at such a height that the expanding fireball does not touch the earth's surface.

Alpha radiation: Some radioactive elements, particularly those with a high atomic number decay by emitting a positively charged particle, the alpha particle, which is identical with the nucleus of a helium atom. Alpha radiation has very little penetrating power, but it may present a serious hazard if alpha emitters are inhaled or ingested.

Annual limit of intake: The activity of a radionuclide which on its own would irradiate a person, represented by 'reference man' (q.v.), to the limit set by the ICRP for each year of occupational exposure.

Atom: An atom is the smallest particle of an element that retains the characteristics of that element. The atom consists of a small positively charged nucleus surrounded by a cloud of negatively charged electrons. An atom is characterised by its mass number (q.v.) and its atomic number (q.v.).

Atomic number: The number of the position of an element in the periodic table. Equal to the number of protons in the nucleus.

Background radiation: The naturally occurring radioactive isotopes in the surroundings and in biological tissue produce a background radiation. Cosmic rays also contribute to the background radiation.

Background reading on instruments: Unavoidable reading on any instrument measuring radiation, usually caused by background radiation and instrumental effects.

Becquerel: The unit of radioactivity, corresponding to one disintegration per second. Previously the unit of radioactivity was the curie (q.v.).

Beta radiation: Some radioactive elements emit from the nucleus charged particles of low mass called beta particles, which are identical to the electrons in the atom. Fission products generally emit negative beta particles. Beta particles have a penetrating power intermediate between that of alpha and gamma radiation.

Carcinogenesis: The production and development of cancer.

Cataract: An opacity of the lens of the eye.

Chain reaction: Occurs in nuclear reactors and fission weapons. Each atom of uranium-235 or plutonium gives off several neutrons when it is fissioned; if on the average one or more of these produces a further fission, a chain reaction is said to occur.

Collective dose equivalent: When a group of persons is exposed to ionising radiation the collective dose equivalent is defined as the sum of the doses equivalent received by the individual members of the group. This measure may be used to estimate the total detriment to the exposed group. The validity of the procedure depends upon the validity of the assumption of linear relationship between radiation dose and its effect.

Committed dose equivalent: When radioactive materials are taken into the body the resulting exposure to radiation is extended in time. The committed dose equivalent is the dose equivalent (q.v.) that will be accumulated over 50 years following an intake of radioactive material. The period was chosen as long enough to cover the effect of an intake of a long-lived radionuclide over a working life, but exposure from short-lived nuclides may be effectively complete in much shorter periods.

Contamination: The deposit of radioactive material on or within structures, land, people or animals following dispersal of the radioactive material, e.g. by a nuclear explosion or dust raising activities.

Convective boundary layer: The unstable lower region of the atmosphere which is well mixed by thermal convection from the earth's surface. The thickness of the convective boundary layer changes during the day as the earth heats up; at dawn it might be less than 100 m but by mid-afternoon its height can be up to 1500 m for Maralinga or Emu. Above the CBL the atmosphere is stable and there is very little turbulence.

Cosmic rays: Radiation originating in outer space, which contributes to the background radiation.

Count rate meter: An instrument which records continuously the arrival of pulses from a radiation detector, usually rated in counts per second.

Critical organ: The part of the body most likely to sustain injury by radiation under particular specific conditions.

Critical mass: The minimum mass of fissile material which will result in a chain reaction.

Curie: A unit of radioactivity equal to 3.7×10^{10} disintegrations per second, the approximate disintegration rate of one gram of radium. The curie is no longer in use and has been superseded by the becquerel (q.v.).

Decay product: The substance formed by radioactive decay of a radioactive nuclide. Some radionuclides, such as uranium-238 which decays through a sequence of steps, have associated with them many successive decay products.

Decontamination: The removal or reduction of contaminating radioactive material from persons, equipment, structures or areas.

Depleted Uranium: Uranium from which some of the naturally occurring isotope uranium-235 has been removed.

Derived air concentration: Equivalent to the annual limit of intake (q.v.) divided by the volume of air inhaled by 'reference man' (q.v.) in a working year. The volume inhaled is 2400 cubic metres and the units are Bq/m³.

Deuterium: A heavy isotope of hydrogen, hydrogen 2, in which the nucleus contains one proton and one neutron.

Dose: The amount of energy delivered to a mass of material by ionising radiation passing through it.

Dose equivalent: Different kinds of radiation, e.g. gamma, alpha and beta, have different biological effects which means that for the same absorbed dose, some radiations (e.g. alpha) produce more harmful effects than other radiations (e.g. gamma). The dose equivalent is equal to the absorbed dose times a quality factor (QF) which is a measure of the biological effectiveness of the radiation. The dose equivalent is measured in sieverts (q.v.). For gamma rays an absorbed dose of 1 gray gives a dose equivalent of 1 sievert while for alpha particles an absorbed dose of 1 gray gives a dose equivalent of 20 sievert. At the time of the British tests, the dose equivalent was measured in rems (q.v.); (100 rem = 1 sievert).

Dose rate: The rate at which ionising radiation delivers energy to a mass of material through which it is passing.

Electron: A particle which has unit negative charge and 1/1840 the mass of a proton (q.v.). Atoms consist of a cloud of electrons around a nucleus.

Element: A substance which cannot be divided into simpler substances by chemical means, being made up of a collection of atoms which have the same number of protons in their nuclei and therefore the same atomic number (q.v.).

Erythema: Reddening of the skin.

External radiation: Radiation received from radioactive sources outside the body.

Fallout: The descent to the earth's surface of particles contaminated with radioactivity, following the dispersion of radioactive material into the atmosphere by a nuclear explosion. The term is applied both to the process and, in a collective sense, to the particulate matter. The early fallout consists of the particles which reach the earth's surface within 24 hours. The delayed fallout consists of smaller particles which may be carried by wind to great distances and even completely around the earth many times before descent.

Fast neutron: Neutrons produced by neutron reactions or resulting from fission of fissile materials but which have lost relatively little of their initial energy as a result of collisions with atoms.

Film badge: A plastic holder containing a piece of film usually the size of a dental X-ray film. The film is subsequently developed and the degree of darkening is a measure of the radiation dose received. The film holder usually contains various metal filters to provide some discrimination for different types and energies of radiation.

Fireball: Almost immediately after a nuclear explosion the residues and surrounding materials form an intensely hot and luminous mass, the fireball. This expands and rises rapidly, cooling in the process.

Fissile: Capable of undergoing fission.

Fission: The process whereby the nucleus of a heavy element, e.g. uranium or plutonium, splits into two nuclei of lighter elements (fission products: q.v.) accompanied by the release of substantial amounts of energy.

Fission products: The complex mixture of substances produced in the process of nuclear fission. The primary fragments produced in fission are themselves radioactive, and decay through a succession of radioactive isotopes until a stable form is reached.

Food chain: The pathways by which any material (such as radioactive material in the environment) passes from the first absorbing organism through plants and animals to man.

Fusion: The process in which the nuclei of light elements, in particular the isotopes of hydrogen, deuterium and tritium, combine to form a nucleus of a heavier element accompanied by the release of substantial amounts of energy. Fusion reactions can only be initiated by very high temperatures in excess of about ten million degrees Celsius; in thermonuclear, or 'hydrogen', weapons such temperatures are provided by a boosted fission explosion.

Gamma radiation: Most radioactive elements emit from the nucleus electromagnetic radiation called gamma rays. Gamma radiation is penetrating and can cause radiation exposure many tens of metres from external sources. It is also the radiation that is most readily measured by monitoring equipment such as film badges and dosimeters.

Glazing: Glassy substance formed from alumino-silicates in soil as a result of heating by a nuclear explosion.

Gray: The SI unit of absorbed dose (q.v.). The gray replaced the rad (q.v.) as the unit of absorbed dose (1 gray = 100 rad).

Ground zero: The point on the ground surface at, or directly below, the initiating point of a nuclear explosion.

Half-life: The time in which the activity of a radioactive species will decline to half its initial value by radioactive decay. The half-life of a radioactive species is a characteristic property of that species, and is independent of its amount or physical condition.

Induced radioactivity: The radioactivity of nuclides produced from naturally stable nuclides, as the result of nuclear reactions with neutrons. Radioactivity is induced in materials close to a nuclear explosion by the absorption of the neutrons given off by the explosion.

Initiator: When the fissionable assembly of an atomic bomb reaches near maximum density, neutrons are injected into it to trigger a chain reaction. The triggering device is called the 'initiator'. It can consist of two materials - a radioactive element such as polonium and a much lighter non-radioactive element, beryllium. When these materials are combined, the alpha particles from the polonium react with the nuclei of the beryllium to produce neutrons.

Internal radiation: Radiation from radioactive substances within the body.

Inversion: In meteorology, a reversal of the normal decrease of temperature with height. The presence of an inversion may lead to dust and smoke becoming trapped beneath a layer of warmer air.

Ion: An atom, molecule or radical which is positively or negatively charged, because it has lost one of its orbital electrons or has acquired an extra electron.

Irradiation: Exposure of a material to radiation.

Isotopes: Forms of the same element whose nuclei contain different numbers of neutrons and therefore have different mass numbers (q.v.). Isotopes of an element have nearly identical chemical properties but differ in their nuclear properties. For instance, some isotopes of an element, but not others, may be radioactive. An example is hydrogen, which has three isotopes with relative masses of 1, 2 and 3. The two lighter, hydrogen and deuterium, are stable but the third, tritium, is radioactive.

Linear energy transfer: The linear rate of energy lost by ionising radiation and locally absorbed as it passes through a material.

mamu: Evil spirit, devil. A term used widely in Western Desert languages including the languages of those people mentioned in the report.

Man-sievert, person-sievert: The SI unit of collective dose or collective dose equivalent (q.v.). In practice it is calculated as the product of the mean population dose and the number of persons in the population group.

Mass number: The total number of protons and neutrons contained in the nucleus of an atom. The mass number is used to characterise isotopes, e.g. uranium-235 is the isotope of uranium that has a mass number of 235.

Microsievert: The one-millionth part of the unit of dose equivalent, the sievert (q.v.).

Millisievert: The one-thousandth part of the unit of dose equivalent, the sievert (q.v.).

Natural uranium: Uranium, as it occurs in nature, is comprised of 99.3 per cent uranium-238 and 0.7 per cent uranium-235 with about 56 parts per million of uranium-234.

Neutron: A nuclear particle having no charge and a mass approximately equal to that of a proton. Neutrons are present in all atoms except those of the lightest isotope of hydrogen. Neutrons are produced in large numbers in nuclear explosions and are very penetrating.

Non-stochastic effect: Effects for which the severity of the effect varies with dose, and for which a threshold may occur.

Nuclear reaction: Any event involving a change in the nucleus of an atom.

Nucleus: The small positively charged region in the centre of an atom. The nucleus carries essentially all of the mass of the atom.

Nuclide: An atomic species characterised by its mass number, atomic number and energy state.

Pathway: See **Food chain**.

Proton: A positively charged particle found in all atoms. The nucleus of the lightest isotope of hydrogen consists of one proton.

puyu: Smoke, mist, breath on a cold morning. A term commonly used in Western Desert languages and other Aboriginal languages.

Quartz fibre electroscope: Dosimeters worn in the pocket like pens and which are read by looking through a lens to observe the position of a quartz fibre against a scale.

Rad: The former unit of absorbed dose (q.v.). It was defined as the absorption of 100 ergs per gram and is equivalent to 1/100 of 1 gray.

Radioactive decay: The spontaneous emission of radiation by unstable nuclei.

Radioisotope: A radioactive isotope.

Radionuclide: A radioactive nuclide.

Reference man: A hypothetical person with anatomical and physiological characteristics defined by the ICRP.

Rem: The former unit of dose equivalent (q.v.). The product of the rad (q.v.) and a quality factor (QF). It is equivalent to 1/100 of 1 sievert (q.v.).

Roentgen: The old unit of exposure to X-rays or gamma radiation. It is defined as the quantity of radiation that will produce 2.58×10^{-4} coulombs per kilogram of dry air. An exposure of 1 roentgen is roughly equivalent to an absorbed dose of 1 rad (q.v.), or 0.01 gray (q.v.), in soft tissue.

SI Units: International System of Units - a group of metric units accepted internationally. They are set by the General Conference on Weights and Measures on the recommendation of international commissions e.g. the ICRP for radiation units and measurements.

Sievert: The SI unit of dose equivalent (q.v.). The sievert replaced the rem (q.v.) as the unit of dose equivalent (q.v.) (1 sievert = 100 rem).

Smear: When a filter paper is wiped over a contaminated surface, it may lift a quantity of radioactive material. The paper is then transferred to a suitable counter to determine the level of removable contamination.

Spontaneous fission: Some uranium isotopes and transuranic elements are unstable to a degree that they may undergo fission spontaneously without the addition of a neutron.

Stochastic effect: An effect such as malignant and hereditary disease for which the probability of an effect occurring, rather than its severity, is regarded as a function of dose without threshold. For example, a radiation dose to the whole body will give to the recipient an increased chance of developing a cancer, but it is not possible to determine who, if any, out of a group of people will get cancer.

Thermal neutrons: Neutrons that are travelling at a relatively slow speed.

Thermonuclear: The process of fusion of light nuclei at a very high temperature, such as occurs in hydrogen bombs.

Trachoma: A chronic contagious disease of the eye caused by a microorganism.

Transuranic elements: Elements with atomic number above 92 produced by artificial means such as by the irradiation of uranium with neutrons. Transuranic elements include neptunium(93), plutonium(94), americium(95), curium(96).

wiltja: A lean-to shelter. A term used widely by Aboriginal people mentioned in this Report.

Wind shear: Difference in direction of wind at various altitudes.

X-radiation: Electromagnetic radiations of energy between that of ultraviolet and gamma rays. Much of the initial release of energy from a nuclear explosion is in the form of thermal and X-radiation which is dissipated in the immediately surrounding media as heat to generate the fireball.

Yield: The effective energy released immediately in a nuclear explosion. The residual nuclear radiation associated with the fission products, which amounts to about 10 per cent of the total fission energy, is not included in the yield. Yield is usually expressed as TNT equivalent - the quantity of TNT that would release the same amount of energy if exploded. Yield is usually given in kilotons or megatons, one kiloton of TNT being defined arbitrarily as 4.18×10^{12} joules.

APPENDIX C

KEY PERSONNEL, COMMITTEES AND ORGANIZATION CHARTS

C.1 Key Personnel

The following list gives details of the personnel who figured prominently in policy or operations roles during the British atomic tests in Australia. Abbreviations are given in Appendix A. The term 'Board of Management' refers to the Board set up in 1957 to manage the Maralinga permanent proving ground after the UK's decision to undertake a continuing series of minor trials made it necessary to create a more permanent administrative structure than that offered by the AWTC.

ADAMS, Charles A Chief of Research, AWRE Aldermaston. Scientific Superintendent, Operation Totem (i.e. Technical Director), Scientific Director, Operation Mosaic (where he worked in conjunction with the Operational Commander, Commodore Martell RN), Trial Director, Operation Antler.

ANDREWS, Lieutenant A A, RAN Officer Commanding Joint Services Training Unit on South East Island, Monte Bellos, Oct-Dec 1952. Also present on HMS Diana during Mosaic G1 and G2.

ATTLEE, Clement UK Labour Prime Minister, 1945-1951.

BAXTER, Professor J P Member of AWTSC, 1955-57. Deputy Chairman of Australian Atomic Energy Commission, 1953-56, and Chairman, 1956-72. Professor of Chemical Engineering and Vice Chancellor, NSW University of Technology (UNSW).

BARNES, D E Superintendent, Health Physics Branch, AWRE.

BEADELL, L Surveyed area north-west of Woomera (Emu) in June 1952, and north of the Transcontinental Railway between Ooldea and Cook (Maralinga) in October 1953. Author of 'Blast the Bush' and 'Bush Bashers'.

BEALE, H Minister for Supply in Menzies Government, 1950-58.

BLACK, Dr D H Head of Staff, UK Ministry of Supply Staff in Australia until 1956, when replaced by Dr W H Wheeler. Member AWTC, 1955-56.

BLUNDEN, W R Scientific Adviser to the Military Board (Chief of the General Staff). Toured Totem 1 site five days after the blast with Lieutenant Colonel Caplehorn, his staff officer.

BROWN, A S Secretary, Australian Prime Minister's Department, 1949-59.

BURNET, Sir Macfarlane Appointed Chairman of the National Radiation Advisory Council (NRAC) on its establishment in 1957.

BUTEMENT, W A S Chief Scientist, Australian Department of Supply. Official Australian observer at Operation Hurricane. Surveyed Emu and Maralinga areas prior to establishment of test sites. Member, AWTSC 1955-57. Appointed to NRAC on its establishment in 1957.

CHERWELL, Lord (Professor F A Lindemann) Held Chair of Experimental Philosophy (Physics), Oxford University, until retirement in 1956. During World War II, he advised UK Cabinet on weapons and scientific matters. He was scientific adviser to Churchill, UK Paymaster-General and spokesman on economic affairs in the Coalition Government 1942-45, and the Churchill Government from 1951-53.

CHURCHILL, W S UK Conservative Prime Minister, 1951-55.

COLQUHOUN, Group Captain D W, RAAF Commander, Eastern Area Detachment, Woomera, 1953, and Officer Commanding RAAF Amberley.

COCKCROFT, Sir John Director, AERE Harwell.

COOK, E L Australian Department of Supply, Assistant Secretary Research and Development. Secretary to Totem Panel. Member of AWTSC and Board of Management.

DAGG, Lieutenant Colonel S J Health Physics Group Leader, Operation Buffalo.

DALE, G C AERE Harwell. Health Physics Adviser, Operations Buffalo and Antler.

DALEY, Air Vice Marshal, RAAF Deputy Chief of Medical Services, RAAF, during Hurricane and Totem tests.

DEWAR, Colonel R Range Commander, Maralinga, 1956.

DHENIN, Wing Commander G H, RAF Deputy Principal Medical Officer, HQ Bomber Command. Flew Canberra aircraft through Totem 1 cloud.

DISNEY, Group Captain A H, RAF Air Task Group Commander, Operation Antler.

DURANCE, Colonel R Range Commander, Maralinga, 1956-59.

DWYER, L J Director, Commonwealth Bureau of Meteorology. 1955 co-opted to AWTSC. Remained on Safety Committee after it was reconstituted in 1957.

EDEN, Sir Anthony UK Conservative Prime Minister, 1955-57.

EDDY, Dr C E Director, Commonwealth X-ray and Radium Laboratory (CXRL), Melbourne. Member of AWTSC. Died in 1956.

ELMHIRST, Air Marshal Sir Thomas, RAF Chairman, Totem Executive.

GALE, H J AERE Harwell. Air Sampling Program Leader, Operation Hurricane (stationed at Broome) and Operation Totem (stationed at Woomera).

HELY, Air Commodore, RAAF Deputy Chief of the Air Staff during period of Hurricane and Totem tests.

KNOTT, J L Secretary, Australian Department of Supply and Chairman, Board of Management.

LLOYD, Captain F B, RN (Retd) Director Atomic Warfare (Trials), UK Department of Supply.

LUCAS, Brigadier L C Commander, Services Construction Group Project X200. Led four-man mission to UK to discuss project, 1953.

McBRIDE, Sir Philip The Minister for Defence in Menzies Government, 1950-58.

MACAULAY, R A Native Patrol Officer stationed at Giles Meteorological Station from 1956 (see MacDougall).

MACDOUGALL, W B Native Patrol Officer stationed at Woomera. Employee of Department of Works and Housing, then Department of Supply. Reported through Controller, Weapons Research Establishment, Salisbury, SA. Copy of reports to Range Commander, Maralinga. Patrolled area from Western Australian border to Coober Pedy, south to Yalata.

MACMILLAN, Sir Harold UK Conservative Prime Minister, 1957-63.

MARKS, Captain W B M, RAN Chairman, Monte Bellos Working Party, a sub-committee of the AWTC established to co-ordinate Australian contribution to Operation Mosaic.

MARLEY, Dr W G Head, Health Physics Division, AERE Harwell. Advised UK Air Ministry in 1950 on hazards to air crews flying through radioactive cloud.

MARTELL, Commodore Hugh, RN Operation Mosaic Task Force and Operational Commander.

MARTIN, Dr J H Chairman of the Australian Cancer Institute Board. Attended the Antler 2 test at Biak site as an Australian safety observer in place of D J Stevens. Became member of AWTSC in September 1957, eventually replacing Stevens who resigned in August 1958.

MARTIN, Professor L H Australian Defence Scientific Adviser. Australian observer at Operations Hurricane and Totem. Present as Chairman of the AWTSC at Operation Mosaic and Operation Buffalo. Appointed to the NRAC in 1957.

MENAU, S Group Captain SWB, RAF Air Task Group Commander, Operation Mosaic and Operation Buffalo.

MENZIES, R G Australian Liberal Prime Minister, 1949-66.

MORONEY, J Secretary to the Atomic Weapons Tests Safety Committee, 1957-1973.

O'CONNOR, F A Secretary, Australian Department of Supply. Chairman, AWTC and Board of Management.

O'CONNOR, W Secretary, AWTC and Board of Management.

PEARCE, N AWRE. Technical Director of Operation Brumby in 1967. Member of Measurement Team for Operation Totem.

PENNEY, Dr W G As Director AWRE Aldermaston, was responsible for technical and scientific planning and execution of all major tests and minor trials. In Australia for Hurricane (1952), Totem (1953) and Buffalo (1956) tests, and for discussions on the establishment of a permanent proving ground at Maralinga, 1953. Dr Penney was knighted after Operation Hurricane.

PLAYFORD, Sir Thomas Premier of South Australia, 1938-1965.

RICHARDSON J Senior Health Physicist, CXRL, Melbourne. Briefly replaced O H Turner as Australian Health Physics Representative, Maralinga, in 1964, after the position had been relocated in Melbourne.

SAXBY, W N Superintendent, Trials Planning Branch, AWRE. Author of Radiological Safety Regulations for Maralinga, 1955 and 1957.

SHEDDEN, Sir Frederick Secretary, Australian Department of Defence and Chairman, Defence Committee.

SOLANDT, Dr O Chairman, Canadian Defence Research and Development Policy Committee. Present at Operation Hurricane.

STEVENS, D J Director, CXRL. Replaced Dr Eddy in that position and on AWTSC, 1956.

STEVENS, Major General J E S Secretary, Department of Supply until 1955, when he became Chairman of the Australian Atomic Energy Commission. Chairman of Totem Panel.

STEWART, Lieutenant Colonel K AWRE Aldermaston. Radiation Hazards Group Leader, Operation Totem. Prepared Radiation Safety Orders for that operation.

SUTCLIFFE, Air Commodore W P, RAF Services Commander, Operation Antler.

THOMAS, Squadron Leader A D, RAAF Scientific Adviser to the Chief of the Air Staff. One of the 'junior technicians' invited by UK Government to work on Operation Hurricane. Advised Joint Services Training Unit during radiation survey of Monte Bello Islands post-Hurricane (Oct-Nov 1952), compiling dose records. Advised RAAF Woomera and Amberley on decontamination after Totem 1 and 2, and drew up Radiological Safety Instructions for those remaining at Emu. Researched and compiled Air Board Orders on radiological safety in the RAAF.

TITTERTON, Professor E W Head of School of Nuclear Physics, ANU. Born UK. Worked on Manhattan Project in USA and then at AERE Harwell. Assisted at Hurricane on UK invitation and was Australian observer at Totem tests. Member of AWTSC from its inception and Chairman from 1957.

TORLESSE, Rear Admiral A D, RN On staff of the UK Deputy Chief of Naval Staff; designated Rear Admiral Trials Planning Section. Task Force and Operational Commander, Operation Hurricane.

TURNER, O H (Harry) Australian Health Physics Representative at Maralinga Range, 1956-62, then until 1964 in Melbourne. Responsible to the AWRE for implementation of Radiological Safety Regulations during inter-trial periods (defined as the period between the departure of the UK Health Physics Adviser (HPA) at one major trial and the arrival date of the HPA for the next major trial). Responsibility extended to whole area for which the Range Commander was responsible, except that during minor trials the senior UK Health Physics officer covered the area in the immediate vicinity of the trials. Turner was seconded from the Australian Atomic Energy Commission and his position was administered by CXRL.

WHEELER, Dr W H Head of Staff, UKMOSS(A) (later UKDRSS), from 1956. Member of AWTC and Deputy Chairman Board of Management.

WHITE, E L D Scientific Assistant to Defence Scientific Adviser (L H Martin). Member, Totem Panel, AWTC and Board of Management.

WILLS, H A Assistant Controller Research and Development, Australian Department of Supply. Chief Executive Officer of Maralinga Committee and Secretary to AWTC and AWTSC.

WILSON, Group Captain D, RAF Attached to School of Radiation Medicine, AERE Harwell. RAF specialist in radiology. Flew as an observer in a Canberra aircraft through the Totem 1 cloud.

C.2 Australian Committees

The following Australian Committees were responsible for various aspects of the British trials in Australia, and are discussed below in the order in which they were established.

The Defence Committee

Comprised the Secretary of the Australian Department of Defence and the Chiefs of Staff of the three Armed Services. Advised the Prime Minister and Minister for Defence on atomic test-related matters, particularly in the period before the first test and during the Hurricane and Totem Operations.

The Hurricane Panel

Established to co-ordinate the Australian response to the needs of the UK authorities in preparing for Operation Hurricane. The Chairman of the Panel was the Australian Deputy Chief of Naval Staff (Captain A W R McNicoll), and other members included the Director of Military Operations and Plans (Army), the Director of Air Staff Plans and Policy (RAAF), the Director General of Security (ASIO), and a representative of the Department of Defence. A representative of the UK Services Liaison Staff (UKSLS) attended meetings where appropriate.

The Totem Panel

Established under the chairmanship of the Secretary of the Australian Department of Supply, J E S Stevens, to co-ordinate activity in Australia for Operation Totem. Other members included representatives of the three Armed Services, the Departments of Defence and Supply, and the Australian Security Intelligence Organisation (ASIO). A UK representative attended meetings where appropriate.

Maralinga Committee

A committee of Federal Cabinet formed to handle matters related to the establishment of a permanent proving ground for weapons tests. It consisted of the Prime Minister (Mr Menzies), the Treasurer (Sir Arthur Fadden), the Minister of Defence (Sir Philip McBride) and the Minister for Supply (Mr Beale).

Atomic Weapons Tests Committee (AWTC)

First met 27 April 1955. Constituted under the Australian Minister for Supply after the Australian Government gave approval to the establishment of a permanent proving ground at Maralinga. The AWTC co-ordinated the various government departments and civilian contractors engaged in Range construction and installation, then co-ordinated Range administration in Australia. Replaced by the Maralinga Board of Management, 1957.

Members included

F A O'Connor, Chairman, (Secretary, Department of Supply)
Dr D H Black, Deputy Chairman, (Head of Staff, UKMOSS(A))
Dr W H Wheeler (replaced Dr Black)
Major General H G Edgar (Department of Army)
W A S Butement (Department of Supply)
Sir J Stevens (Australian Atomic Energy Commission)
Group Captain B A Eaton (Department of Air)
Captain W B M Marks (Department of Navy)
Dr B G Gates (Department of Supply)
L J Price (Department of Works)
M W O'Donnell (Treasury)
H A Wills (Department of Supply)
E L Cook (Department of Supply)
E L D White (Department of Defence)
J Herington (Department of Supply)
H J Brown (Department of Supply)
W O'Connor, Secretary
A representative of ASIO.

Unless otherwise stated, these members were Australian.

The Monte Bello Working Party

A sub-committee of the Atomic Weapons Tests Committee, formed to co-ordinate activity in Australia for Operation Mosaic. The Chairman was Captain W B M Marks, RAN, and other members included representatives of the RAN and RAAF, the Department of Supply, ASIO, UK Ministry of Supply staff in Australia and the UKSLS.

Atomic Weapons Tests Safety Committee (AWTSC)

First met 8 May 1955. The AWTSC reviewed the UK Government's proposed test safety measures and firing criteria. The prevention of injury to persons or damage to livestock or other property in Australia was its principal safety criterion, as stated in its constitution [AC 552565]. The AWTSC reported to

the Prime Minister, through the Minister of Supply, and was directed by its constitution to advise, where appropriate, on additional or alternative safety measures. The Safety Committee, as it was also known, held the power to veto a proposed firing if, in the Committee's opinion, safety criteria were not met. However, no authority was held to oversee, or even observe, the minor trials which comprised a large part of Range activity, particularly after Operation Antler. Nevertheless, AWTSC recommendations on the safety of minor trials were sought by the Board of Management and the Minister for Supply.

The Safety Committee was disbanded on 16 July 1973. Committee members during its 18-year history were:

Professor L H Martin (Australian Defence Scientific Adviser) Chairman 1955-1957, Sir Ernest Titterton (Head of School of Nuclear Physics, ANU) 1955-1973, Chairman after 1957, W A S Butement (Chief Scientist, Department of Supply) 1955-1957, Dr C E Eddy (Director, Commonwealth X-ray and Radium Laboratory) 1955-1956, Professor J P Baxter (Deputy Chairman, Australian Atomic Energy Commission) 1955-1957, L J Dwyer (Director, Commonwealth Bureau of Meteorology) 1956-1962, D J Stevens (Director, Commonwealth X-ray and Radium Laboratory) 1956-1958 and 1958-1973, Dr J H Martin (Cancer Institute Board) 1957-1960, W J Gibbs (Director, Bureau of Meteorology) 1962-1973.

The position of Secretary to the Safety Committee was filled principally by H A Wills (Department of Supply) 1955-1957, and then J R Moroney, full-time Secretary of the AWTSC and NRAC 1957-1973.

Board of Management, Maralinga Range

The Board of Management was established under Supply and Development Regulations of the Australian Department of Supply. It was officially constituted on 30 August 1957, although a preliminary meeting had been held on 29 April 1957. The Board was an interdepartmental body under the chairmanship of the Secretary of the Department of Supply. The Head of Staff of UKMOSS(A) was Deputy Chairman, and the position of Chief Executive Officer was filled by the UKMOSS(A) Atomic Weapons Staff Officer. The Board was charged with the general management of the Range, the Range Commander acting as agent of the Board. It replaced the AWTC.

Membership at 30 August 1957 included

F A O'Connor (Secretary of the Department of Supply, and Chairman)
Dr W H Wheeler (Head of Staff, UKMOSS(A), and Deputy Chairman)
Captain T M Synnott (Department of Navy)

Major General H G Edgar (Department of Army)
Group Captain W E Townsend (Department of Air)
W A S Butement (Department of Supply)
E L Cook (Department of Supply)
Lieutenant Colonel J R Blomfield (UKMOSS(A), and Chief Executive Officer)
R Anderson (UKMOSS(A))
Colonel M W Biggs (UKSLS)
W O'Connor (Department of Supply, and Secretary to the Board)

Later prominent members were

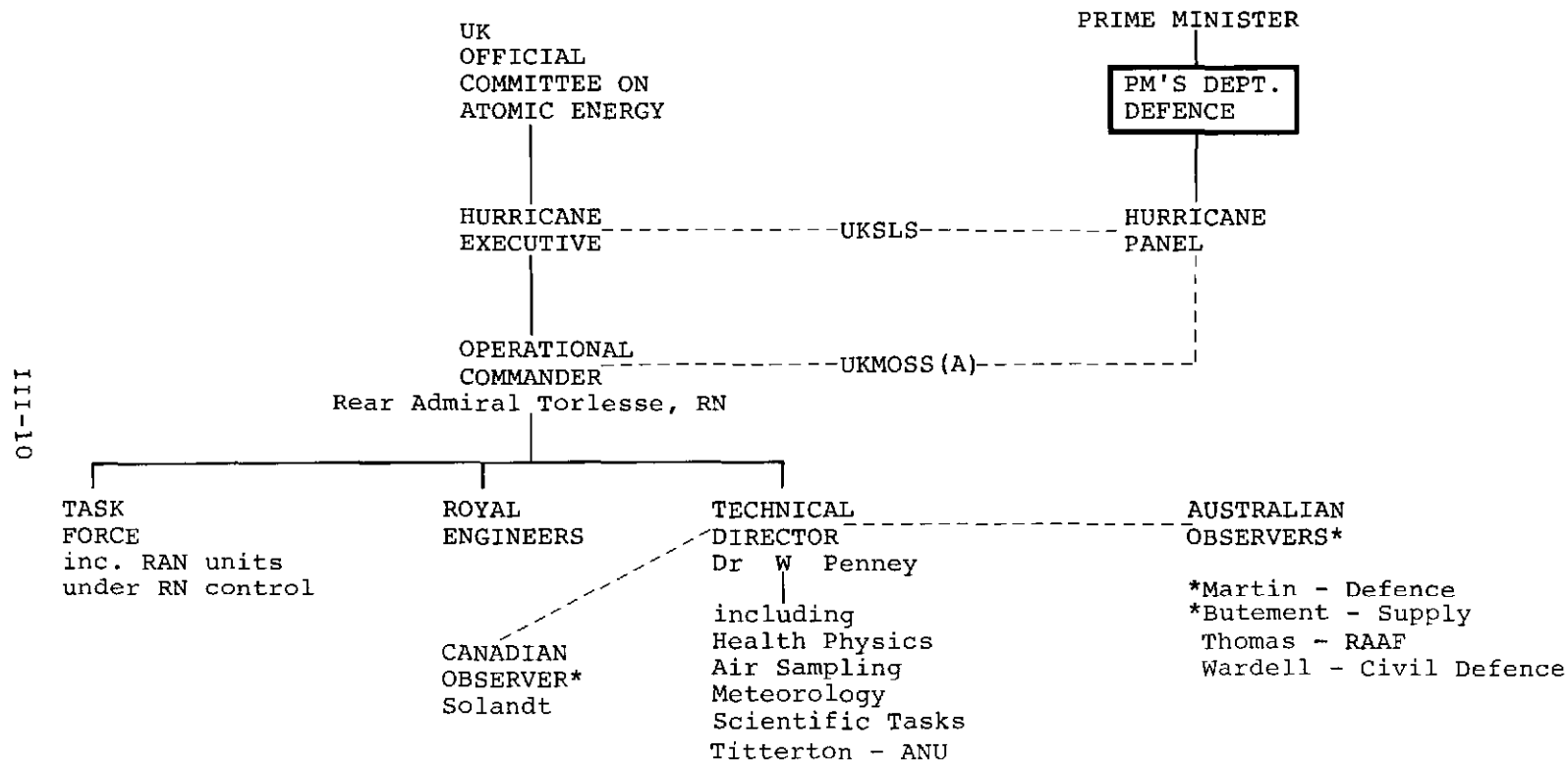
J L Knott (Chairman, and Secretary of the Department of Supply),
S Scott-Hall (Deputy Chairman), Colonel R A Barron (CEO), D Syme (UKMOSS(A)) and B S Lade (Supply).

C.3 Organisation Charts for the Trials

The following charts show the main organisational structure for managing the British Tests in Australia and the interactions between the UK and Australian Authorities.

Chart 1	Operation Hurricane
2	Operation Totem
3	Operation Mosaic
4	Operation Buffalo
5	Operation Antler
6	Inter-trial period
7	Minor Trials

OPERATION HURRICANE



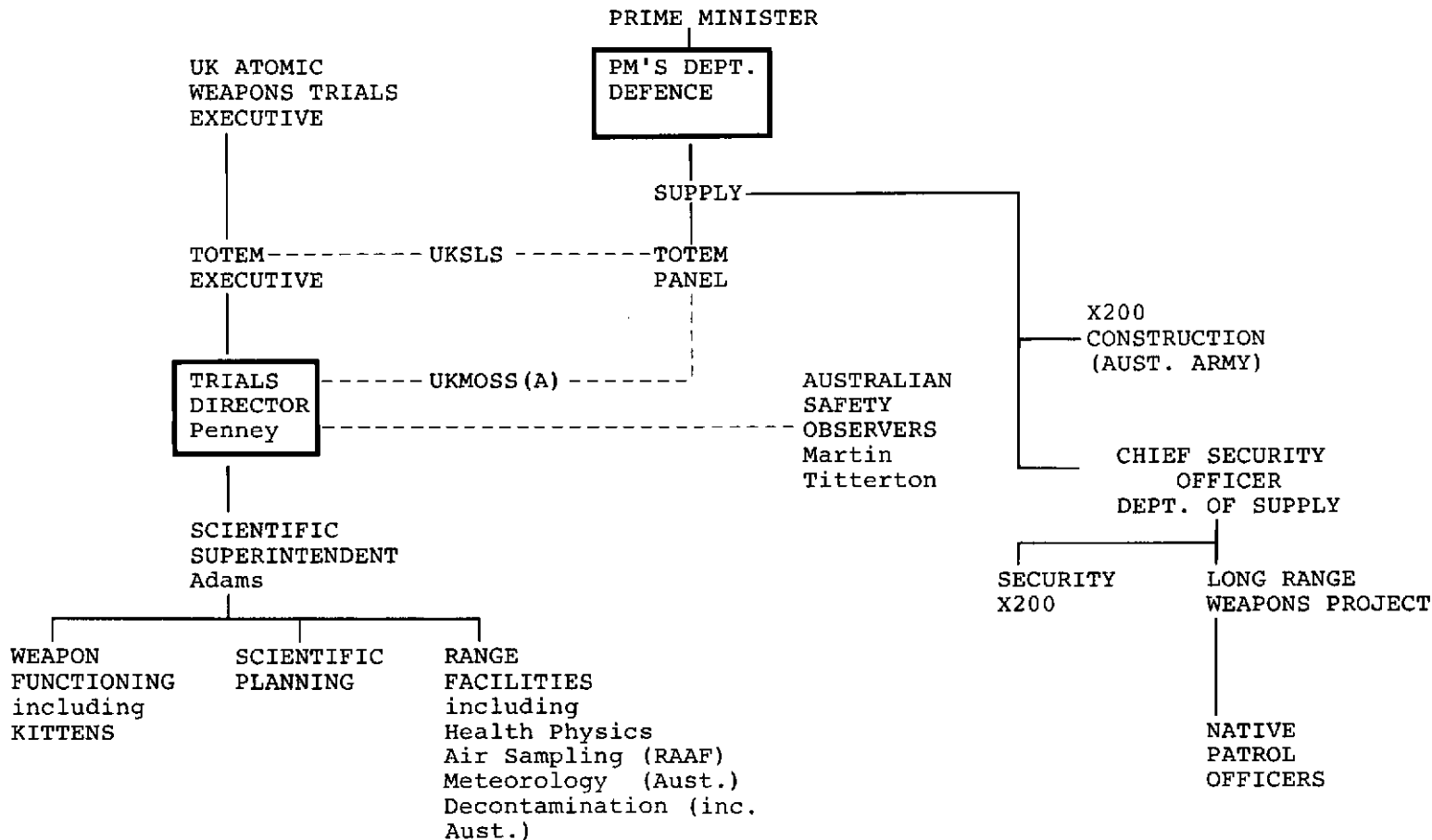
UKSLS : UK Services Liason Staff

UKMOSS(A) : UK Ministry of Supply Staff in Australia

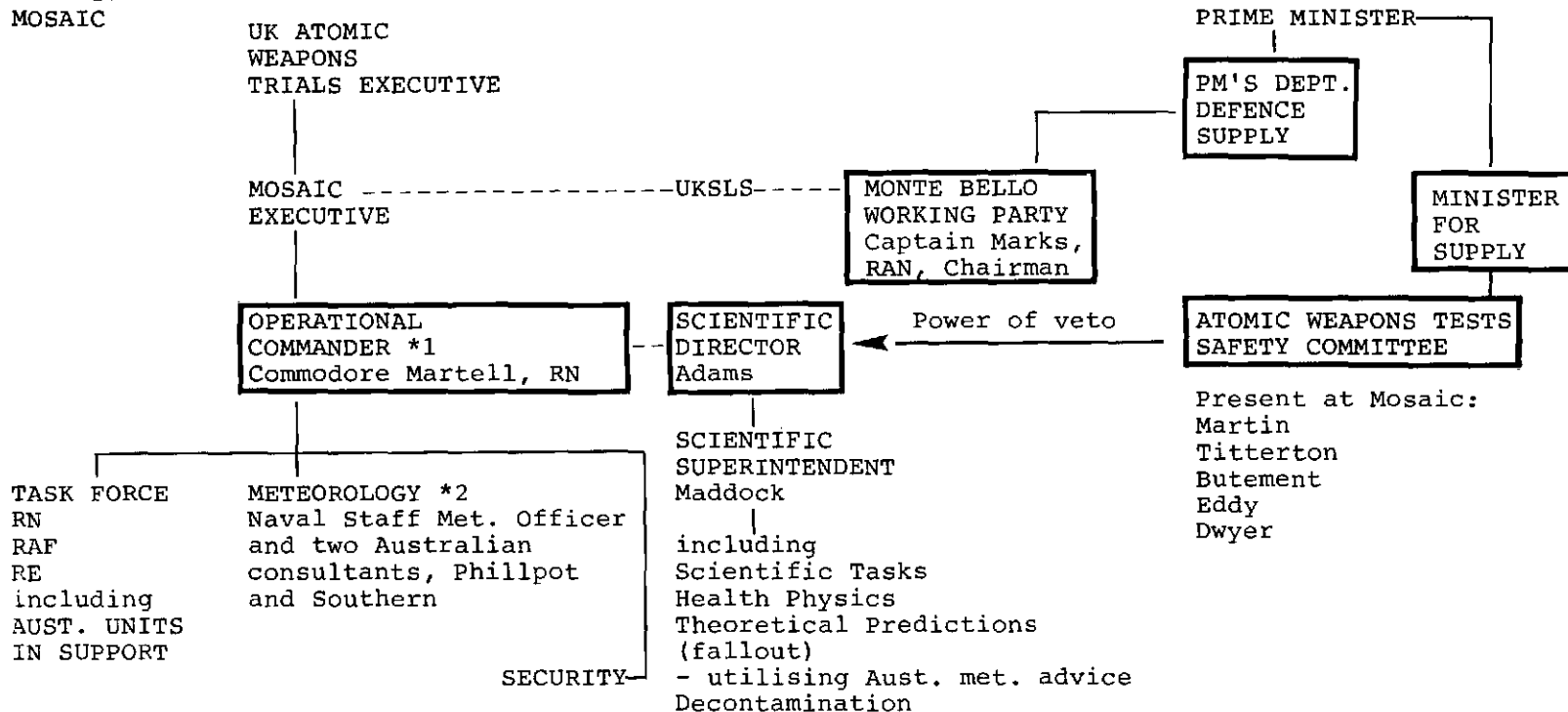
*Martin, Butement and Solandt (Canada) were the only Official Observers at the Test. All Australians present, and Solandt, were allotted tasks in connection with the Test, although Solandt's involvement was significantly more intimate.

OPERATION
TOTEM

II-III



OPERATION
MOSAIC

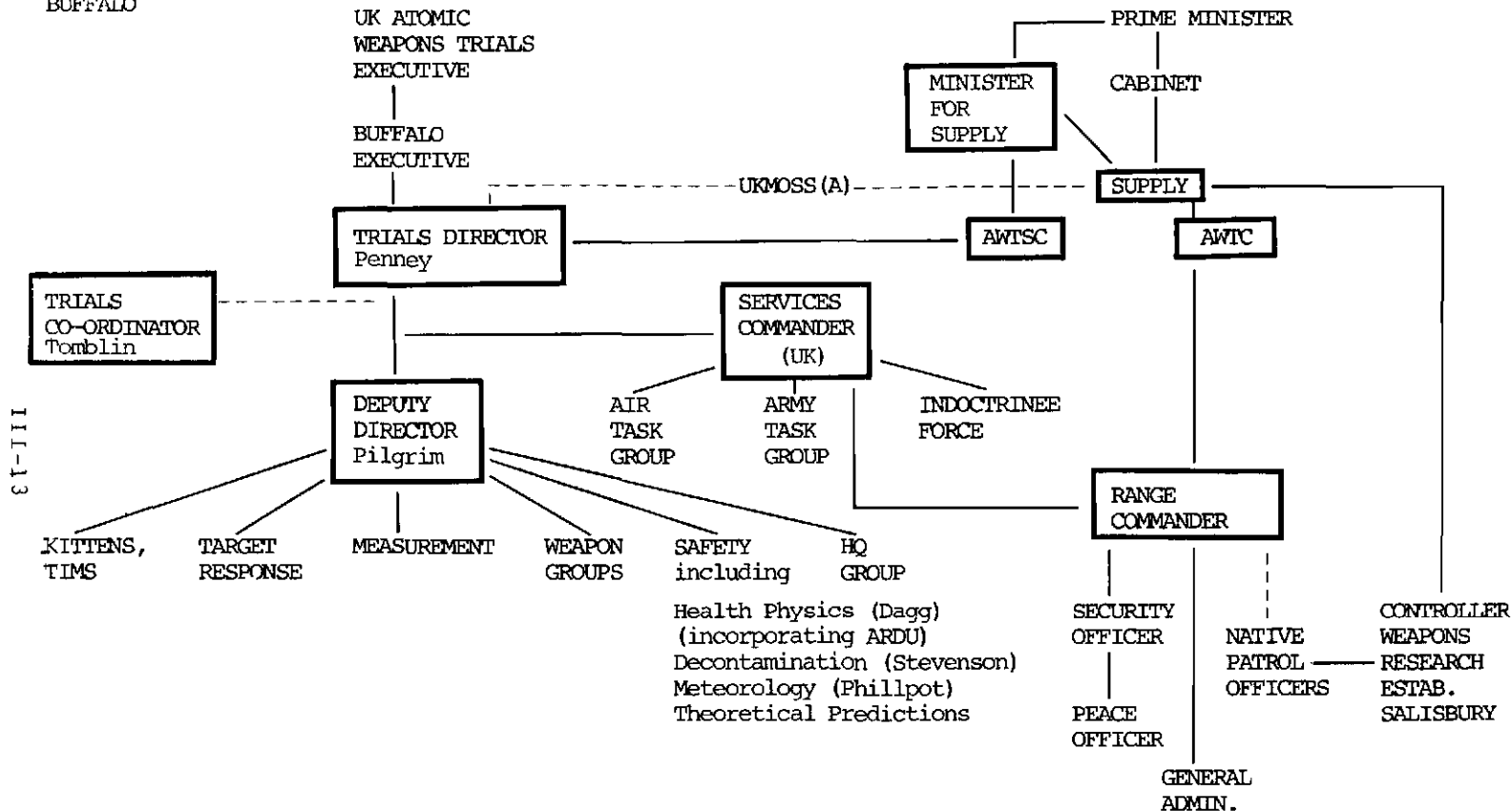


III-12

Note: *1. Decision to fire rests with Operational Commander, to be taken only after Scientific Director satisfied that technical requirements met, and Op. Commander, Scientific Director and AWTSC satisfied regarding safety requirements.

*2. Operational Commander, Scientific Director, Naval Staff Met. Officer, Group Leader Theoretical Predictions and AWTSC convened regularly to discuss meteorological conditions for firing.

OPERATION
BUFFALO



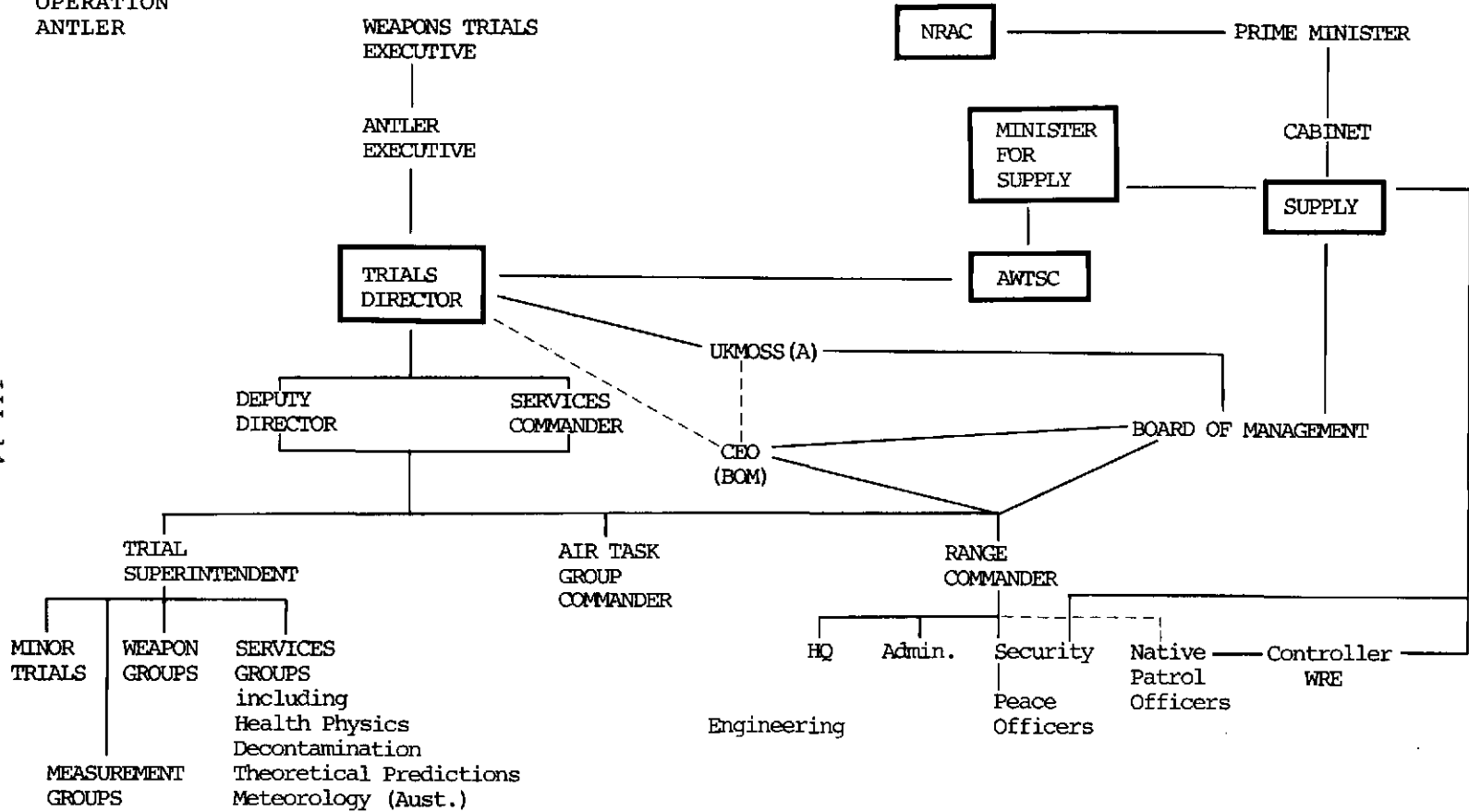
III-13

Note: Trials Director is responsible for Health Physics matters (through Health Physics Advisor, G C Dale).

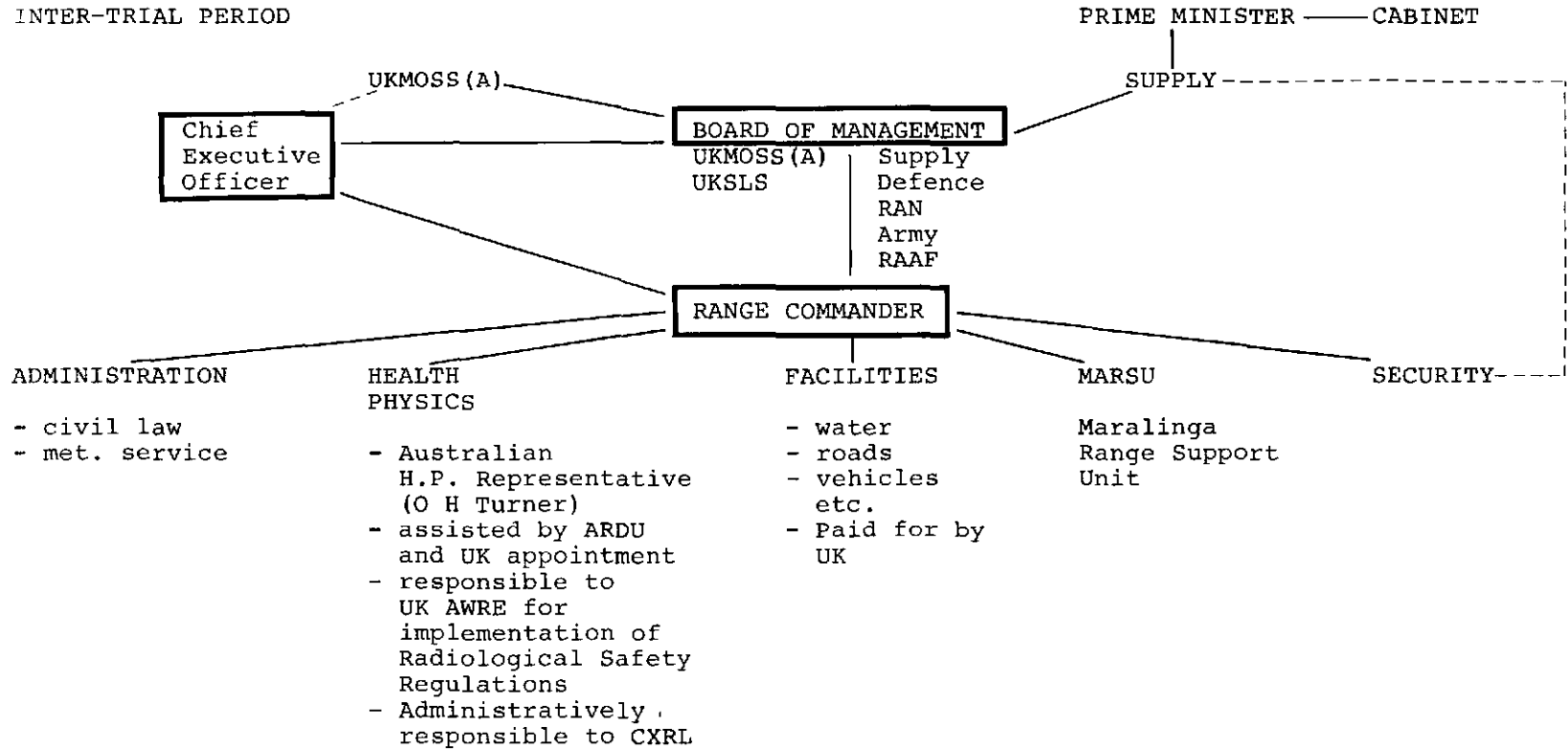
On completion of Trial, responsibility reverts to Range Commander, assisted in Health Physics matters by the Australian Health Physics Representative (O H Turner), with support from ARDU.

OPERATION
ANTLER

111-14



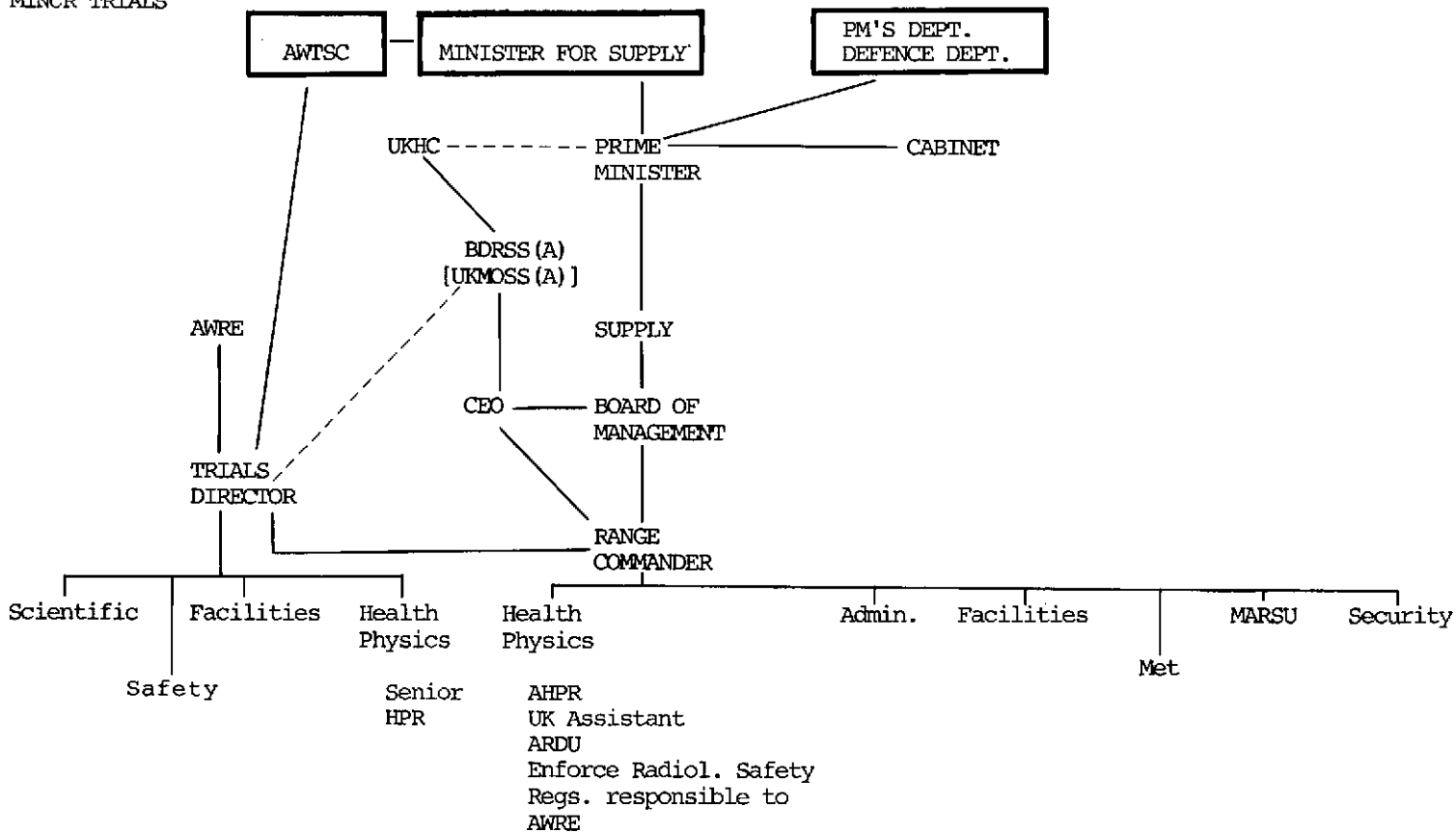
MARALINGA RANGE
INTER-TRIAL PERIOD



SI-115

Note: 1. During minor trials and assessment tests, Trials Director or Senior Scientist assumes responsibility for Health Physics matters in localised areas of tests through UK Health Physics Adviser.

MINOR TRIALS



91-111

APPENDIX D

WITNESS AND STATEMENT LIST

Australian Specialists/Advisers

Name	Role	Transcript Page No.
Carter, M W	Health Physicist, Office of the Supervising Scientist, Department Home Affairs	1352
Clark, A M	Chairman AIRAC, Emeritus Professor of Biology, Flinders University	3796
Coulter, J R	Medical Practitioner, Geneticist	3637
Davy, D R	Chief, Environmental Science Division AAEC	9990
Donovan, J W	Senior Medical Adviser in Epidemiology, Department of Health	9139
Hamilton, A	Professor of Anthropology and Comparative Sociology, Macquarie University	9663
Kerr, C B	Professor of Preventative & Social Medicine, University of Sydney	9720
Langlands, A O	Professor of Radiation Oncology, University of Sydney	9596
Lokan, K H	Director, Australian Radiation Laboratory	1908
Matthews, J D	Principal Research Fellow, National Health & Medical Research Council	2558
Robotham, F P J	Head, Physical Safety & Radiation Protection Unit, Melbourne University	2185
Somers, R L	Epidemiologist, SA Health Commission	8123
Thackrah, C	Anthropologist, Dept of Aboriginal Affairs	7335
Tonkin, D O	Ophthalmologist	8630
Tonkinson, R	Professor of Anthropology, University of Western Australia	7565a
Watson, G M	Formerly AIRAC	8999

Australian Scientists and Technical Personnel

Butement, W A S	Chief Scientist, Dept of Supply AWTSC	2836
Gordon, A	Meteorologist	8899
Green, E D	Bureau of Meteorology	7356a
Grenning, W R	Bureau of Meteorology	2378

Hartley, B M	WA Health Dept	7372
Hemmy, W F	Materials Research Laboratory, Dept of Supply	2849
Lloyd, S J	Medical Practitioner, Naval Specialist in Nuclear Medicine	9034
McKiggan, I F	Australian Radiation Detection Unit Dept of Supply	2543
Mizon, E A	Bureau of Meteorology	3335
Moroney, J R	Secretary, AWTSC, NRAC	8161
Phillpot, H R	Bureau of Meteorology	8714
Richardson, J F	Formerly CXRL	8926
Smith, G C	Formerly Director of Industrial Hygiene and Medicine, School of Public Health and Tropical Medicine, University of Sydney	30
Stevens, D J	Formerly AWTSC	2474
Taylor, G A G	Bureau of Meteorology	10085
Thomas, D A	RAAF Sqn Ldr, Scientific Adviser to Chief of Staff	8669
Titterton, Sir E	Chairman, AWTSC	7609
Turner, O H	Health Physics Representative, Dept of Supply	2864

Australian Servicemen

Adlington, B G	RAN	10091
Aitken, M H	RAN	10091
Aldridge, S B	Army	10091
Andrews, A A	RAN	1318
Angel, L G	Army	4068
Arnold, K A	RAN	7537
Avaient, W S	RAN	1055
Bailey, G L	RAN	4069
Baker, A H	RAAF	617
Baker, J A	RAAF	1898
Balcombe, J	RAAF	7460
Bear, G	RAAF	10091
Beauglehole, W A	RAAF	10091
Beaver, R R	RAN	1669
Beevers, L V	Army	945
Beitzel, F W	RAN	898
Bird, C I	RAAF	645
Blinco, A E	RAN	10091
Blinco, M H	RAN	10091
Bovill, W R	RAAF	1000
Boyd, E	RAAF	2369
Bradley, J	RAAF	3862
Brennan, L R	RAN	10091
Brindley, T R	Army	2130
Broadbent, J R	Army	1792
Brown, R B	RAAF	9583
Brown, W D	Army	7537

Buchanan, E G	Army	7537
Bullus, W H	RAAF	944
Burke, E	Husband RAAF	3728
Burnside, I M	RAN	10091
Busby, H J	RAAF	10091
Byron, H R	Army	2269
Caine, T J	RAAF	3247
Callaghan, R	RAN	10091
Cannon, V	Army	10091
Challen, G	RAN	7321
Clark, A H	RAAF	2383a
Clatworthy, H R	RAAF	10091
Coleman, R	Husband Army	30
Collins, B	Husband RAN	10091
Collins, L J	RAAF	715
Colquhoun, D W	RAAF	8609
Coolahan, J N	RAAF	425
Cosgrove, R E	RAAF	1852
Cotton, S	Army	10091
Coulson, F H C	RAAF	944
Craig, J B	RAAF	7437
Crompton, R A	RAAF	737
Crosby, J M	RAN	1511
Crossfield, A G	Army	2832
Cubillo, P J	Army	10091
Dash, R H	RAAF	581
Davis, W L	RAAF	881
Dean, K F	RAAF	663
Dennis, R J	RAN	2823
Domyer, F L	Army	7498
Donald, R R	RAAF	808
Douglas, V J	RAN	10091
Draisey, P	RAN	10091
Durance, R	Army	2384
Earnar, M V	RAAF	508
Edwards, B P	Army	2832
Edwards, L	RAAF	454
Edwards, W A	RAAF	1020
Elletson, B J	RAAF	1557
Flynn, E J R	RAN	10091
Forbes, G	Army	1520
Francis, R	RAAF	964
Freeman, K A N	RAAF	547
Gabelish, A J	RAN	7537
Gantzer, V A	Army	7413
Gates, N R	Husband RAN	10091
Geschke, C N	RAAF	10091
Ginnane, K	RAN	10091
Gore, K C	Army	10091
Grant-Fackrell, J	RN	7537
Greathead, W	Husband RAN	7537
Grebert, F H	RAN	774
Grimster, D G	RAN	7537
Gunnourie, A E	RAAF	10091

Haffert, R	RAN	10091
Hampshire, J B	RAAF	10091
Hansen, B	RAAF	748a
Harper, R M	RAN	10091
Henderson, W G	Army	8562
Heseltine, D P	Army	882
Hewitt, J S	Army	7537
Hillam, E J	Army	2828
Hogan, F R	RAN	7538
Hollingsworth, L	RAN	7537
Hooton, J G	Army	9063
Howard, T J	RAN	10091
Hudson, A J	RAAF	3920
Hughes, W J	RAAF	2076
Humphrey, D R C	RAN	10091
Hutton, J C	Army	120
Ireland, C L J	Army	8488
Jarvis, R A	Army	7477
Jellie, M D	Army	3975
Jenkinson, G I	Army	8528
Johnstone, D R	RAAF	181
Johnstone, H H F	Army	10091
Jones, O L	RAAF	10091
Joyner, B B	RAN	10091
Kendall, N J	RAN	1312a
Kennedy, R J	Army	3486
Kimber, M A	RAN	7537
Kittle, V T	RAAF	10091
Lamey, G H	RAN	2278
Lang, G A H	Army	2832
Lang, G W	Army	1239
Last, B J	RAAF	2055
Lawrance, L C	RAN	7295
Leane, B A	RAAF	629
Lee, W T	RAAF	10091
Lewis, R E	RAN	7433
Lloyd, D F	Army	1072
Longworth, D W	RAN	7315
Lonie, F R	RAAF	9552
McCloskey, B W	Army	1681
McClure, J	Army	10091
McEwen, A	RAAF	338
McHardie, E D	RAAF	8502
McKay, G V	RAN	820
McLean, R N	RAAF	10091
McSorley, D T	RAN	7410
MacDonald, L G	Army	9133
Mackaway, T C	RAN	10091
MacLean, N	Husband Army	10091
Macnish	RAN	30
Magee, D O A	Army	1701
Maguire, T K	Army	10091
Marqueur, R	Army	2025
Martin, D	Army	9571

Melville, A J	RAAF	1850
Meredith, K W	Army	69
Moffat, J G	Army	10091
Monaghan L D	RAN	9082
Moore, G L	RAAF	794b
Moore, R R	RAAF	7291
Murphy, K I	RAF	4069
Muxworthy, J S	Army	7537
Naggs, R E	RAAF	1262a
Newgrain, A	Husband RAAF	4069
Newman, M E	RAAF	2328
Newgreen, G D	Army	2281
Nicholls, W R	RAN	10091
Nickol, N	RAAF	10091
Norris, R F	RAAF	10091
O'Brien, J R	RAAF	10091
O'Brien, N C	RAN	3464
Ollington, H J	RAN	911
Palfreyman, J	RAN	1850
Partridge, J W	Army	1275
Peach, F S B	Army	8468
Peck, E K	RAAF	839
Peters, T K	RAN	9086
Phillipson, R F	Army	1540a
Plewright, W B	RAN	7324a
Plummer, R J R	RAAF	10085
Pollard, M	RAN	242
Pont, C P	RAN	10091
Puxty, H W H	RAAF	496
Pywell, R W	RAN	10091
Rae, R T	RAN	10091
Ramsay, O G	RAN	7304
Raph, R T	RAAF	10091
Ravenscroft, W L	RAAF	7417
Raymond, C S	RAN	10091
Reynolds, A J	Husband RAN	7537
Roberts, R P	RAAF	10091
Robertson, B L	RAN	2831
Rock, J	RAN	10091
Rogers, G O J	RAAF	1040
Ronan, J F	RAAF	2812
Ruffe, S L	Army	723a
Ryan, K J	Army	2326
Scott, R H	RAN	2821
Sharpe, N W	Army	10091
Shergold, J A	RAF	30
Simister, N C	Army	10091
Sirotzki, A F	Army	10091
Slattery, K M	RAAF	10091
Smith, F	Army	8568
Smith, G W	RAN	7432
Smith, L M	RAF	4019
Smith, W E	RAN	7405
Sowton, D	Army	3478

Spring, A J	RAAF	832
Stacey, J B	RAN	10091
Stahl, L W	RAAF	10091
Stanton, E	Husband Army	10091
Stapleton, A W	RAAF	9073
Stein, B D	RAAF	484
Stephens, K A	RN	4068
Steward, F V	RAAF	881
Stilwell, P P	RAN	269
Stuart, M L	Husband Army	10091
Sullivan, W F	RAN	7537
Swenson, A	RAAF	964
Taudevin, S	Husband RN	10091
Taylor, H W	RAAF	2086
Therkelson, K	RAAF	1452
Thomas, D J	Army	30
Thomas, W H	RAAF	753
Thompson, G O	Army	8510
Tomerini, F	RAN	10091
Thornton, P F	RAAF	7537
Timbs, J J	RAN	1815
Tooke, T F	RAAF	2109
Toon, T	Army	363
Townsend, G R	RAAF	622
Townsend, W E	RAAF	30
Turner, R	RAAF	2096
Turner, W A	RAAF	283
Van Munster, E C	Army	675
Walker, L R	RAAF	768
Walker, R E	Army	10091
Walington, R C	RAAF	10091
Walsworth-Bell, I A	Army	10091
Ward, G E	RAN	10091
Ward, T H	RAN	10091
Watts, J F	RAAF	606
Weaver, C P	RNZN	10091
Webster, R S	RAAF	55
Westwood, M C	RAN	38
Whitfield, R C	RAN	10091
Whyte, O J	Husband Army	10091
Wilkinson, D E	RAAF	593
Wilkinson, F J	RAN	924
Willes, D E	RAAF	9564
Willie, R F	Army	10091
Wilson, B J R	RAAF	10091
Wilson, K K	RAAF	323
Windle, C	Army	3618
Winton, J	RAN	10091
Wood, J W	Army	10091
Woodland, K J	Army	1290
Yet Foy, G C	RAAF	954
Zander, C G	RAAF	881

Aborigines

Anderson, H	Arbaburula - Cundeelee	7218
Baker, A	Granite Downs - Wallatina Station	7176
Baker, J	Ooldea	7235
Baker, T	Wallatina Station	7193
Brown, E	Wallatina Station	7176
Christian, P	Warrie Station	7581
Cook, K	Ooldea/Yalata	7235
Cox, A	Ooldea/Yalata	7267
Cox, J	Ooldea/Yalata	7235
Day, M	Ooldea	7235
Edwards, D	Salvage Worker/Yalata	7252
Gibson, M	Salvage Worker/Yalata	7252
Illie, E	Ooldea/Yalata	7267
Kanginy, L	Wallatina Station	7176
Kanytji	Wallatina Station	7176
Lambina, A	Wintinna Station	7203
Lennon, L	Health Worker, Aboriginal Health Organisation, Port Augusta	7141
Lennon, S	Stockman, Fencer, Builder	7161
Lester, J Y	Director, Institute of Aboriginal Development, Alice Springs	7111
Milpuddie, E	Tjundrun/Yalata	7267e
Mayawara, J	Wallatina Station	7176
Minning, S	Ooldea/Yalata	7261
Monadee, B	Gnoorea Point	7557
Monadee, C	Ghoorea Point	7557
Pennington, M	Arbaburula - Cundeelee	7218
Peters, G	Ooldea/Yalata	7267
Pingkayi	Wallatina Station	7176
Poobidie, L	Yalata/Salvage Worker	7252
Queama, K	Ooldea/Salvage Worker	7235
Queama, M	Ooldea/Yalata	7267
Queama, T	Ooldea/Salvage Worker	7235
Sandimar, R	Ooldea/Yalata	7267
Smart, J	Ooldea/Yalata	7235
Smith, A	Red Hill Station	7557
Stevens, D	Arbaburula - Cundeelee	7218
Tjanyiri, A	Wallatina Station	7176
Tjapilyi, K	Wallatina Station	7176
Tjukanku, W	Wallatina Station	7176
Wallatina, H	Wallatina Station	7176
Wallatina, J	Wallatina Station	7176
Wallatina, M	Wallatina Station	7176
Wallatina, N	Wallatina Station	7176
Wangati, K E	Ooldea	7193
Wangati, W	Assistant to MacDougall/Mimili Station	7193
Watson, D	Ooldea/Yalata	7267
Watson, M	Ooldea/Yalata	7207
West, C	Ernabella - Cundeelee	7218
Windlass, H	Ooldea/Salvage Worker	7235

UK Specialists/Advisors

Beck, C A	AWRE: Head, Chemistry & Explosives Division	5817
Bristow, H	AWRE: Chemical Technology Division; Senior UK representative at Maralinga 1979 (repatriation of plutonium)	6762
Dennis, J A	NRPB: Assistant Director	6967
Dunster, H J	NRPB: Director	6923
Fuller, E W	AWRE: scientist	9227
Pochin, Sir E E	Former Scientist, British Medical Research Council; Consultant to National Radiation Protection Board	9334
Roach, W T	Meteorological Office Assistant Director (Special Investigations)	4616
Vallis, D J	AWRE: Principal Scientific Officer, Radiological Detection	5729

UK Scientists

Adams, C A	AWRE: Deputy Technical Director, Hurricane; Scientific Superintendent, Totem; Scientific Director, Mosaic; Trials Director, Antler	635
Austin, J	AWRE: Leader, Decontamination team (RH5), Totem, Amberley	5948
Bailey, E H	AWRE: Engineer-in-Charge, Explosives Assembly (XA) Area, Minor Trials 1960	3562
Barnes, D E	AWRE: Health Physics Superintendent; Radiological Safety Adviser to Naval Commander, Hurricane	4667
Beale, E M	AWRE: Theoretical Physics Division; Mathematician	7014
Butler, R F C	REME: Radiation Hazards (RH) Group, Totem, Amberley	6786
Cambray, R S	AERE, Harwell: Assistant Experimental Officer; Leader, Radioactive Sampling Team (RS2)	6878
Carter, R F	AWRE: Health Control & Field Operations, Minor Trials 1957, 1959, 1960	6610
Coppard, J M	AWRE: Health Physics, Minor Trials 1959, 1961, 1963; Deputy Range Health Physics Representative 1961-1964	6351
Cotgrove, D F	AWRE: High Explosives Experiments	7078
Dagg, S J	AWRE: Leader Health Physics Group, Buffalo	6199

Dale, G C	AWRE: Health Physics Adviser, Leader, Radiation Measurements Group, Totem, Buffalo, Antler	4988
Drake Seager, E R	War Office Thermal Effects, Hurricane: Leader, Target Response, Totem, Buffalo; IF Co-ordinator	6037
Fotheringham, R R	RN; Meteorologist-in-Charge, Mosaic; Consultant Meteorologist Buffalo	5485
Freeman, M H	Meteorologist, Totem	5523
Gale, H J	AERE, Harwell: Cloud Sampling, Hurricane (Broome), Totem (Woomera)	5261
Hole, J A	AWRE: Health Physics; Leader, Personnel Monitoring Group (RH4), Hurricane; Leader, Radiological Safety Group, Mosaic	5147
Jones, W E	AWRE: Staff Officer Operations, Buffalo & Antler; Co-ordinator of Operations, Vixen B, 1960, 1961, 1963	6531
Long, W S	AWRE: Scientific Trials Manager Mosaic	7014
McDougall, W G	AWRE: Group Leader Health Physics, Antler	5827
Matthewman, A G	AWRE: Met Office Theoretical Predictions Group, Mosaic	6811
Marks, J M	AWRE: Scientific Officer, Minor Trials	7078
Pearce, N	AWRE: Blast Measurement, Hurricane and Totem; Minor Trials (Vixen A); Hercules 5 1964, Operation Radsur 1966, Operation Brumby 1967	6389
Peirson, D H	AERE, Harwell: Leader, Radiological Survey (RS2) Team, Hurricane;	
Penney, Lord W G	AWRE: Director; Technical Director, Hurricane; Trials Director, Totem; Trials Director, Buffalo	5559 4294
	and	7033
Saxby, W N	AWRE: Health Physics Hurricane and Totem; Range Facilities, Trials Planning, Buffalo & Antler	6037
Schofield, A	AWRE: Minor Trials 1953, 1958, 1961	6270
Siddons, R A	AWRE: Radiation Hazards Group, Totem; Leader, Theoretical Predictions Group, Antler	5413
Stevenson, D G	AWRE: Decontamination Team, Totem; Leader, Decontamination Group, Mosaic (Pearce) & Buffalo	5876
Stewart, K	AWRE: Leader, Radiological Hazards RH5 Team, Hurricane; Leader, Radiation Measurements and Radiological Safety, Totem; Minor Trials (Vixen A)	6183
Walkling, A E	AWRE: Leader, Radiological Hazard Division, Hurricane	4504

Wilson, D A	RAF Radiologist; Co-Pilot, Canberra (Hot Box), Totem	5345
Wood, A P	AWRE: Health Physics Antler; Health Physics Adviser, Minor Trials, 1957-62; Health Physics, Hercules 5, 1964	6900

UK Servicemen

Addy, L F	RAF	3996
Angwin, R H	RN	4291
Bambridge, T H	RAF	7078
Berry, J G	RN	4092
Blake, A W	Leading Engineer Mechanic	
Blakeney, M H	Army	7078
Browne, H	RAAF	7078
Buckley, D	Army	7078
Campbell, C W	RAF	4133
Campbell, Dr J G	RAAF	7078
Carter, H G	RN	5134
Coles, H	RN	7078
Collier, J F	RAF	4291
Connolly, P G	RAF	7441
Coulton, E J	RAF	10091
Cumper, R J	RN Petty Officer (Met Observer)	7078
Dent, F	RAF	4277
Donne, C H	RAF	4150
Elliott, A J	RAF	3909
Fletcher, S	RN	4222
Garbett, R J	RN	7078
Greenwood, K	RAF	7078
Hailing, M P	RAF	7078
Hale, E A	Army	7078
Hall, N	Army	4222
Hardisty, M	RAF	7078
Jones, R A	RN	10091
Keys, D A	RAF	7078
Kyle, R	Army	4222
Lamerton, E	RN	4222
Larkin, T N	RAF	7078
Lloyd Owen, D L	Army	7078
Lowe, P A	Army	4190
Mabutt, G E	RN	4143
Martell, Sir H	RN	4878
Maughan, R G	RN	7078
Menaul, S	RAF	6982
Nettley, R	RAAF	4222
O'Fee, N	RAF	4243
Owen, G	UK	4213
Perkins, B J H	RN	4162
Reid, J W	Army	6962
Sinclair, A B G	RAF	4222

Stephens, M H	RN	4247
Swainston, S	RN	7078
Syder, K	RN	4223
Taylor, T W	RAF	4273
Tilling, D E G	RAF	4207
Tomlinson, C E	RAF	4154
Walker, J	RN	7078
Walton, K	Army	10091
Wilson, G W	Army	4106
Wilson, T	Army	7078

Other

Andrews, L M	Husband Dept of Works Labourer	4069
Arnold, C E	Peace Officer Guard	2778
Ayres, J	Housewife	10091
Beadell, L	Surveyor	3497
Bingham, F W	Dept of Supply	3886
Blair, I	Sergeant of Police, Marble Bar	9781
Bock, G E	Housewife, Broken Hill	10091
Brougham, T	Dept of Supply	4068
Brown, J N	Husband Dept of Supply	4069
Budden, F W	WRE	3953
Buetefuer, H	Dept of Mines	10091
Bulman, A	Peace Officer Guard	4069
Cassidy, P A	Husband Civilian, Emu	10091
Clark, M S	Pearl Lugger/Housewife	10091
Comas, C A	WRE Liaison Engineer	10091
Conlon, J A	Dept of Supply	3899
Coombe, D E	Peace Officer Guard	3706
Corney, G	Civilian	30
Crawford, E L	Pastoralist, Red Hill	10091
Crosbie, H J	Civilian	10091
Department of Housing & Construction		4070
Department of Resources & Energy		4072
Dickinson, Sir B	Dept of Mines	10091
Dnersi, P	PMG	10091
Dutschke, I	Yalata Mission	3181
Dutton, L C	Peace Officer Guard	10091
Edwards, A L	Stockman	10091
Findley, I J	Shell Company	10091
Flannery, A C	Dept of Supply	2686
Freeman, McD	Alexander Gibb & Partners	2330
Gabli, A	Dept of Works Maintenance	1251
Gaghan, J	Mines Dept	4045
Gerdsden, B H	Dept of Works	3234
Giles, E	Welbourn Hill Station	7175
Giles, E C	Welbourn Hill Station	10091
Glover, E	Journalist	10091
Golding, R J	Peacock & Co.,	4031
Gostelow, A W	Dept of Housing Construction	10091
Gould, F J	Dept of Supply	10091

Griffiths, B O	Dept of Supply	10091
Hammond, W L	Kwinana Construction Co.	4068
Hedrick, K R	Green Point Shipyard	10091
Henderson, S D	Dept of National Development	4177
Hewitson, W F	Peace Officer Guard	3696
Hein, G P	Dept of Works	4068
Hudson, C	Peace Officer Guard	3733
Jackson, K H	Commonwealth Police, Maralinga	10091
Jones, F H	Dept of Supply	2244
Jones, G I	Husband AWRE	7078
Justice, M F	Husband WRE	4048
Kareta, K C	Dept of Interior	10091
Keane, D	Civilian	30
Lane, J W	Dept of Works	10091
Lander, A	Contract Worker	7094
Lightbody, J	Dept of Supply	4069
Lindner, B G	Yalata Community, Manager	3423
Lindschau, M P	Husband Locomotive Driver	10091
Little, K	Medical Scientist	7078
Ludwig, E J	Civilian	10091
McGee, W L	Kwinana Construction	10091
Macauley, R A	Aboriginal Patrol Officer	1583
Marchioro, M A	Father WRE	4069
May, C	Husband Civilian Plumber	3625
Meynell-James, J	Civilian	10091
Miller, W A	Fisherman	7541
Morrison, C S	Dept of Supply	9112
Murray, T	Peace Officer Guard	3254
Novello, N	Kwinana Constructions	3933
Nunn, C	Father Commonwealth Dept Employee	4069
Philp, D C	Peace Officer Guard	3915
Potter, P T R	Civilian, Maralinga	4038
Press, P	Commonwealth Police Force	3721
Prior, D	Journalist	10091
Radford, E P	Adjunct Professor of Epidemiology, University of Pittsburgh, USA	4739
Rickard, D W	Dept of Supply	3132
Roberts, B N	Atomic Energy Authority	4233
Ruff, A	Dept of Works Mechanic	4069
Sanders, F J	Kwinana/Dept of Supply Plumber	4068
Scott, J L	Federal Member for Hindmarsh	3439
Shevlin, F J	In charge of Hygiene	4066
Southwell, R G	Kwinana Const/Maint Dept of Supply	4260
Squire, R J	Civilian	30
Stewart, A	Epidemiologist, Birmingham University	6718
Stirna, G A P	Dept of Works/Supply Cook	4068
Stoncius, R	Husband H Stauber, Construction Worker	10091
Stubbs, S	Mechanical Engineer (Mining)	7586
Suffling, G E	Dept of Supply Electrical Fitter	1273
Szymanski, J	Kwinana/Dept of Supply Construction Worker	10091
Tennigkeit, R	Rigger	3601

Tomkins, A F	Dept of Supply General Duties	3717
Tozar, G	Fishing Boat Owner	7552
Tucker, A F	Company Rep., WAPET, Onslow	10091
Weightman, J D	Welfare Officer, Aborigines Dept, SA	6632
Williams, C J	Civilian Nurse	4069
Williams, N L	Attorney-General's Peace Officer's Guard	4007
Wilson, D J	Civilian, Army Store	10091
Withers, R J	PMG Manager Post Office	10091
Wolf, K	Construction Worker, Morag P/L	10091
Wroblewski, K	Dept of Works Driver	4068

LIST OF EXHIBITS

No.	Date	Place	Witness	Description
AB1	2.10.84	Sydney		G M Eames and A C Collett - preliminary submission on behalf of the Aboriginal people
AB2	25.10.84	Sydney		Map of South and Central Australia - land utilization and pastoral runs
AB3	22.11.84	Adel	L Beadell	(a) Map of Maralinga area - layout of sites, bores - ref: Mara 3 (b) Emu Test Area - site plan
AB4	14.1.85	Lond	Lord Penney	Map plotting possible direction for cloud from Totem 1 if wind blowing 190 degrees or between 218 and 246 degrees
AB5	14.1.85	Lond	Lord Penney	Letter 31 August 1956 - Lord Penney to S G Middleton re: Maralinga Range and Giles meteorological station
AB6	5.2.85	Lond	G C Dale	Table - Comparison of maximum permissible levels of contamination
AB7	6.2.85	Lond	J A Hole	Table - Comparison of contamination rates/gamma doses - Mosaic 1 and 2
ABB	18.2.85	Lond	Lord Penney	Documents referred to Penney - Letter 19 August 1952 to R M Saner - Use of Australian centre for tests; - Letter to Lord Cherwell; - Press Statement 4 May 1955: H Beale
AB9	20.4.85	Marla		Map of Western and South Australia detailing Aboriginal lands/sites
AB10	20.4.85	Marla	A Lander	Statement and drawing
AB11	20.4.85	Marla	J Y Lester	Statement
AB12	20.4.85	Marla	L Lennon	Statement
AB13	20.4.85	Marla	S Lennon	Statement
AB14	24.4.85	Mar'ga	C West	Statement
AB15	25.4.85	Mar'ga		Submission by Ms M Brady and Dr K Palmer; map of Maralinga sites referred to by witnesses
AB16	2.5.85	Perth	E Milpuddie	Two statements
AB17	2.5.85	Perth	R S Stewart	Affidavit
AB18	18.9.85	Sydney		Number not used
AB19	18.9.85	Sydney		Extracts from 'Aborigines, Change - Australia in the 70s': Berndt - Chapter 8 'From camp to village: some problems of adaptation': Isobel M White - Chapter 10 'Decentralisation trends in Arnhem Land': W J Gray - Chapter 11 'Pitjantjatjara decentralisation in north-west South Australia: spiritual and psycho-social motivation': Noel M Wallace
AB20	18.9.85	Sydney		Affidavit from James Yami Lester, 13 September 1985
AB21	18.9.85	Sydney	N L Sheppard	Statement and further documents listing dates of epidemics affecting Aboriginal communities
AG1	4.10.84	Sydney	D R Johnstone	Two colour photographs
AG2	4.10.84	Sydney	D R Johnstone	Two photocopies of photographs
AG3	11.10.84	Bris	S L Ruffe	Emu Test Area - site map
AG4	30.10.84	Melb	B J Last	Map - Restricted Flying Area 1961 - ref: SPT/RF/232/6
AG5	22.11.84	Adel	E H Bailey	Press Release from British High Commission on Official Secrets Act, 30 October 1984
AG6	30.11.84	Adel		Submission - Commonwealth of Australia Dept of Housing and Construction (DHC)
AG7	30.11.84	Adel		Submission - Commonwealth of Australia Dept of Resources and Energy (DRE)
AG8	1.2.85	Lond	Adm Martell	Reports from Commanding Officers of Narvik, Junee, MRL and Fremantle
AG9	4.2.85	Lond	Adm Martell	Reports to Cabinet re: problems of safety at Maralinga, 3 September 1955; 13 August 1956; 3 September 1956; 4 September 1956.

AG10	18.2.85	Lond	Lord Penney	Documents referred to Penney by J McIntyre: - Message 28 March 1952 Rear Admiral to UKSLS Melbourne re: long-range air sampling - Message 15 September 1952 DCNS to UKSLS Melbourne re: Broome and Townsville collections - Letter 31 October 1952 F B Lloyd to Vice Admiral E M Evans-Lombe re: guarding of site - Letter 2 January 1953 - Lloyd to Pritchard re: contamination of Monte Bello Islands - Letters 30 November 1954 Gates to UKMOSS(A) (DOS); 24 January 1955 - Pilgrim to Lloyd; Telexes 6 January 1955 Lloyd to Penney, 10 January 1955 - Penney to Black re: removal of guards from Emu - Telex 21 September 1956 Penney to E L Cook re: abortion of test - Telex October 1956 Penney to Cook re: cancellation of test - Letter 17 June 1957 E Edwards to Pilgrim and reply 21 June 1957 re: Health Physics - responsibility - Letters 1 August 1957 W H Wheeler to Secretary, Dept of Supply (DOS) and 9 August 1957 F A O'Connor, (DOS) to UKMOSS(A) re: Health Physics - responsibility Operation Buffalo - miscellaneous health physics reports Two Reports - 'Evaluation of Radiation Sensitivity of Two Survey Meters': Hargrave, 15 May 1985 - Evaluation of Survey Meter Readings made by J Stubbs: Wise, 24 June 1985 Report - 'Management of Former UK Atomic Test Site in Australia - Report 1979 Work Program', Dept National Development and Energy, November 1979
AG11	18.9.85	Sydney		
AG12	18.9.85	Sydney		
AG13	18.9.85	Sydney		
AN1	2.10.84	Sydney		Preliminary submission by Shaw, McDonald and Partners on behalf of ANVA(NSW)
AN2	12.10.84	Bris	F H Grebert	Photograph of 1st Monte Bello explosion
AN3	Oct 84			Interim submission No. 1 Preliminary Credence - ANVA (NSW)
AQ1	11.10.84	Bris	W H Thomas	Service History of RAAF Lincoln aircraft - 24 September 1981 - ref: AF 334/1/47 Part 3
AS1	2.10.84	Sydney	-	Preliminary submission by G D Hemsley and Associates on behalf of the ANVA (SA)
AS2	22.11.84	Adel		Mrs C May
BV1	14.1.85	Lond	Lord Penney	Report 12 January 1951 Epicure: Report on Proposed Site: W G Penney
BV2	14.1.85	Lond	Lord Penney	Report 6 February 1947 Genetic Effects of Irradiation with Reference to Man: D G Catchside
BV3	14.1.85	Lond	Lord Penney	Memo 20 May 1953 - Report to Chiefs of Staff Committee by the Defence Research Policy Committee entitled 'Atomic Weapons Trials'
MM1	2.10.84	Sydney	-	Submission on behalf of the Maralinga and Monte Bello Atomic Ex-Servicemen's Association (MMESA)
MM2	4.10.84	Sydney	M Pollard	Five Black and White photographs of Hurricane explosion

RC1	11.9.84	Adel		Memorandum of Arrangements between Australian and United Kingdom Governments - Atomic Weapons Proving Ground - Maralinga - 7 March 1956. - Memorandum of Arrangements between the UK and Australian Governments in regard to allocation of the costs of establishing and maintaining a proving ground for atomic weapons in South Australia and for any tests carried out thereon - 7 March 1956. - Memorandum respecting the termination of Memorandum of Arrangements between the UK and Australian Governments of 7 March 1956 concerning the Atomic Weapons Proving Ground - Maralinga - 23 September 1956.
RC2	2.10.84	Sydney	-	Submissions: R Coleman; G Corney; D Keane; B W McCloskey; C J Macnish; G I Jenkinson; J A Shergold; G C Smith; R J Squire;; D J Thomas; W C Townsend
RC3	2.10.84	Sydney	-	Map of Australia - Aboriginal lands/sites (Gregory's map 150, 12th Ed)
RC4	2.10.84	Sydney	-	Map - Range Commander - Maralinga Range layout
RC5	2.10.84	Sydney	-	Map No. SH 53-1 Ed 1 series R502 NATMAP 1965 - Giles
RC6	2.10.84	Sydney	M C Westwood	Statement
RC7	2.10.84	Sydney	R S Webster	Statement
RCB	2.10.84	Sydney	K W Meredith	Statement
RC9	2.10.84	Sydney	K W Meredith	Four Photographs, 'First nuclear explosion at Maralinga, Australia 27 September 1936 One Tree'
RC10	2.10.84	Sydney	K W Meredith	Photograph - Protective Clothing
RC11	2.10.84	Sydney	K W Meredith	Dosimeter
RC12	2.10.84	Sydney	K W Meredith	Film Badge (No. 02944)
RC13	2.10.84	Sydney	K W Meredith	Photograph of Decontamination Caravans
RC14	3.10.84	Sydney	J C Hutton	Statement
RC15	3.10.84	Sydney	J C Hutton	Addendum (27 September 1984) to statement
RC16	3.10.84	Sydney	J C Hutton	Documents relating to health condition of Hutton
RC17	3.10.84	Sydney	J C Hutton	Health Physics Reports on natives at Pom Pom - 14 May 1957 by O H Turner, Sergeant F Smith
RC18	3.10.84	Sydney	D R Johnstone	Statement
RC19	3.10.84	Sydney	D R Johnstone	Photograph of protective clothing
RC20	3.10.84	Sydney	D R Johnstone	Article: 'The Biological Effects of Atomic Radiation' - A report to the public by National Academy of Sciences - National Research Council, Washington 1956
RC21	4.10.84	Sydney	D R Johnstone	Photographs - construction, village, people etc.
RC22	4.10.84	Sydney	M Pollard	Statement
RC23	4.10.84	Sydney	D R Johnstone	Dosimeter No. 301166 and Film Badge No. 01046 of LAC I A Hamilton
RC24	4.10.84	Sydney	P P Stilwell	Statement
RC25	8.10.84	Bris	W A Turner	Statement
RC26	8.10.84	Bris	K K Wilson	Statement
RC27	8.10.84	Bris	A McEwen	Two Statements
RC28	9.10.84	Bris	T Toon	Map - Tietkens Plain - burial sites, vehicle, decontamination and camera sites - ref: SPT/RF/2
RC29	9.10.84	Bris	T Toon	Statement and telegram 25 March 1981 from I Morrison, Dept National Development and Energy; - Newspaper article Melbourne Age 21 June 1984 'UK paper claims mentally disabled used in tests'; - MMESA newsletter June 82 Vol.(1),1 and letters to Fraser 11 January 1983; 15 April 1983 Hawke; - J J J Boughen Statutory Declaration; - Letter Saxby AWRE to Dept Defence re: rad exposure 9 January 1982; - Letter 27 April 1982 T Toon to NSW Health Minister re: radiation readings Byron Bay; - Newspaper article 'Nuclear rad claim' Brisbane Courier Mail 1980; newspaper article 'The Tragic story of Col Bird', The Australian 23 March 1981; - Photograph RAAF Base Amberley 1955 men and plane; - Photographs taken at Maralinga and Emu during the British nuclear tests in 1956 of men, vehicles (damaged by explosion and normal), plutonium mixing sheds, One Tree, Water treatment Camp 43, canteen, Watson siding

RC30	9.10.84	Bris	J N Coolahan	Statement
RC31	9.10.84	Bris	L Edwards	Statement
RC32	9.10.84	Bris	B D Stein	Statement
RC33	9.10.84	Bris	H W H Puxty	Statement
RC34	10.10.84	Bris	M V Earner	Statement
RC35	10.10.84	Bris	K A N Freeman	Statement
RC36	10.10.84	Bris		Letter 5 March 1954 from Headlam to Secretary, Air Board re: Operation Totem - Consolidated Report (AFHQ Operation Instructions No. 4/53 para.21-3); - Report Operation Totem - Consolidated Report; - Report on RAAF Richmond participation - Operation Totem by Operation Commander RAAF Richmond; - ref: 28/14/AIR(99a) - RAAF Report on Operation Totem
RC37	10.10.84	Bris	R H Dash	Statement
RC38	10.10.84	Bris	D E Wilkinson	Statement
RC39	10.10.84	Bris	K F Dean	Statement
RC40	10.10.84	Bris	J F Watts	Statement
RC41	10.10.84	Bris	A H Baker	Statement
RC42	10.10.84	Bris	G R Townsend	Statement
RC43	10.10.84	Bris	B A Leane	Statement
RC44	11.10.84	Bris	-	Report on visit to examine radioactive contamination of RAAF Lincoln Aircraft - ref: CRB 2/54
RC45	11.10.84	Bris	C I Bird	Statement
RC46	11.10.84	Bris	C I Bird	Photographs of men with planes, tents, shower block
RC47	11.10.84	Bris	B A Leane	Notes - Atomic Physics Lecture
RC48	11.10.84	Bris	E C Van Munster	Statement
RC49	11.10.84	Bris	L J Collins	Statement
RC50	11.10.84	Bris	L J Collins	Map of Amberley - sheet 9442-27 Ed 1, Queensland 1:10 000 series. Topographic 1975
RC51	11.10.84	Bris	S L Ruffe	Statement
RC52	11.10.84	Bris	R A Crompton	Statement
RC53	11.10.84	Bris	B Hansen	Statement
RC54	11.10.84	Bris	W H Thomas	Statement
RC55	11.10.84	Bris	L R Walker	Statement
RC56	12.10.84	Bris	F H Grebert	Statement
RC57	12.10.84	Bris	G L Moore	Statement
RC58	12.10.84	Bris	R R Donald	Statement
RC59	12.10.84	Bris	G V McKay	Statement
RC60	12.10.84	Bris	A J Spring	Statement
RC61	12.10.84	Bris	E K Peck	Statement
RC62	12.10.84	Bris	E K Peck	Operation Hurricane - Training Report - ref: 5200/1/13, 9 January 1953 - Letter 21 December 1981 Air Force Health Services to Dr M Stevens re: RAAF medical reports; - Medical reports; - Fig. 1 Map of Monte Bello Islands
RC63	12.10.84	Bris	C G Zander	Statement
RC64	12.10.84	Bris	W L Davis	Statement
RC65	12.10.84	Bris	F V Steward	Statement
RC66	12.10.84	Bris	D P Heseltine	Statement
RC67	12.10.84	Bris	D P Heseltine	Letter 13 August 1984, Prof A M Clark, Chairman AIRAC to Minister for Home Affairs and Environment re: British Nuclear Tests in Australia and Kerr Report - letter 2 August 1984 Clark, Chairman AIRAC to Minister for Home Affairs and Environment re: Exposure of Australians to radiation at Maralinga - Letter 16 June 1983 R J Walsh, Chairman AIRAC to Minister for Home Affairs and Environment re: Radiation monitoring claims by D W Rickard

RC67	contd		- Assessment of statements made by Rickard on the standards of radiological safety at the Maralinga nuclear weapons tests range - Letter 9 July 1985 Prof C Kerr to Royal Commission - response to AIRAC letter 13 August 1984
RC68	13.10.84	Bris	F W Beitzel
RC69	13.10.84	Bris	H J Ollington
RC70	13.10.84	Bris	H J Ollington
RC71	13.10.84	Bris	F J Wilkinson
RC72	13.10.84	Bris	W H Bullus
RC73	13.10.84	Bris	F H C Coulson
RC74	13.10.84	Bris	L V Beevers
RC75	13.10.84	Bris	G C Yet Foy
RC76	13.10.84	Bris	R Francis
RC77	13.10.84	Bris	A Swenson
RC78	17.10.84	Bris	-
			Statement Statement Photograph of HMAS Hawkesbury Statements (11 October 1984, November 1980, 12 October 1983, and annexures) Statement Statements Statement Statement Statement Statement Statement Attachment 4, Letter DRE 6 October 1983, p.49 DRE file - Operation Hurricane - Trial Orders 1 September 1952; File 89/25/AIR - Operation Hurricane - Letter 20 January 1953 re: 86(T) Wing aircraft; - Report on Operation Hurricane; - Letter 23 October 1952 W Hely to Headquarters re: Operation Hurricane - detachments 82 and 86 Wing and 5 Airfield Construction Squadron; - Letter 3 October 1952 G Hartnell to RAAF Headquarters (HQ) - Operation Hurricane; - Telegrams 30 September 1952, 19 September 1952 re: crews at Amberley and Townsville; - Postagram 25 September 1952 re: receipt Order 5/52; - Operation order 4/52 Operation Hurricane; - Telegram 24 September 1952 re: crew detachment; - Telexes 19 September 1952, 11 September 1952, 8 September 1952, 15 September 1952, 16 September 1952 re: crew detachments No. 82(B) Wing - Operation order No. 3/52 - Operation Hurricane; Dept Air File 60.501.287 - Minutes 1 August 1952, 10 July 1952, 11 July 1952; - Air Force Headquarters (AFHQ) Operation Instruction No. 4/52 Operation Hurricane (series 2); - AFHQ Operations Instruction No. 3/52; - AFHQ Operations Instruction No. 5/52 (series 3); - AFHQ Operations Instruction No. 4/52 (series 2); - Postagram 4 September 1954; - AFHQ Operations Instruction Nos 3/52 and 4/52 - Operation Hurricane Statement Statement Statement Statement File - Dept of Army B84/700 - Letter April 1954 re: Radiation doses received by Australian personnel Australian Military Forces; - Minute 3 December 1953 from Air Vice Marshal Daley, Radiological Health during Operation Hurricane (Monte Bello Island October/November 1952) and Totem (Emu Claypan October/November 1953); - Letter 21 October 1953 Daley from A D Wilson re: Lincoln aircrew; - Report Operation Hurricane by Air Officer Commanding Western Area, RAAF; - Part 1 Air Operations; - Part 3 Comments upon Operation Hurricane, Director General, Medical - Letter 19 March 1954 Daley to Director General Medical Services re: Radiological Health during Operation Hurricane 1952 and Totem 1953; - Radiation Safety Orders Letter 10 November 1953 W Watson to Headquarters (HQ) Home Command re: Radioactivity - Operation Totem Statement
RC79	17.10.84	Bris	W R Bovill
RC80	17.10.84	Bris	W A Edwards
RC81	17.10.84	Bris	G O J Rogers
RC82	17.10.84	Bris	W S Aivalent
RC83	18.10.84	Bris	
RC84	18.10.84	Bris	D F Lloyd

RC85	18.10.84	Bris	D F Lloyd	Protective clothing
RC86	18.10.84	Bris	D F Lloyd	Map of Tietkens Plain - Location of Health Physics sites - ref: SPTRF2
RC87	18.10.84	Bris	G W Lang	Statement
RC88	19.10.84	Bris	A Gabli	Statement medical report and four photographs
RC89	19.10.84	Bris	R E Naggs	Statement
RC90	19.10.84	Bris	G E Suffling	Statement
RC91	19.10.84	Bris	J W Partridge	Statement
RC92	19.10.84	Bris	K J Woodland	Statement
RC93	19.10.84	Bris	N J Kendall	Statement
RC94	23.10.84	Sydney	A A Andrews	Statement
RC95	24.10.84	Sydney	K Therkelsen	Notes
RC96	24.10.84	Sydney	J M Crosbie	Statement
RC97	24.10.84	Sydney	G Forbes	Statement
RC98	24.10.84	Sydney	R F Phillipson	Statement
RC99	24.10.84	Sydney	B J Elletson	Statement
RC100	25.10.84	Sydney		Commonwealth files - Native Welfare - Reports and Correspondence
				- R022.001 SA 5288-1-4 - Anthropological findings at Mabel Creek Station SA
				- R022.002 SA 5288-1-2 Part 1 - Maralinga Area;
				- R022.004 SA 5288-1-3 - Giles Area;
				- R022.005 SA 5288-1-1 Part 2 - Giles Area;
				- R022.003 SA 5288 Parts 1 and 2 - Welfare of Aborigines;
				- R022.006 SA 5288-1-1 - Film Record of Aboriginal life;
				- R022.007 SA 5288-1-1 - General;
				- R022.010 SA 5288-1-1 Part 2 - General;
				- R022.009 SA 5288-1-1 Part 3 - General;
				- R008.003 81/254 Part 3 - Atomic Weapons Test - Health Effects
RC101	25.10.84	Sydney		Letter 10 September 1957 J Weightman to C E Bartlett
RC102	25.10.84	Sydney	R R Beaver	Statement
RC103	25.10.84	Sydney	B W McCloskey	Statement and photographs - protective clothing, vehicles, shelter, balloons, towers
RC104	26.10.84	Sydney	J R Broadbent	Statement
RC105	26.10.84	Sydney	A J Melville	Statements
RC106	26.10.84	Sydney	J Palfreyman	Statements
RC107	26.10.84	Sydney	R E Cosgrove	Statement and photographs - atomic cloud
RC108	26.10.84	Sydney	J A Baker	Statement and photographs - tanks
RC109	30.10.84	Melb	R Marqueur	Statement
RC110	30.10.84	Melb	H W Taylor	Statement
RC111	30.10.84	Melb	R Turner	Statement
RC112	31.10.84	Melb	T F Tooke	Statement
RC113	31.10.84	Melb	T R Brindley	Statement
RC114	1.11.84	Melb	F H Jones	Statement
RC115	1.11.84	Melb	G H Lamey	Statement
RC116	1.11.84	Melb	G D Newgreen	Statement and notebooks - Decontamination: Clothing, vehicles and health physics
RC117	1.11.84	Melb	K J Ryan	Statement
RC118	1.11.84	Melb	M Newman	Statement
RC119	2.11.84	Melb	M Freeman	Statement and Curriculum Vitae
RC120	2.11.84	Melb	M Freeman	Map - Maralinga Atomic Proving Ground - Fig. 1. October 1984
RC121	2.11.84	Melb	M Freeman	Series of plans - Maralinga - Plan and elevations, Layout Maralinga Village - sheet 1 - west side, sheet 2 east side, watermains - Parts 1 and 2, Foul sewers Parts 1 and 2, plant in power station;
				- Collector mains from Bore Holes; airstrip with DC and RB areas;
				- Test area layout, sheets 1 and 2; 'NAYA';
				- 'Roadside', pipe services;
				- Recovery tank in building BL/12;

RC131 Contd Part 6 - R029.211 - 18th Meeting 29.3.72; 190 - 2.6.72 (Agenda only); 191 - 17.7.72; 192 - 27.7.72; 193 - 21.8.72; 194 - 29.9.72; 195 - 23.10.72; 196 - 7.12.72; 197 - 24.1.73; 198 - 19.2.73; 199 - 26.3.73 (Agenda only); 200 - 12.6.73 (Agenda only); 201 - 17.7.73 (Agenda only)

RC132 7.11.84 Melb J F Ronan Statement
RC133 7.11.84 Melb R H Scott Statement
RC134 7.11.84 Melb R J Dennis Statement
RC135 7.11.84 Melb E J Hillam Statement
RC136 7.11.84 Melb A G Crossfield Statement
RC137 7.11.84 Melb G A H Lang Statement
RC138 7.11.84 Melb B P Edwards Statement
RC139 7.11.84 Melb B L Robertson Statement
RC140 13.11.84 Sydney O H Turner Statement and photographs - Aboriginal woman and child for decontamination, Pom Pom Health Control 14 May 1957

RC141 15.11.84 Sydney O H Turner **Monthly Health Physics Reports - Maralinga - Preface with distribution list:**
- R32.1-32.9 1956-57, Nov 1959, Dec 56-Jan 57, Feb, Mar, Apr/May, June, July, Aug, Sept, Oct, Nov, Dec 57-Jan 58;
- R32.10-32.19 1958-59 - Feb, Mar/Apr, May, June, July, Aug, Sept, Oct, Nov, Dec/ Jan 58-59;
- R32.20-30 - Feb 59, Mar, Apr, May, June, July, Aug, Sept, Oct, Nov, Dec 59/Jan 60;
- R32.31-40, 1960 - Feb, Mar/Apr, May, June, July, Aug, Sept, Oct, Nov;
- R32.41-51, 1961-62 - Feb, March, Apr, May, June, July, Aug, Sept, Oct, Nov, Dec 61-Jan 62;
- R32.52-62, 1962- Feb, Mar, Apr, May, June, July, Aug, Sept, Oct, Nov,
- R32.63-76, Dec 62-Jan 1963, Feb, Mar, Apr, May, Jun, Jul, Aug, Sept, Oct, Nov, Dec 1963-Jan 1964
- R32.77-85, 1964 - Feb, Apr, May, June, July, Aug, Sept, Nov 56-Dec 64, Oct-Dec 64.
Commonwealth X-Ray and Radium Laboratories files: 950/2; 950/3; R/1/1
Series of documents shown to Turner during preparation of statement:
- Letter 21 January 1956 Turner to J Richardson re: trip Coober Pedy, classifications, duties of Health Physics teams;
- Letter 4 December 1956, R30.41, Secretary Supply to Director, Dept Health re: Continental Rad Measurements;
- Meetings - Health Physics Requirements at Maralinga during Inter-trial periods 8 October 1956;
- Letter 9 November 1956, R40.43 Turner to Richardson re: Appointment as Australian Health Physics Representative;
- Letter 16 January 1957 Turner to Richardson re: Security Classifications, UK accepted standards, rabbits, staffing;
- Letter R30.43 Turner to Richardson Health Physics Report February 1957;
- Letter to Turner 20 February 1957 re: Report;
- List Radiation Detection Unit (RDU) Members;
- Letter 12 February 1957 G C Dale to Turner re: Report;
- Letter Turner to Dale - Reply;
- Letter 31 May 1957 Turner to Range Commander re: Report on Kangaroos in Woomera Area;
- Letter 18 May 1957 Turner to Range Commander re: Health Physics Report on Natives at Pom Pom - 14 May 1957;
- Letters 27 March 1957, 25 July 1957 Turner to Richardson;
- Duties of Health Physics Team during Inter-trial period;
- Letter 11 November 1957 D J Stevens to Turner re: duties, film badges;
- Extract from Letter to Turner, 28 November 1957;
- Letter 9 January 1958 D J Stevens to G Dale;
- Letter 24 January 1958 Dale to Stevens;

RC142 15.11.84 Sydney O H Turner
RC143 15.11.84 Sydney O H Turner

RC143	Contd			<ul style="list-style-type: none"> - Letter 20 June 1958 to Director AWRE re: Radioactive Contamination from DC12 on area off road to Maralinga Village and Future Disposal; - Letter 27 June 1958 Turner to Director AWRE re: DC12 Filter Change; - Letter 11 July 1958 Turner to Director AWRE re: Cobalt 60 Pellets in Tadge Area; - AHP/17/4 Measurements made on 7-8 July 1958 Cobalt 60 beads from Tadge 0/7; - Letter 1 December 1958 Turner to Director AWRE; - Letter 24 July 1958 Turner to Range Commander re: Disposal of Radio-active pellets; - Letter 12 August 1958 to Turner re: Letter 11 July 1958; - Letter 25 June 1959 Turner to Director CXRL re: Assessment Tests - Maralinga 1959; - Letter 10 November 1959 to Turner re: Letter 2 November 1959; - Letter 23 November 1959 to Turner ; - Letter 9 December 1959 Turner to Richardson; - Letter 28 February 1960 Turner to Richardson; - Letter 18 January 1960 Turner to Richardson re: Courses for Servicemen; - Letter 26 January 1960 Turner to Richardson re: Further RDU Course; - Notes on interview with Turner at CXRL; - Letter 28 July 1960 Turner to Richardson; - Letter 7 September 1960 Director to Turner re: University of Adelaide disposal of radioactive waste; - Letter 23 March 1960 Turner to Range Commander re: Health Physics Programme Pending Maralinga Experimental Programme (MEP); - Health Physics Staff and Programme 1962; - Letter February 1964 Secretary to Director General Dept Health re: Australian Health Physics Control at Maralinga; - Letter 31 May 1962 Turner to Range Commander re: Long-term Protection and Marking of radioactive areas and Report 'The Protection and Marking of radioactive areas at Maralinga'; - Letter 12 February 1964 Director to Director General of Health re: Health Physics (HP) - Position of Australian Health Physics Representative
RC144	15.11.84	Sydney	D W Rickard	<ul style="list-style-type: none"> Statement and further documentation: - Note on Film Badges; - Thyroid Iodine 131 measurements, Quartz, Fibre Dosimetres, desert hot spots; - Letter 8 June 1977 Personnel Officer to Turner re: Radiation records Rickard; - Letter 17 February 1977 Dept of Defence to Australian Institute of Marine Science re: Rickard; - Letter 2 February 1977 Personnel Officer to AWRE re: Rickard - Rickard - Record of Employment On Atomic Tests; - Article from the Principles and Practices of Medicine; - Letter 22 December 1982 On G Arthur to Commission for Employees Compensation re: Rickard U/N 539012; - To whom it May Concern from Turner; - Compensation (Commonwealth Government Employees) Act 1971, Claim
RC145	19.11.84	Adel	Mrs E Giles	Statement
RC146	19.11.84	Adel	I Dutschke	Statement and Slides - Aborigines on roadway
RC147	19.11.84	Adel	B Gerdson	Statement
RC148	20.11.84	Adel	T Murray	Statement and Map of Restricted Flying Area 1961, photographs - cloud, aerial of village animal skins - ref: SPT/RF/232/6
RC149	20.11.84	Adel	E A Mizon	Statement
RC150	21.11.84	Adel	B G Lindner	Statement
RC151	21.11.84	Adel	J Scott	Statement
RC152	21.11.84	Adel	N C O'Brien	Statement
RC153	21.11.84	Adel	D Sowton	Statement
RC154	21.11.84	Adel	R J Kennedy	Statement and photographs
RC155	22.11.84	Adel	E H Bailey	Letter 14 September 1984 E H Bailey to Royal Commission

RC156	22.11.84	Adel	R Tennigkeit	Statement
RC157	22.11.84	Adel	C Windle	Statement
RC158	22.11.84	Adel	Mrs C May	Statement and health record, letters to AWRE
RC159	23.11.84	Adel	DR J Coulter	Statement and Article 'Radiation and genetic toxicity - Legal Questions without an answer' Author: J Coulter, published in 'Legal Service Bulletin October 1984'
RC160	23.11.84	Adel	A F Tomkins	Statement
RC161	23.11.84	Adel	P Press	Statement
RC162	23.11.84	Adel	E Burke	Statement
RC163	28.11.84	Adel	C Hudson	Statement and copies of 'Bulldust' magazine
RC164	28.11.84	Adel	C E Arnold	Statement
RC165	28.11.84	Adel	Prof Clarke	Correspondence: Letter 15 January 1981 Assist Secretary, Dept National Development and Energy (DNDE) to Secretary AIRAC re: Investigations into effects of UK atomic tests in Australia;
				- Letter 19 November 1980 J L Carrick to Hon R J Ellicot re: AIRAC assistance in investigations into UK atomic tests;
				- Request 28 October 1980 AIRAC from Minister for National Development and Energy
				- Letter 8 September 1980 Carrick to Hon D Thomson, Minister for Science and Environment re: AIRAC assistance in investigation into UK atomic tests;
				- Draft 10 May 1983 - Summary Record of the Meeting between the Minister B Cohen and Walsh and G M Watson of AIRAC
RC166	29.11.84	Adel	J Bradley	Statement
RC167	29.11.84	Adel	F W Bingham	Statement
RC168	29.11.84	Adel	J A Conlon	Statement
RC169	29.11.84	Adel	A J Elliott	Statement
RC170	29.11.84	Adel	A J Hudson	Statement and photographs - target response; planes, diagram - firing platform
RC171	29.11.84	Adel	N Novello	Statement
RC172	29.11.84	Adel	F W Budden	Statement
RC173	29.11.84	Adel	R J Withers	Statement
RC174	29.11.84	Adel	M D Jellie	Statement
RC175	29.11.84	Adel	L F Addy	Statement and photographs - planes, tents, etc.;
				- Security Instructions No. 10 - Basic Security Rules
RC176	30.11.84	Adel	N L Williams	Statement
RC177	30.11.84	Adel	L M Smith	Statement
RC178	30.11.84	Adel	R J Golding	Statement
RC179	30.11.84	Adel	P T R Potter	Statement
RC180	30.11.84	Adel	J Gaghan	Statement
RC181	30.11.84	Adel	M F Justice	Statement
RC182	30.11.84	Adel	K A Stephens	Statement
RC183	30.11.84	Adel	T Brougham	Statement
RC184	30.11.84	Adel	G A Stirna	Statement
RC185	30.11.84	Adel	W L Hammond	Statement
RC186	30.11.84	Adel	L G Angel	Statement
RC187	30.11.84	Adel	F J Sanders	Statement
RC188	30.11.84	Adel	G P Hein	Statement
RC189	30.11.84	Adel	K Wroblewski	Statement
RC190	30.11.84	Adel	K A Murphy	Statement
RC191	30.11.84	Adel	C J Williams	Statement
RC192	30.11.84	Adel	A Bulman	Statement
RC193	30.11.84	Adel	L M Andrews	Statement
RC194	30.11.84	Adel	M A Marchioro	Statement
RC195	30.11.84	Adel	J Lightbody	Statement
RC196	30.11.84	Adel	C Nunn	Statement
RC197	30.11.84	Adel	R A Jones	Statement
RC198	30.11.84	Adel	G L Bailey	Submission

RC199	30.11.84	Adel	Mrs A Newgrain	Submission
RC200	30.11.84	Adel	A Ruff	Statement
RC201	30.11.84	Adel	J N Brown	Statement
RC202	3.1.85	Lond	J G Berry	Statement
RC203	3.1.85	Lond	G W Wilson	Statement and photograph
RC204	3.1.85	Lond	C W Campbell	Statement
RC205	3.1.85	Lond	G E Mabutt	Statement
RC206	3.1.85	Lond	C H Donne	Statement
RC207	3.1.85	Lond	C E Tomlinson	Statement
RC208	3.1.85	Lond	B J Perkins	Statement
RC209	4.1.85	Lond	S D Henderson	Statement
RC210	4.1.85	Lond	P A Lowe	Statement
RC211	4.1.85	Lond	D E Tilling	Statement
RC212	4.1.85	Lond	G Owen	Statement
RC213	4.1.85	Lond	S Fletcher	Statement
RC214	4.1.85	Lond	R Kyle	Statement
RC215	4.1.85	Lond	A Sinclair	Statement
RC216	4.1.85	Lond	N Hall	Statement
RC217	4.1.85	Lond	R Nettley	Statement and correspondence, medical opinion of Dr A Johnson relating to R Nettley
RC218	4.1.85	Lond	E Lamerton	Statement
RC219	4.1.85	Lond	K Syder	Statement
RC220	7.1.85	Lond	B N Roberts	Statement
RC221	7.1.85	Lond	N O'Fee	Statement
RC222	7.1.85	Lond	M H Stephens	Statement and photographs (Hurricane)
RC223	7.1.85	Lond	R G Southwell	Statement
RC224	7.1.85	Lond	T W Taylor	Statement
RC225	7.1.85	Lond	F Dent	Statement
RC226	7.1.85	Lond	J F Collier	Statement
RC227	7.1.85	Lond	R H Angwin	Statement
RC228	10.1.85	Lond	Lord Penney	Statement
RC229	11.1.85	Lond	Lord Penney	Documents - UK Atmospheric Nuclear Tests in Australia and at Christmas Island 1952-58, 20 March 1984; - UK Atmospheric Tests in Australia October 1952-October 1957, 28 January 1983
RC230	11.1.85	Lond	Lord Penney	Atomic Energy Authority Act 1954 (UK)
RC231	11.1.85	Lond	Lord Penney	Operation Hurricane - Report of Naval Commander
RC232	11.1.85	Lond	Lord Penney	Operation Totem - Summary Plan (Part 1), Diagrams (Part 2)
RC233	11.1.85	Lond	Lord Penney	Mosaic - Monte Bello Atomic Tests - 1956. Report by Operational Commander
RC234	11.1.85	Lond	Lord Penney	Report T8/57 - Operation Buffalo, Meteorological Services, Vol. 2: Phillipot
RC235	11.1.85	Lond	Lord Penney	Report T33/54 - Operation Hurricane Group Reports (Part 45) - Quartz Fibre Dosimeter Trials on Operation Hurricane: Williams, Luxford
RC236	11.1.85	Lond	Lord Penney	Report T107/54 - Operation Hurricane Group (Part 55) - Decontamination of Personnel and Equipment: Luxford, Halliday, Lavender
RC237	11.1.85	Lond	Lord Penney	Report T7/54 - Operation Totem - Radioactive Sampling - Deposited Activity: Cambray, Munnock
RC238	11.1.85	Lond	Lord Penney	Report T4a/55 - Operation Totem - Survey of residual Contamination from Operation Totem (supplement): Gaskell, Saxby
RC239	11.1.85	Lond	Lord Penney	Report T106/54 - Operation Totem - The Prevention and Removal of Radioactive Contamination Part 6. Decontamination of Aircraft and Health Control at Woomera and Amberley: Austin
RC240	11.1.85	Lond	Lord Penney	Report T3/54 - Operation Totem - Canberra Flight Report, October 53 (Operation Hotbox): Wilson
RC241	11.1.85	Lond	Lord Penney	Report T23/57 - Operation Mosaic - Air Blast Measurements: Potter, Purdie
RC242	11.1.85	Lond	Lord Penney	Report T11/57 - Operation Buffalo - The dose received at various parts of the body by a man walking over contaminated ground: Barnaby

RC243	11.1.85	Lond	Lord Penney	Report T52/57 - Operation Buffalo - Measurements of Airborne Radioactivity and Ground Contamination at 15 and 200 miles from Ground Zero (GZ): Carter
RC244	11.1.85	Lond	Lord Penney	Report T51/57 - Operation Buffalo - The aerial survey of radioactivity deposited on the ground: Clay
RC245	11.1.85	Lond	Lord Penney	Report T22/57 - Operation Buffalo - Decontamination Group Report Parts 1-4: Stevenson
RC246	14.1.85	Lond	Lord Penney	Report T12/54 - Operation Totem - Meteorological Services: Westwater, Freeman
RC247	14.1.85	Lond	Lord Penney	Report A32 - High Explosives Research - Materials and Physical Research Division (HER)
RC248	15.1.85	Lond	Lord Penney	Report T44/54 - Operation Hurricane Group Reports (Part 46) Summary Report on Biological Experiments: Butterfield
RC249	21.1.85	Lond	A E Walkling	Statement
RC250	21.1.85	Lond	A E Walkling	Operation Hurricane - Report of the R H Division: Walkling
RC251	21.1.85	Lond	A E Walkling	Report T14/54 - Operation Hurricane Group Reports (Part 41). The Decontamination of Radioactive Clothing. I. Preliminary Survey: Austin, Stevenson
RC252	21.1.85	Lond	A E Walkling	Report T15/54 - Operation Hurricane Group Reports (Part 42). The Decontamination of Radioactive Clothing. II. Laboratory Investigations: Stevenson
RC253	22.1.85	Lond	W T Roach	Statement and Report - Transport of Debris from the British Nuclear Test in S A on 15 October 1953 - Commentary on SDTN 8/84 by W N Saxby 18 September 1984
RC254	22.1.85	Lond	W T Roach	Diagram showing likely Fall-out from Totem cloud
RC255	28.1.85	Lond	D E Barnes	Statement and papers <ul style="list-style-type: none"> - Estimation of Emergency tolerances for fission products in air and water; - International Recommendations on Radiological Protection Vol. 24, No. 277, January 1951; - Recommendations of the International Commission on Radiological Protection. British Journal of Radiology 1955, Supplement No. 6; - Recommendations of the International Commission on Radiological Protection. Adopted 9 September 1958 - A second report to the Medical Research Council: The Hazards to Man of Nuclear and Allied Radiations, December 1960; - Documents relating to radiation dosage levels; - AWRE Report: Maximum Permissible Dose for Weapons Trials: Barnes
RC256	28.1.85	Lond	D E Barnes	Report TS75/20 - Fall-out of Contamination from the Monte Bello explosion: Criteria for Firing; <ul style="list-style-type: none"> - Report - Recommendations on maximal permissible exposures to radiation for the division of atomic energy (production): Edson; - Report H.18 - Health Monitoring at Hurricane: Barnes, Walkling, Maddock, Marshall, Adams; - Report H.27 - Health control vessel for 'Hurricane': Walkling; - Note H.32 - Radiation hazards in Operation Hurricane, with reference to the Safety Distances to be laid down in advance for various stages of the operation: Walkling; - Maximum permissible dosages to be taken by participating teams in Operation Hurricane; - PABE 39 - Meeting 11, (15 August 1951) Medical Research Council; - Letter Penney to J M Wilson re: Radiation dosage - Minute 22 October 1951, Radiation Dosage by W G Penney; - MRC 50/795 PABE 26, Allowable doses of radiation; - Record of a discussion on Radiation Safety 12 September 1951; - Letter 21 November 1951 Operation Hurricane Radiation Dosage from J M Wilson; - Letter 20 September 1951 P Brooking from Torlesse; - Paper E16 Operation Hurricane Rad Dosage; - TP Report 17/51 - The Possibility of Radioactive Contamination of the Australian Mainland as a Result of Operation Hurricane: Woodcock; - Letters E5 - 20 February 1952 Admiralty to Minister of Supply - E6 - 29 February 1952 M Kinsella to Director General RAF Medical Services - E4 - 14 January 1952 F C Wickson to Torlesse

RC256	Contd			- E6A - 14 November 1951 N Langdon, Lloyd to L2 Shell MEX House, Rm 967, Ext 1087 - E8 - 5 March 1952 G P O'Connell to Minister of Supply - E7 - 6 March 1952 Army Medical Services to Minister of Supply - Memo 20 March 1952 Operation Hurricane - Decontamination; - E10 - Fall-out contamination criteria for firing: Barnes; - Memo E12 - 22 May 1952 Fall-out contamination - criteria for firing: Tyte - Message E7A 5 July 1952 - monitoring surveys - E8A - Admiralty to CTF4 - monitoring surveys - E9 30 July 1952 - Letter Penney to W Wilkinson - E9A Letter 30 July 1952 Penney to US (EO) Operation Hurricane - Radiation dosage - Note and reply 7 August 1952; - E11 8 August 1952 Memo by M Kinsella; minute
RC257	29.1.85	Lond	Prof Radford	Report - Cancer risks from Ionising Radiation: Radford, Technology Review, November/December 1981
RC258	29.1.85	Lond	Prof Radford	Report - Human Health Effects of Low Doses of Ionising Radiation - The BEIR 3 Controversy: Radford
RC259	29.1.85	Lond	Prof Radford	Report - Statement concerning Proposed Federal Radiation Protection Guidance for Occupational Exposures
RC260	29.1.85	Lond	Prof Radford	Report - 'Scientific Controversy and the Public Domain': Radford, in Technology Review November/December 1981
RC261	29.1.85	Lond	Prof Radford	Report TC9/55 - Fall-out from an Atomic Cloud: Hicks, McDougall, Matthewman, Beale
RC262	29.1.85	Lond	Prof Radford	Report O-35/56 - Dose rates from ground contamination with residual radioactive materials from an atomic explosion: Dale, Bomyer
RC263	31.1.85	Lond	Adml Martell	Statement
RC264	31.1.85	Lond	Adml Martell	Letter 12 June 1956 W Cook to Vice Admiral Clifford re: AWTSC and firing conditions for G2
RC265	31.1.85	Lond	Adml Martell	Minutes of Meetings - Atomic Weapons Trials Executive 11 July 1956, 7 December 1955, 5 October 1955
RC266	31.1.85	Lond	Adml Martell	Article - Radioactive Fall-out in Australia from Operation Mosaic: Butement, Dwyer, Eddy, Martin, Titterton, Australian Journal of Science 20:5 December 1957, incorporated in RC 547
RC267	31.1.85	Lond	Adml Martell	Minutes of Meeting 28 June 1956: C A Adams, A L Martell, G W Tory, Rouse
RC268	31.1.85	Lond	Adml Martell	Record of Commodore Special Squadron; - Firing of Weapon G2 'Glimmer' and 'Flashlight' orders
RC269	1.2.85	Lond	G C Dale	Statement
RC270	4.2.85	Lond	G C Dale	Report T24/57 - Operation Mosaic - Theoretical Predictions: Matthewman
RC271	4.2.85	Lond	G C Dale	Report T45/58 - Operation Antler - Health Physics Services: McDougall, Lexford-Wetch, Douglas
RC272	4.2.85	Lond	G C Dale	Report T40/58 - Operation Antler - Aerial survey of radioactivity deposited on the ground: Carter
RC273	4.2.85	Lond	G C Dale	Report O-26/59 - Suggested safety levels for contamination from fission product Fall-out: Dale
RC274	4.2.85	Lond	G C Dale	Report O-41/55 - Safety levels for contamination from Fall-out from atomic weapons trials: Dale
RC275	4.2.85	Lond	G C Dale	Report T6/55 - Operation Totem - The response of high range quartz fibre dosimeters: Williams
RC276	4.2.85	Lond	G C Dale	Report T40/57 - Operation Buffalo - The measurement of radiation dose-rates from Fallout: Howes, Peirson
RC277	4.2.85	Lond	G C Dale	Report T4/55 - Operation Totem - The survey of residual contamination from Operation Totem: Gaskell, Saxby
RC278	4.2.85	Lond	G C Dale	Report T1/56 - Operation Totem - The dust hazard during Operation Totem: Carter
RC279	4.2.85	Lond	G C Dale	Report T50/54 - Radiac dosimeters tested under field conditions during Operation Totem: Carr

RC280	4.2.85	Lond	G C Dale	Report T104/54 - Operation Totem - The prevention and removal of radioactive contamination: Austin, Stevenson
RC281	4.2.85	Lond	G C Dale	TPN124/55 - A reanalysis of Fall-out data for Totem: Beale (Copy No. 31)
RC282	5.2.85	Lond	G C Dale	Booklet - Radiological Safety Regulations Maralinga - ref: RSRM/56(5), Fifth Edition 29 March 1956, issued by AWRE
RC283	5.2.85	Lond	G C Dale	Instruction Manual - Australian Continental Fall-out Sampling, AWRE Aldermaston, Berkshire, February 1956
RC284	5.2.85	Lond	G C Dale	TPN78/55 - Predictions of ground contamination at Operation Mosaic: Hicks, McDougall, Matthewman
RC285	5.2.85	Lond	G C Dale	Report T52/54(X) - Operation Totem - Gamma radiation measurements in field trials: Dale
RC286	5.2.85	Lond	G C Dale	Report No. T34/58 - Operation Antler - Gamma dose - distance measurements: Carr
RC287	5.2.85	Lond	G C Dale	Report T33/57 - Operation Mosaic - aircraft decontamination: Stevenson
RC288	5.2.85	Lond	G C Dale	Report T49/57 - Operation Buffalo - The radiation survey of ground deposited radio-activity: Rae
RC289	5.2.85	Lond	G C Dale	Report T45/54 - Operation Totem - Group Report, Group 8 Radiation hazards and measurements - Preliminary report on nuclear radiation measurements by RH group at Operation Totem: Stewart
RC290	5.2.85	Lond	J A Hole	Statement
RC291	5.2.85	Lond	H G Carter	Statement and Report T21/57 - Operation Mosaic - Radiological Group Report: Hole; - Report Personnel Monitoring and General Film Dosage Teams RH4, RH6: Hole; - Mosaic Joint Trial Order No. 12 - Rad safety regulations for Trimouille Island 26 March 1956; - Special Squadron Memo No. 3, 24 April 1956
RC292	6.2.85	Lond	J A Hole	Maps (a) Appendix A to Operation Mosaic Summary of Operations for G1 and G2, July 56
RC292	6.2.85	Lond	J A Hole	(b) Appendix D to Operation Mosaic Summary of Operations for G1 and G2, July 56
RC293	6.2.85	Lond	J A Hole	Memo 4 May 1956 Scientific Superintendent to Commodore Special Squadron re: Radiological hazard precautions in HMS Diana and attached comments on a visit to HMS Diana to discuss protective measures
RC294	7.2.85	Lond	H J Gale	Statement
RC295	11.2.85	Lond	D A Wilson	Statement and Article - Some aspects of aviation medicine in regard to radiological hazards: Group Captain D Wilson, Wing Commander D H Dhenin: in Proceedings of the Royal Society of Medicine Vol. 48, Unites Services Section, 7 October 1954
RC296	11.2.85	Lond	D A Wilson	Letter 10 April 1952 to Air Officer Commanding Eastern Area RAAF, from Air Vice Marshall Hancock re: Operation Hurricane - Long range air sampling
RC297	11.2.85	Lond	R A Siddons	Statement and two Articles: - The Prediction of Fall-out at Totem 1: R A Siddons, 6 February 1985 - Long Range Safety Aspects for Totem 2, ref: Totem Planning 0261 Part 3B: J T Tomblin, 25 October 1953
RC298	13.2.85	Lond	R A Siddons	Report T54/57 - Operation Buffalo - The hazards to aircrew flying through atomic cloud: Holmes
RC299	13.2.85	Lond	R A Siddons	Report T25/58 - Operation Buffalo - Theoretical predictions of cloud height and Fall-out: Hicks, MacDougall
RC300	13.2.85	Lond	R A Siddons	Report T4/58 - Operation Antler - Theoretical predictions: Siddons, Sams
RC301	13.2.85	Lond	R A Siddons	Report H7/53 - Dose rates from ground contaminated with fission products of U235 and Pu239: Dale, Kendell, McKendrick
RC302	13.2.85	Lond	R Fotheringham	Statement
RC303	13.2.85	Lond	M H Freeman	Statement
RC304	14.2.85	Lond	D H Peirson	Statement
RC305	14.2.85	Lond	R A Siddons	Statement and graph of replotted predicted centre-line ground contamination in micrograms per square metre one hour after burst; - Diagrams of downwind danger areas, same adjusted for 10 kt burst;

RC305	Contd			- Totem 1 data - all originally presented in A32.
RC306	14.2.85	Lond	D H Peirson	Report T113/54 - Operation Hurricane Group Reports (Part 52) - The results of aerial radiological survey over the Australian coastline between Onslow and Broome; Peirson
RC307	14.2.85	Lond	D H Peirson	Report T6/54 - Operation Totem - Radioactive sampling and analysis report: Gale
RC308	14.2.85	Lond	D H Peirson	Report T88/54 - Operation Hurricane Group Reports (Part 50) - The collection of radioactive cloud samples by aircraft sweeps: Gale, Crooks
RC309	14.2.85	Lond	D H Peirson	Report T28/57 - Operation Buffalo - Measurement of radioactivity of water contaminated by Fall-out: Peirson, Sinton, Howes
RC310	14.2.85	Lond	D H Peirson	Letter 29 September 1955 C Adams to D Black re: TPN78/55
RC311	18.2.85	Lond	W T Roach	2nd statement with Revised Model Computations - Emu 15 October 1953;
RC312	18.2.85	Lond	W T Roach	- Supplementary to second statement - Results of hotspot experiments Letter 6 April 1983 Sir J Mason to F Morgan; - Article B1 - D/Met 09/16/2/3 Transport of debris from nuclear tests in SA on 15 October 1953; - B2 - D/Met 014/11/4/1B Maralinga - Britain's Atomic Legacy: Carson; - B3 - Measurement of the dispersion of a smoke plume at large distances from the source: Bigg, Ayres, Turvey; - C - Transport of debris from the British nuclear test in SA 15 October 1953 (Draft); - D1 - The estimation of the dispersion of windborne material: Pasquill; The Meteorological Magazine, Vol. 90, No. 1063, February 1961 - D2 - The development of a dry inversion-capped convectively unstable boundary layer: Carson, Quarterly Journal of the Royal Meteorological Society, Vol. 99, No. 421, July 1973
RC313	19.2.85	Lond	R A Siddons	Extract - Report T2/77 - Mosaic 2 - General Information
RC314	19.2.85	Lond	R A Siddons	Extract - 'Effects of Nuclear Weapons' - 1964
RC315	19.2.85	Lond	D G Vallis	Statement
RC316	20.2.85	Lond	D G Vallis	TPN58/56 - An alternative theory for the amount of ground contamination from Fall-out at medium ranges following an atomic explosion: Beale
RC317	20.2.85	Lond	C A Beck	Statement
RC318	20.2.85	Lond	W G McDougall	Statement
RC319	21.1.85	Lond	D G Stevenson	Statement
RC320	22.2.85	Lond	D G Stevenson	Report T63/57 - Operations Mosaic and Buffalo - The handling, servicing and decontamination of radioactive aircraft: Stevenson
RC321	22.2.85	Lond	D G Stevenson	Report T7/60 - Operation Antler - Decontamination Group Report (Parts 1-3): Wells, Sinclair, Shore
RC322	22.2.85	Lond	D G Stevenson	Report Operation Antler - Atomic Trials August-October 1957 - Air Task Group Technical Report Copy No. 23
RC323	22.2.85	Lond	J Austin	Statement
RC324	22.2.85	Lond	J Austin	Letter 12 March 1954 Cook to Squadron Leader Thomas; - Personnel radiation doses on Totem 2 March 1954
RC325	25.2.85	Lond	E Drake-Seager	Statement and attachments: - Copy of Indoctrinee Force Commanders Report December 1956; - Indoctrinee Force - Note on the radiation levels experienced by its members in the Buffalo series tests 1956; - Buffalo 1956 - Indoctrinee Force - Summary of trials activities; - Buffalo - Summary Plan - Section B29 Indoctrinee Force; - Report 9/57 - The value of live indoctrination at a nuclear weapon trial; - Note on result of request for volunteers to help with site programme; - Buffalo - Review of target response tests; - Copy instructions E R Drake-Seager to Lieutenant Colonel Peach - Film badges, health escorts 17 August 1956
RC326	25.2.85	Lond	E Drake-Seager	Report T1/57 - Operation Buffalo - Target response tests: (Co-ordinator E R Drake-Seager; The construction and operation of a field radiological decontamination centre: Janisch

RC327	25.2.85	Lond	E Drake-Seager	Report T2/57 - Operation Buffalo - Target response tests: Drake-Seager; Field trials of radiac instruments in a radioactively contaminated area: Janisch
RC328	25.2.85	Lond	Seager	Report T6/63 - Operation Buffalo - Target response tests: Drake-Seager; Ordnance Group Leader Lieutenant Colonel J N N Hearner; - Part 2 - Details of exposure of A vehicles: Wilson
RC329	25.2.85	Lond	W N Saxby	Statement and Appendices: (a)Security Search; (b)Re-entry to test area - north of Roadside; (c)UNSCEAR 1982 Report, Annex. A, para.27; (d)Health Physics Group - Personnel monitoring (film) 3 October 1952 - Canberra crews films and 'D'-day films of others; Health Physics Services Group film issue record - Yellow areas, 26 October 1956, Blue areas, 1 September 1957; Area Vixen B, 26 April 1961; (e)Team RH4 22 October 1952; RH Group daily records 22 October 1953, 31 October 1953; (f)RC-M1388/70; Army M1388/70; RCT (Army); RAF M1388/70; RM, Table I - Distribution of exposures - UK atmospheric nuclear tests and experiments in Australia 1952-67; Table II - Distribution of effective doses equivalent: UK Atmospheric nuclear tests and experiments in Australia 1952-67; Table III - A comparison of distributions of doses at tests etc. with certain UK distributions
RC330	26.2.85	Lond	W N Saxby	Two maps of Monte Bello 1953
RC331	26.2.85	Lond	W N Saxby	Report 30 July 1959 - Security patrol of Shell Lakes and Lake Ell area: Morrison; map - ref: YA 6/1/1
RC332	26.2.85	Lond	W N Saxby	Report on Operation Buffalo: Air Commodore C T Weir - ref: BUF/S.117/Org
RC333	26.2.85	Lond	W N Saxby	Report on Operation Antler: Air Commodore W P Sutcliffe - ref: Copy No. 43
RC334	26.2.85	Lond	W N Saxby	Operation Antler - Air Task Group Report on Air Operation
RC335	26.2.85	Lond	W N Saxby	Operation Antler - Summary Plan Section H - The Security Plan - ref: Antler
RC336	26.2.85	Lond	W N Saxby	Operation Buffalo - Summary Plan Section C3 - Security - ref: BUBB/C3
RC337	27.2.85	Lond	W N Saxby	MODUK Cable 12 October 1982 commenting on AIRAC 9 Report
RC338	27.2.85	Lond	W N Saxby	Operation Buffalo - Summary Plan - Section B29 - Indoctrinise Force
RC339	27.2.85	Lond	W N Saxby	Report T8/54 - Operation Totem - Operational Report: Cooper
RC340	27.2.85	Lond	W N Saxby	Letter 8 December 1950 Marley to Group Captain Ford and attachment 'Danger to Air Crews from the products of an atomic bomb explosion'
RC341	27.2.85	Lond	W N Saxby	Transcript of tape 18 June 1984 Richard Bradshaw and Yami Lester with Government officials in London
RC342	27.2.85	Lond	W N Saxby	Report AWRE - Radiation Hazards at Emu 1 February 1955: Dale, Saxby - ref: HP13/3024
RC343	27.2.85	Lond	K Stewart	Statement
RC344	27.2.85	Lond	S J Dagg	Statement
RC345	27.2.85	Lond	K Stewart	Report T15/60 - Vixen A Trials 1959 - Experiments to study the release of particulate material during the combustion of plutonium, uranium and beryllium in a petrol fire: Stewart
RC346	27.2.85	Lond	K Stewart	Report T24/63 - Dispersal of beryllium from experiments involving beryllium and HE: Thomas
RC347	27.2.85	Lond	K Stewart	Report T9/64 - Vixen A Field Experiments 1961 - Part 1 - Experiments to study the release of radioactive material from actinium oxide heated in a petrol fire to temperatures up to 1100 degrees Celsius: Chatfield, Haberfield
RC348	28.2.85	Lond	K Stewart	Report T27/63 - Vixen A Trials 1959 - Experiments with implosion assemblies - Dispersal of beryllium and uranium: Stewart
RC349	28.2.85	Lond	K Stewart	Two papers by Dr K Stewart: - 'Particulate Material formed during the Combustion of Plutonium and Polonium'; - 'The Resuspension of Particulate Material from Surfaces'
RC350	28.2.85	Lond	A Schofield	Statement (with references to documents 1-43 re: Minor Trials)
RC351	4.3.85	Lond	A Schofield	Schedule of Minor Trials prepared by G Eames
RC352	4.3.85	Lond	A Schofield	Diagrammatic plans of Minor Trials (Documents 2-6 of statement)

RC353	4.3.85	Lond	A Schofield	Operation Totem - Radiological Safety Orders: Stewart
RC354	4.3.85	Lond	A Schofield	Documents 9-12 of Statement: - Kittens: Operational Planning - First Statement - Kittens: The Scope and Radiological Hazards of Kittens 1955 - Kittens 55: Radiological Safety Orders issued by Pilgrim - Additional Regulations for the TIMs firings
RC355	4.3.85	Lond	A Schofield	Report - Operation Buffalo - Summary Plan - B26 - Kittens - April 1956
RC356	4.3.85	Lond	A Schofield	Report - Operation Buffalo - Summary Plan - Section B25 - TIM series 2 - May 1956
RC357	4.3.85	Lond	A Schofield	Kittens 3rd Series - Radiological Safety Instructions issued by Pilgrim (Document 16 of statement)
RC358	4.3.85	Lond	A Schofield	MIN 1 Minor Trials, Maralinga February 1957 (Document 15 of statement)
RC359	4.3.85	Lond	A Schofield	Operation Antler - Summary Plan - Section C - Weapons Groups - Parts C6 and C7 Minor Trials 1957 (Document 17 of statement)
RC360	4.3.85	Lond	A Schofield	MIN 2 Minor Trials, Maralinga 1958 (Document 18 of statement)
RC361	4.3.85	Lond	A Schofield	MIN 3 Minor Trials, Maralinga 1958: Phase 2 (Document 19 of statement)
RC362	4.3.85	Lond	A Schofield	MIN 4 Assessment Tests, Maralinga 1959 - Minor Trials (Document 20 of statement)
RC363	4.3.85	Lond	A Schofield	MIN 5 Maralinga Experimental Programme (MEP) 1960 (Document 21 of statement)
RC364	4.3.85	Lond	A Schofield	MIN 6 Maralinga Experimental Programme (MEP) 1960 - Vixen B (Document 22 of statement)
RC365	4.3.85	Lond	A Schofield	MEP 7 Maralinga Experimental Programme (MEP) 1961 Facilities Plan for Vixen A (Document 23 of statement) - MEP 7 Maralinga Experimental Programme (MEP) 1961 Facilities Plan for Vixen A, Vixen B1, TIMS and Kittens (Document 24 of statement)
RC366	4.3.85	Lond	A Schofield	AWRE Explosives Safety Regulations for Maralinga Range (Document 25 of statement)
RC367	4.3.85	Lond	A Schofield	MEP 8 Maralinga Experimental Programme (MEP) 1961 - Facilities Plan for TIMS series - Flash Radiography (Supplement to MEP 7) (Document 26 of Statement)
RC368	4.3.85	Lond	A Schofield	MEP 9 Maralinga Experimental Programme Vixen B3 (Document 27 of statement)
RC369	4.3.85	Lond	A Schofield	Report P2/62 - Maralinga Experimental Programme - Vixen B3 - Facilities Plan (Document 28 of statement)
RC370	4.3.85	Lond	A Schofield	Report P3/62 - Maralinga Experimental Programme - Facilities Plan for TIMS (Document 29 of statement)
RC371	4.3.85	Lond	A Schofield	Maralinga Experimental Programme - Safety Statements for the years 1959-62 and 1963 (Documents 30-34 of statement)
RC372	4.3.85	Lond	A Schofield	Maralinga Experimental Programme Safety Instructions for the years 1960-63 (Documents 35-37 of statement)
RC373	4.3.85	Lond	A Schofield	Maralinga Experimental Programme Statements to Dept of Defence for the years 1962 and 1963 (Documents 38 and 39 of statement)
RC374	4.3.85	Lond	A Schofield	Maralinga Experimental Programme Statements of Residual Radioactive and Toxic Contamination for the years 1960-61 and 1964 (Documents 40-42 of statement)
RC375	4.3.85	Lond	A Schofield	Radiological Safety Regulations - Maralinga (4th Edition) - ref: RSRM 55(4) (Document 43 of statement)
RC376	4.3.85	Lond	A Schofield	Report T21/58 - Minor Trials
RC377	4.3.85	Lond	A Schofield	Contamination of Assessment Tests Sites at Maralinga December 1959
RC378	4.3.85	Lond	J M Coppard	Statement
RC379	4.3.85	Lond	J M Coppard	Report T28/63 - Operation Ayres 2: Oldbury
RC380	4.3.85	Lond	J M Coppard	Appendix to Coppard's statement - Summary of Health Physics at Maralinga (May 64): Coppard Statement
RC381	5.3.85	Lond	N Pearce	Report SRI/R/5/3 29 April 1956 - Radiological Safety Aspects of Maralinga Range: DAWRE
RC382	6.3.85	Lond	N Pearce	Interim Statement of results from Operation Radsur - a radiological survey of Maralinga Range and Emu site - 6 February 1967 - ref: SRI/R/5/4
RC383	6.3.85	Lond	N Pearce	Draft of Operation Radsur 1966 Report
RC384	6.3.85	Lond	N Pearce	Report to AWTSC on the Residual Radioactive and Toxic Contamination at Maralinga
RC385	6.3.85	Lond	N Pearce	Range November 1964 - SRI/M/1/3

RC386	6.3.85	Lond	N Pearce	<p>Four documents re Minor Trials</p> <ul style="list-style-type: none"> - Maralinga Minor Trials in relation to a ban on nuclear testing <i>SSWA/858/197</i> 29 August 1958; - Letter 29 August 1958 P W B Brooking to Sir W Cook re: Minor Trials Maralinga - Continuation; - Letter 23 September 1958 Brooking to AWRE re: Minor Trials; - Letter 29 September 1958 ADD/AWRE to Director re: Minor Trials
RC387	6.3.85	Lond	N Pearce	<p>Notes re: Discussion with Moroney 18 May 1966;</p> <ul style="list-style-type: none"> - Plan Maralinga Experimental Program 1960 restricted area and permitted firing sectors - ref: PFE/RF/259/2 - Article - The hazard from the contamination of wounds: Fuller - ref: RMS/SRI 4 May 1966 - Operating instructions for type 1320X monitor 27 February 1963 - Notes on Vixen A; - List of Reports; - Summary Statement AWRE - Long term control of residual contamination at Maralinga and Emu and diagram
RC388	6.3.85	Lond	N Pearce	Summary Statement AWTSC - Long Term Control of Residual Contamination at Maralinga and Emu
RC389	6.3.85	Lond	W E Jones	Statement
RC390	6.3.85	Lond	W E Jones	Three documents - titles restricted
RC391	7.3.85	Lond	W E Jones	Extract from House of Lords Hansard of 7 April 1954
RC392	7.3.85	Lond	W E Jones	Letter 30 September 1964 Moroney to N Pearce re: radioactive sources at range and its annexures
RC393	7.3.85	Lond	W E Jones	Operation Buffalo - Summary Plan - Section A1 - Introduction
RC394	7.3.85	Lond	W E Jones	Operation Buffalo - Summary Plan - Section B1 - Health Physics Services
RC395	7.3.85	Lond	W E Jones	Operation Buffalo - Summary Plan - Section B2 - Decontamination
RC396	7.3.85	Lond	W E Jones	Operation Buffalo - Summary Plan - Section B14 - Radiological Measurements
RC397	7.3.85	Lond	W E Jones	Operation Buffalo - Summary Plan - Section B28 and B28A - Meteorology
RC398	7.3.85	Lond	W E Jones	Operation Antler - Summary Plan - Section A - Introduction
RC399	7.3.85	Lond	W E Jones	Operation Antler - Summary Plan - Section B - Services Group
RC400	7.3.85	Lond	W E Jones	Operation Antler - Summary Plan - Section D - Measurement Groups
RC401	7.3.85	Lond	W E Jones	Operation Antler - Summary Plan - Section G - Meteorology
RC402	7.3.85	Lond	W E Jones	Operation Antler - Summary Plan - Section J - The Alice Road Plan
RC403	7.3.85	Lond	W E Jones	Operation Antler - Summary Plan - Section L - Staff Lists
RC404	7.3.85	Lond	W E Jones	Vixen A - 1960 Preliminary Report
RC405	7.3.85	Lond	W E Jones	Letter 26 January 1960 D E H Peirson to D L Cole re: Professor Titterton's involvement in test negotiations
RC406	7.3.85	Lond	W E Jones	Report T4/61 - Operation Vixen B1
RC407	7.3.85	Lond	W E Jones	Report T12/63 - Vixen B - Maralinga, February-June 1961 - Decontamination Group Report: Beal
RC408	7.3.85	Lond	R F Carter	<p>Statement and three appendices;</p> <ul style="list-style-type: none"> - Parts 1-5 '1957 Minor Trials (Kittens 4, Tims 3, Rats 1)' - Paper 'Contamination Levels Resulting from Beryllium Field Experiments (Maralinga 1959-60) - Notes referring to the state of the Wewak area
RC409	8.3.85	Lond	J O Weightman	Statement and 18 letters and Memos 8 July 1957-14 November 1957 Aboriginal Protection Board re: assigning of Welfare Officer, Native Patrol Officer, safety and closing of Everard Park
RC410	8.3.85	Lond	R F Carter	Report T39/58 - Minor Trials - Health Physics Report: TIM Series 3: Carter
RC411	11.3.85	Lond	H Bristow	Statement
RC412	11.3.85	Lond	H Bristow	Report O-24/80 - Repatriation of Plutonium residues from Maralinga February/March 1979: Bristow, Flook
RC413	11.3.85	Lond	H Bristow	Operation Brumby - Final Report: Cook - September 1967

RC414	11.3.85	Lond	A Stewart	Article - Radiation exposures of Hanford workers dying from cancer and other causes: Mancuso, Stewart, Kneale; - Statement for 'The Royal Commission of Inquiry, British Columbia, Health and Environmental Protection on Uranium Mining': Stewart; - Paper - Low level radiation long-term effects for radiation workers and the general public: Stewart; - Paper - Job related mortality risks of Hanford workers and their relation to cancer effects of measured doses of external radiation; - Paper - German; - Paper - Identification of occupational mortality risks for Hanford workers: Kneale, Mancuso, Stewart
RC415	12.3.85	Lond	R F Butler	Statement
RC416	12.3.85	Lond	A G Matthewman	Statement
RC417	13.3.85	Lond	A G Matthewman	Letter 23 March 1956 Adams to Wheeler UKMOSS(A) - Reports for basis of safety conditions
RC418	13.3.85	Lond	A G Matthewman	TPN45/56 - A general formula for the dependence of medium range fallout on the yield and height of burst of an atomic weapon: Macdougall; - TPN42/56 - On the height of rise of cloud resulting from an atomic explosion: Matthewman; - TPN40/56 - The effect of non-local winds on the centre-line of fallout: MacDougall; - TPN103/55 - The dependence of ground contamination at large distances on the height of burst of an atomic bomb: MacDougall
RC419	13.3.85	Lond	A G Matthewman	Extracts from report HMS Diana - Operation Mosaic; - Extract from log 20 June 1956
RC420	13.3.85	Lond	A G Matthewman	Document - Meteorological Forecasting Report: Maddock 20 June 1956
RC421	13.3.85	Lond	R S Cambray	Statement
RC422	14.3.85	Lond	A P Wood	Statement
RC423	14.3.85	Lond	J Dunster	Statement and attachments - Some policy statements made by ICRP; - NRPB advice given in compliance with the direction of the Health Minister's 9 August 1977 in relation to radiation protection standards
RC424	14.3.85	Lond	J W Reid	Statement
RC425	15.3.85	Lond	J A Dennis	Statement and annexure; - Report 'Protocol for a study of the health of UK participants in the UK Atmospheric Nuclear Weapons Tests' - ref: NRPB-R154 September 1983
RC426	15.3.85	Lond		Report - Fall-out Predictions for Operation Mosaic: Beale - March 1956 - ref: ARL/RI/C791
RC427	15.3.85	Lond		Operation Mosaic - Final Report on Naval Measurements: Ellis, Morgan, Thomas - ref: ARL/R4/C791
RC428	15.3.85	Lond		Report T13/60 - Operation Ayres: Oldbury
RC429	15.3.85	Lond		Report E3/58 - Summary of British Atomic Cloud Rise Data and a comparison with Theoretical Predictions: Cheeseman
RC430	15.3.85	Lond		Report O-35/56 - Dose rates from ground contamination with residual radioactive materials from an atomic explosion: Dale, Bomyer
RC431	15.3.85	Lond		Report T9/57 - Operation Buffalo - Interim Report - Target Response - Instrumentation Group: Colebrooke
RC432	15.3.85	Lond		Report - for Tripartite Conference on Effects of Atomic Weapons, London September 1957 - On the Predictions and Interpretations of Fall-out Patterns: MacDougall - ref: AWEC/P(57)208
RC433	15.3.85	Lond		Report for Tripartite Conference on Effects of Atomic Weapons, London September 1957 - Operation Buffalo - Fall-out Measurements: Dale - ref: AWEC/P(57)/201
RC434	15.3.85	Lond		Report for Tripartite Conference on Effects of Atomic Weapons, London September 1957 - Operation Mosaic - II. The Fall-out analysed with reference to HMS Diana: Beale - ref: AWEC/P(57)202

RC435	15.3.85	Lond		Report TC 4/55 - Air currents above ground zero area after a low air burst and their relation to fallout: Penney
RC436	15.3.85	Lond		Report T44/58 - Operation Antler - Radiological survey operations in the Alice Road area: Beaver
RC437	15.3.85	Lond		Report T38/58 - Operation Antler - Meteorological Services Vol. 2: Tables and Figures: Phillipot
RC438	15.3.85	Lond		Reports T1/54 and T1a/54 - Operation Hurricane Directors Report - Scientific data obtained at Operation Hurricane
RC439	15.3.85	Lond		Report T5/54 - Operation Totem - Fission product sampling: Part 1 Lewis, Part 2, Howard
RC440	15.3.85	Lond		Report T49/54 - Measurement of Beta radiation on Operation Totem: Kendall
RC441	15.3.85	Lond		Report T8/55 - Operation Totem - Fall-out particles from Totem 1 and Totem 2: George
RC442	15.3.85	Lond		Report T3/57 - Operation Buffalo - Target Response Tests - The shielding from initial radiation afforded by fieldworks and AFVs: Janisch et al.
RC443	15.3.85	Lond		Report T9/55 - Operation Totem - Radiation surveys of Totem craters: Rae
RC444	15.3.85	Lond		Report T54/54 - Operation Totem - Totem administration: Redmond
RC445	15.3.85	Lond		Report T57/58 - Operation Buffalo - Target Response Tests, Biology Group Part 5: The entry of fission products into food chains: Loutit, Scott Russell
RC446	15.3.85	Lond		Report T78/54 - Operation Totem - The effects of an atomic explosion on a centurion tank Vol. 2: Messenger (Vol. 1 is RC 607)
RC447	15.3.85	Lond		Report T27/57 - Operation Buffalo - Air sampling in the village and airfield area: Holmes
RC448	15.3.85	Lond		Report T15/58 - Assessment Tests - Fall-out measurements during Operation Kittens, 1955: Mayhew
RC449	15.3.85	Lond		Report T24/58 - Operation Antler - Airborne sampling of radioactivity: Eyre
RC450	15.3.85	Lond		Record of Commodore Special Squadron in relation to Operation Mosaic
RC451	15.3.85	Lond		Two letters; 4 March 1985 W Moriarty, Australian Bureau of Meteorology to Dept Resources and Energy re: temperature conditions on day of firing of Totem 1
RC452	15.3.85	Lond	S Menaul	Statement and paper - Protocol for a study of the health of UK participants in the UK atmospheric nuclear weapons tests: Reissland
RC453	15.3.85	Lond	S Menaul	Two transcripts - Parliament of the Commonwealth of Australia Dept Parliamentary Library: 23 April 1980 - AM - Maralinga, nuclear safety: S Menaul; - Parliament of Commonwealth Australia, Dept of the Parliamentary Library 18 May 1982 - Doubletake: Beale, Robotham, Menaul, Woodland
RC454	15.3.85	Lond	E M Beale	Statement
RC455	15.3.85	Lond	W S Long	Statement and extract from T15/59 pp.4-11; - Extract Mosaic Operational Commander's Report p.178
RC456	18.3.85	Lond	G C Dale	Note on AWRE Report O-41/55 and Appendix A: Dale
RC457	18.3.85	Lond	G C Dale	Report prepared for US Dept Defence and US Atomic Energy Commission - 'The Effects of Atomic Weapons' Parts 1 and 2 Los Alamos Scientific Laboratory
RC458	18.3.85	Lond	G C Dale	RAAF reports on Operation Totem
RC459	18.3.85	Lond	G C Dale	Report T89/54 - Operation Hurricane Group Reports (Part 51) - Measurements of the radio-activity of an airborne sample of the cloud collected at Broome, WA: Gale
RC460	18.3.85	Lond	G C Dale	Report T10/60 - On the resuspension in the atmosphere of radioactive or other fine particulate material deposited on the ground: Stewart
RC461	18.3.85	Lond	G C Dale	Health Physics Memo-6/55 - Safety Levels for Contamination from fallout from Atomic Weapons Trials: Dale
RC462	18.3.85	Lond	G C Dale	Report E6/56 - The dispersion of radioactivity in the sea after the explosion of an atomic weapon: Steel
RC463	18.3.85	Lond	G C Dale	Report TC16/55 - for Tripartite Conference on Effects of Atomic Weapons London September 1957 - Staging a Trial: Tomblin November 1957
RC464	18.3.85	Lond	G C Dale	Report MISC/SSRT/1 - Maralinga Range - Plans of Roads and Buildings and the General Geography of the Maralinga Range
RC465	18.3.85	Lond	G C Dale	Report O-71/61 - The estimation of the inhalation hazard from plutonium dioxide: Stewart

RC466	18.3.85	Lond		<p>Report T108/54 - The decontamination of radioactive clothing; Stevenson Documents referred to Lord Penney by P McClellan:</p> <ul style="list-style-type: none"> - Letter 5 March 1957 Penney to Musgrave re: Antler Command; - Telegram 29 March 1955 Secretary of State to UK High Commissioner to Australia re: candidates for Safety Committee; - Letter Commonwealth Relations Office Sykes to Cockran re: risks of contamination; - Letter 5 January 1951 M W Perrin to R C C Hunt re: Titterton at Monte Bello 1952; - Telegram 21 March 1955 (UK High Commissioner to Australia) to Secretary of State re: names of candidates for Safety Committee; - Telegram AN79 from Penney AWRE to Adams Admiralty re: not showing Safety Committee weapon details; - Memo 25 July 1956 to Minister re: difficulties with Menzies satisfaction on safety with Safety Committee; - Telegram 1 April 1952 Commonwealth Relations Office to UK High Commissioner to Australia re: Australian Scientific observers at test; - Letter 22 December 1955 AWRE to Brundrett re: request for filters from planes; - Report of visit L Williams and Pilgrim to Australia 25 October 1962-7 November 1962; - Telegram 16 October - Adams to T Elmhirst re: description of explosion; - Minutes Operation Totem 7th Meeting of Interdepartmental Panel 26 June 1953
RC467	18.3.85	Lond		
RC468	18.3.85	Lond		<p>H M G Documents referred to Lord Penney:</p> <ul style="list-style-type: none"> - Letter 15 August 1952 Penney to R Makins re: draft letter to Lord Cherwell and draft; - Telegram Commonwealth Relations Office to UK High Commissioner to Australia re: Antler program - description
RC469	18.3.85	Lond		<p>Record of discussions Penney/W A S Butement re: suitable site for bomb site</p> <p>24 submissions tendered: E A Hale, D F Cotgrove; R J Garbett; D Buckley; T Walker; A W Blake; P A Lowe; R G Maughan; D L Lloyd Owen; K Greenwood; J G Campbell; G I Jones; T H Bambridge; H Browne, T Wilson; D A Keys; M Hailing; H Coles; M Hardisty; M Blakeney; R J Cumper; S Swainston; J M Marks; T W Larkin</p>
RC470	18.3.85	Lond		
RC471	18.3.85	Lond	Greenpeace	<p>Report - The controversy over low dose exposure to ionising radiations, Author: Patrick A Green, 30 January 1985, Published for Greenpeace Environmental Trust</p>
RC472	18.3.85	Lond	Dr K Little	<p>Report - Low dose level mythology - An assessment of current radiation theories as compared with evidence from the biological mechanisms of radiation effect</p>
RC473	18.3.85	Lond		Report TCEAM/57 - Item 47 - The Rising Cloud: Cheeseman
RC474	18.3.85	Lond		Report TCEAM/57 - Item 48 - The UK method of predicting fallout beyond 10 miles - criteria used at Maralinga: Hicks
RC475	18.3.85	Lond		Report TCEAM/57 - Item 50 - Fall-out contours for 'Buffalo': J J Ray
RC476	30.4.85	Perth		D/Sc(Nuc) 2/5/8/10 - Minor Trials Schedule - UK Ministry of Defence
RC477	30.4.85	Perth	R R Moore	Statement
RC478	30.4.85	Perth	L C Lawrance	Statement
RC479	30.4.85	Perth	O G Ramsay	Statement
RC480	30.4.85	Perth	D W Longworth	Statement
RC481	30.4.85	Perth	G Challen	Statement
RC482	30.4.85	Perth	W B Flewright	Statement and letter 14 September 1984
RC483	1.5.85	Perth	C Thackrah	<p>Report - Population distribution and lifestyle of Aboriginal people in the Pilbara and Gascoyne 1952 and 1956: Thackrah;</p> <ul style="list-style-type: none"> - Map of Australian Aboriginal population distribution 1956 southern WA, North East WA; 1952 north WA; southern WA
RC484	1.5.85	Perth	E D Green	Statement
RC485	1.5.85	Perth	B M Hartley	<p>Statement and Report - Visit to Trimouille Island 29 October 1974;</p> <ul style="list-style-type: none"> - Appendix 1 - Preliminary Report to RAC Radiation Survey: Monte Bello Islands - Appendix 7 - 2nd Radiation Survey Monte Bello Islands; - Appendix 3 Monte Bello Islands 23-28 October 1978 Preliminary Report of Visit;

RC485	Contd			- Report Dr B Hartley conversation with K Oliver; - Note 3 January 1980, B Hartley on radiation safety in future land use in the Monte Bello Islands; - Memo re: K Oliver 6 June 1980; - Memo 15 July 1981 re: Monte Bello Islands - Memo 4 March 1983 B King re: Crawford radiation levels; - Report Monte Bello Islands visit 23-28 May 1983 - Memo 25 July 1983 L Troussaint re: Crawford; - Paper - Observation on a nuclear explosion site (Monte Bello Islands) 20 years after: King, Hartley, Davies, Murrell
RC486	1.5.85	Perth	W E Smith	Statement and diagram of diving gear
RC487	1.5.85	Perth	D T McSorley	Statement
RC488	1.5.85	Perth	V A Gantzer	Statement
RC489	1.5.85	Perth	W L Ravenscroft	Statement
RC490	1.5.85	Perth	G W Smith	Statement
RC491	1.5.85	Perth	R E Lewis	Statement
RC492	1.5.85	Perth	J B Craig	Statement
RC493	2.5.85	Perth	P G Connolly	Statement
RC494	2.5.85	Perth	J Balcombe	Statement and annexures - Site map Emu test area; - Letters 10 August 1984 Dr M E Quinlan to Dr Q F Ho re: J Balcombe's medical condition
RC495	2.5.85	Perth	R A Jarvis	Statement and annexures:
RC496	2.5.85	Perth	R L Southern	Statement and newspaper article 'Weekend News' 12 January 1985 - Diagram of idealised fallout pattern for H+6 hours based on effective winds; - Diagram of required analogue weather pattern for stable conditions for firing Monte Bello Islands May-June 56; - Diagram of weather pattern G2 Mosaic noon 19 June 1956; - Diagram of weather pattern G1 Mosaic 16 June 1956; - Table - Mosaic G2 upper winds 11am 18 June 1956; - Newspaper clipping 12 January 1985 'Expert denies fallout claims'
RC497	2.5.85	Perth	F L Domyer	Statement
RC498	2.5.85	Perth	J S Muxworthy	Statement
RC499	2.5.85	Perth	P F Thornton	Statement
RC500	2.5.85	Perth	W F Sullivan	Statement
RC501	2.5.85	Perth	W D Brown	Statement
RC502	2.5.85	Perth	E G Buchanan	Statement
RC503	2.5.85	Perth	D G Grimster	Statement
RC504	2.5.85	Perth	M A Kimber	Statement
RC505	2.5.85	Perth	K A Arnold	Statement
RC506	2.5.85	Perth	J Grant-Fackrell	Statement
RC507	2.5.85	Perth	L Hollingsworth	Statement
RC508	2.5.85	Perth	A J Gabelish	Statement
RC509	2.5.85	Perth	J S Hewitt	Statement
RC510	2.5.85	Perth	W Greathead	Statement
RC511	2.5.85	Perth	A J Reynolds	Statement
RC512	2.5.85	Perth	F R Hogan	Statement
RC513	5.5.85	K'atha	W A Miller	Statement
RC514	5.5.85	K'atha	G Tozer	Statement
RC515	5.5.85	K'atha	A Smith	Statement
RC516	5.5.85	K'atha		Three Maps - two of NW Australia, one of Monte Bello Islands - location of firing points
RC517	5.5.85	K'atha	B Monadee	Statement
RC518	5.5.85	K'atha	C Monadee	Statement
RC519	5.5.85	K'atha	Prof Tonkinson	Report on a visit to Jigalong West Australia, 30 April-3 May 1985: Tonkinson

RC520	5.5.85	K'atha	P Christian	Statement
RC521	5.5.85	K'atha	S Stubbs	Statement
RC522	14.5.85	Sydney	Sir E Titterton	Submission and Report - The Role of the 'Observers' and the AWTSC at British Weapons Tests in Australia: Titterton
RC523	27.5.85	Sydney		Documents referred to Titterton by G Eames:

- Telegram 21 August 1956 Penney to President Council, Ministers of Defence and Supply re: continued use of Maralinga;
- Telegram 8 September 1952 Commonwealth Relations Office to UK High Commissioner to Australia re: Martin at Hurricane;
- Letter 23 October 1956 House to M B Allen re: split in Labour party on tests;
- Minute 20 February 1954 to UK High Commissioner to Australia re: D H Black/Butement;
- Letter 1 March 1954 UK High Commissioner to Australia to Pritchard re: testing sites;
- Letter 17 September 1952 E J S Clarke to B H Curson re: Butement;
- Letter 13 January 1956 W B MacDougall to Native Welfare re: reconnaissance - Rawlinson Range;
- Memo 7 March 1956 H J Brown to Chief Scientist re: welfare of Aborigines - Maralinga Project Meteorological station etc;
- Memo 14 March 1956 Chief Scientist to Controller WRE re: fallout in Aboriginal reserve;
- Letter 15 March 1956 Butement;
- Letter 16 March 1956 Butement to A S Brown - Welfare of Aborigines - Maralinga etc;
- Letter 20 March 1956;
- Letter 19 August 1952 to Saner re: testing site - approach to Government;
- Report on Visit L Williams and Pilgrim to Australia 25 October-7 November 1962;
- Report to Cabinet 13 August 1956 - Problems of Safety Committee at the Maralinga Test series, L H Martin
- Cabinet Minute 4 September 1956 Submission 328 - Atomic Tests in Australia;
- Transcript R Siddons pp.5709-12;
- Transcript A M Stewart pp.6742-47;
- Memo 20 February 1956 P Tayne to S Woenne-Green re: W B MacDougall at Ingomar dog fence Coober Pedy;
- Memo 11 May 1959 E S Jackson AWRE to Sir F Brundrett re: Titterton and underground tests;
- Telegram 751, 26 August 1958 re: underground tests;
- Memo 6 August 1956 re: natives in test zone;
- Map SA Dept Mines - NW South Australia water utilization survey, distribution of population;
- Letter 9 May 1956 A S Brown to Chief Scientist re: Aboriginal population in SA;
- Extract letter 13 August 1956 L H Martin AWTSC;
- Telegram 8 September 1956 Chief Scientist to Controller WRE Woomera re: natives at northern rectangle; reply;
- Telegram 3 September 1956 Chief Scientist to Nossiter re: movement and numbers of aboriginals;
- Memo 4 September 1956 Butement to Controller WRE re: control of Aborigines - Operation Buffalo;
- Telegram 10 September 1956 from Jay re: W B Macaulay no radio in vehicle;
- Telegram re: Sergeant Smith;
- Telegram re: control of Aborigines;
- Telegram 10 September 1956 Jay to Director Maralinga re: Macaulay no transport or radio;
- Letter 10 September 1956 to Weapons Research Establishment re: control of Aborigines;
- Telegram J G Brookman to L Beadell re: vehicles for R A Macaulay;

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- Minute 19 September 1956 Chief Engineer Dept Supply to Controller re: Smith and Bartlett;
- Telegram 1 October 1956 J G Brookman to Weapons Research Establishment (WRE) re: Smith's movements;
- Letter 10 July 1956 R A Macaulay to Superintendent Woomera re: Shell Lakes-Boundary Dam Patrol;
- Letter 14 September 1960 Macaulay to Superintendent Woomera re: Patrol to NW perimeter Maralinga prohibited zone;
- Telegram 16 May 1955 UK High Commissioner to Australia to UK High Commissioner to New Zealand re: South Pacific site for tests;
- Letter 5 October 1956 Cook to Jackson re: report on results of Mosaic;
- Memo 20 August 1956 Jackson to AS/AW re: magnitude of second explosion;
- Notes 8-9 October 1956 Bullock ADAW re: G1, G2;
- Memo 8 August 1956 Lloyd to DGAW re: G1 and G2;
- Letter 9 October 1956;
- Memo 23 October 1956 Jackson;
- Newspaper clipping 'Adelaide Advertiser' 5 May 1984 'Government survey team to inspect nuclear dump sites';
- Minutes 11 November 1960;
- Paper by Dwyer, Martin and Titterton re: paper by Marston;
- Paper - Radioactive iodine in the thyroids of grazing animals as an indication of the degree of hazard entailed in the contamination of terrain by products of nuclear explosions deposited from the troposphere: Marston;
- Extract from book 'Nuclear Knights' by B Martin;
- Report 28 October 1956 - Ranger Uranium Environmental Inquiry: Fox, Kelleher, Kerr;
- Letter 25 January 1960 Peirson to Cole re: nuclear weapons safety experiments;
- Letter 18 September 1952 Dept Supply to Curson re: Titterton

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- Documents referred to Titterton by J McIntyre:
- Minutes 6th Meeting AWTSC, 17 April 1956 p.5;
- 10th Meeting 28 July 1956;
- 11th Meeting 3 August 1956;
- 12th Meeting 13 August 1956;
- 13th Meeting 20 August 1956;
- 14th Meeting 30 August 1956;
- Note 30 July 1957 - Safety levels for contamination of Fall-out from atomic weapon trials - submitted for approval by the National Radiation Advisory Committee: Titterton
- Extract T4/58, pp.6-7;
- Telegram 28 August 1956 Secretary Melbourne to J Harman, Supply re: Titterton's presence at Cabinet;
- Letter 5 September 1956 O'Connor to Titterton re: amendment to Cabinet paper;
- Telegram 28 September 1956 Secretary Melbourne to Minister Supply - Titterton available for Cabinet

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- Documents referred to Titterton by P McClellan:
- Letter 3 March 1953 B Cockram to A S Brown re: Martin, Titterton - Operation Totem yield;
- Letter 5 March 1953 A D McKnight to J E S Stevens re: Totem;
- Minute 5 March 1953 Titterton to A S Brown re: Totem;
- Letter 9 March 1953 Titterton to Brown re: Australian involvement in tests;
- Telex 16 May 1953 Penney to L H Martin re: cloud height;
- Cable 12 June 1953 A D McKnight to A S Brown re: test safety;
- Letter 17 June 1953 Martin and Titterton to Prime Minister re: description of bomb and impact, and covering letter 17 June 1953 McKnight from Cook
- Letter 17 June 1953 McKnight to J E S Stevens re: safety report;

- File note by McKnight 16 July 1953 re: Totem - monitoring by Wardell;
- Memo 12 August 1953 Cook to Secretary Prime Minister's Dept re: use of Titterton;
- Note 10 September 1953 Titterton - use of Australian National University (ANU) staff at tests;
- Letters 10-11 September 1953 M Oliphant to Brown re: staff from ANU availability;
- Letter 11 September 1953 Brown to Associate Vice Chancellor ANU - staff for tests;
- Note 25 July 1956 to Minister re: Safety Committee, information;
- Telex 21 September 1956 Penney to Cook re: test delay;
- Telex 19 February 1959 Wheeler to Lloyd re: Titterton's consent for 1959 programme;
- Telex 23 February 1959 Lloyd to Wheeler re: Titterton, safety aspects;
- Letter 19 May 1959 to Jackson re: use of plutonium;
- Note 22 May 1959 by Lloyd re: briefing Titterton on proposals;
- Letter 25 May 1959 Lloyd to S Scott-Hall re: use of plutonium, beryllium and uranium;
- Letter 26 May 1959 Brundrett to Penney re: Vixen, approach Titterton for approval;
- Letter 26 May 1959 Brundrett to Jackson - agreement of NTPC;
- Letter 15 June 1959 to Titterton re: plutonium use;
- Letter 15 June 1959 Penney to Titterton re: plutonium use;
- Telex 25 June 1959 Titterton to Penney re: Safety Committee consent;
- Letter 10 July 1959 Titterton to A S Hulme re: use of plutonium;
- Letter 28 July 1959 N Levin to Titterton re: dispersal;
- Letter 30 July 1959 Hulme to A G Townley re: AWTSC approval of fissile materials;
- Letter 29 September 1960 H K Matthews to M C Timbs re: programme for 1961;
- Letter 30 September 1960 Pilgrim to Titterton re: programme for 1961;
- Note 11 November 1960 on visit to Australia DSAW and DAWT 12-29 October 1960;
- Letter 30 November 1960 **HSC/Trials/31/MEP** - Note on Determination of Safety Distances for the Maralinga Experimental Programme;
- Letter 17 January 1961 Titterton to Hulme re: Vixen B materials and safety;
- Letter 31 January 1961 N E Costar to H V Bunting re: safety statement;
- Memo 27 March 1961 J L Knott to AWTSC re: MEP 1961;
- Letter 26 June 1961 Titterton to N Levin re: UK visit;
- Memo 29 August 1961 Costar to Prime Minister's Dept re: Vixen B, TIMs and Kittens;
- Letter 5 September 1961 Pilgrim to Titterton re: MEP 1962 and safety statement;
- Letter 16 October 1961 Chairman AWTSC to Hulme re: 1962 MEP programme;
- Letter 8 November 1961 Pilgrim to Titterton re: infringement of firing sectors;
- Letter 6 February 1961 Pilgrim to Titterton re: residual radioactive and toxic contamination at Maralinga, December 1961;
- **SRI/48/1** Statement of Residual Radioactivity and Toxic Contamination;
- Letter 11 October 1962 Pilgrim to Titterton re: Vixen B, Kittens, TIMs 1963;
- MEP 1963 Safety Statement (**SRI/m/1/2(3)**);
- 13 December 1962 Report of visit from 25 October 1962-7 November 1962 by L T D Williams and Pilgrim to Australia;
- Undated note from Titterton to Moroney re: toned down minutes;
- Report **HSC Trials/31-19 SRI/48/1 MEP 61** - safety statement 27 September 1960
- Transcript of a tape of the meeting Titterton had with AIRAC 20 March 1981
- Report to the Prime Minister on the Monte Bello atomic test held 19 June 1956 by the Safety Committee;
- Report 16 May and 19 June 56 - Summary of report;
- Mosaic atomic weapons tests Monte Bello Island 16 May and 19 June 56;
- Report to the Prime Minister by the AWTSC on the Buffalo Trials, Maralinga 1956 - ref: 6012.1.154
- Report to the Prime Minister on a detailed assessment of Fall-out in Australia by the National Radiation Advisory Committee June 1962;

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RC527	Contd	- Safety aspects of residual radioactive contamination of the Maralinga Range and the Emu Site - Report to Prime Minister by AWTSC July 1967
RC528	27.5.85 Sydney	Report T10/54 - Operation Totem - Neutron measurements at Emu on Totem 1 and Totem 2: Titterton
RC529	27.5.85 Sydney	Tables by Dr J Harries - Maximum limits to dose used in specifying the Fallout criteria; - Permissible levels of Fall-out
RC530	27.5.85 Sydney	Two volumes of documents referred to Titterton by Mr Auld: Statements - W E Jones, N Pearce, A Schofield; Prof K Stewart; - Letter 16 August 1958 Adams to Titterton re: Turner discovery of Cobalt 60; Reply 28 August 1958; AWTSC Minutes - 6th on 17.4.56; 7th on 9.5.56; 8th on 15.5.1956; 52nd on 9 July 1959; 65th on 24.8.60; 66th on 21.9.60; 68th on 29.11.60; 70th on 16.1.61; 146th on 7.4.67; 129th on 7.3.66; 131st on 6.5.66; 132nd on 7.5.66; 137th on 8.9.66; 133rd on 14.5.66; 141st on 12.12.66; 147th on 26.5.67; 148th on 26.6.67; 149th on 8 and 9.7.67; 151st on 19.7.67; MOD Files - E19 Telegram UK High Commissioner in Australia (UKHCA) 30 March 1951 re: tests and elections; - Telegram No. 262 to UK High Commissioner to Australia from Defence re: Australian observers at test - Letter Secretary DCNS to UKSLS re: Martin on Monte Bello team; - Cypher No. 639 Defence to UK High Commissioner to Australia, 23 August 1952 re: Hurricane - site; - Letter 9 September 1952 to Evan-Loabe re: Martin at Hurricane; - Telegram 172 28 February 1953 Defence to UKHCA re: disclosure of information to Australians; - TOT/74 Minutes of Totem Executive 27 April 1953; - Minutes 7th Meeting Interdepartmental Panel 24 June 1953; - Telegram 17 October 1953 Adams to T Elmhirst re: explosion; - Telegram 19 October 1953 Elmhirst from Penney re: Prime Minister's speech; - Telegram 26 October 1953 to Elmhirst from Penney re: Interim Report on first explosion; - Telegram T Elmhirst from Adams re: Totem; - Telegram 25 October 1954 to Commonwealth Relations Office from UKHCA re: further tests; - Letter 25 October 1954 Prime Minister to UKHCA re: further tests; - Report RD/3 - A report on alternative sites for weapons tests in Australia, including estimates for the preparation of a special test site at Maralinga compared with estimates for the consolidation of the existing site of Emu, Dept Supply; - Memo 15 July 1955 W J Challens to Pilgrim re: Mosaic; - Letter 15 July 1955 AWRE to Cook re: Mosaic yield; - Letter Adams to Dr D H Black re: wind heights and table; - Minutes 16 February 1956 to discuss AWRE Air Measurement requirements for Operation Mosaic - Report of Monte Bello working party on Operation Mosaic 10 October 1955; - Letter 24 August 1956 Jackson to Wheeler, Minister Supply re: magnitude G2; - Letter 23 August 1956 AWRE to Jackson re: H Beale statement on G2; - Telegram 19 February 1959 Wheeler to Lloyd re: 1956 Trials Programme; - Telegram 23 February 1959 Lloyd to Wheeler re: 1959 safety aspects; - Letter 19 May 1959 AWRE to Jackson re: plutonium use; - Letter 15 June 1959 Penney to Titterton re: plutonium hazards; - Telegram 25 June 1959 Penney to Titterton; - Letter 10 July 1959 Titterton to Penney re: Vixen series; - Letter Pilgrim to I Maddock re: Vixen B firings;

RC530	Contd				<ul style="list-style-type: none"> - Letter 6 April 1960 E F Newley to Lloyd re: data on plutonium; - Telegram AWRE Maralinga to AWRE Aldermaston re: Vixen B1; - Note of visit to Australia by DGAW and DAWT 12-29 October 1960; - Note - Some impressions gained from a recent visit to Australia undertaken in connection with the 1963 MEP; - Report of a visit by L Williams and Pilgrim to Australia from 25 October 1962-7 November 1962; <p>Transcript: D J Stevens pp.2480-2522; O H Turner pp.2905-7; Lord Penney pp.4337-46; 4354-5; 4401-3; 4451-69; Siddons pp.5413-7; 5429-34; R R Fotheringham pp.5502-12; N Pearce pp.6391-6461, 6515-21; Penney pp.7045-58;</p> <p>Exhibits - RC247; RC297; RC284; RC461; RC417; RC420; RC274; RC267; RC266; RC332; RC299; RC371; RC373; RC374; SCRM/64 Statement of residual radioactive and toxic contamination Maralinga, November 1964; RC385; RC382; RC383; RC388;</p> <p>Report O-16/68 - Final report on residual radioactive contamination of the Maralinga Range and Emu site: Pearce</p>
RC531	28.5.85	Sydney	Dr K Lokan		<p>ARL Report - Residual radioactive contamination at Maralinga and Emu 1985: Lokan;</p> <ul style="list-style-type: none"> - Documents - Some useful concepts and units; and Results of representative calculations: Lokan
RC532	28.5.85	Sydney	Dr K Lokan		16 colour photographs of Monte Bello Islands
RC533	28.5.85	Sydney	Dr K Lokan		<p>Album of photographs - Maralinga village, TM100, TM101, Pit 23, Ooldea, Roadside, Taranaki, Breakaway, Tadje, One Tree, Marcoo, Emu, Totem 1 and 2, Kittens, warning signs plutonium fragments, monitoring equipment, mobile laboratory, Wewak, balloon bays, Rats scintillation detector, NAYA 3, Dobo site, TM50, TM2, uranium fragments, concrete trap, buried vehicle, XA, DC/RB, airfield cemetery and wash-down site, Watson</p>
RC534	28.5.85	Sydney	Dr K Lokan		Slide with particle of uranium
RC535	28.5.85	Sydney	Dr K Lokan		<p>Reports ARL/TRO49 - Environmental radiation at the Monte Bello Islands from nuclear weapons tests conducted in 1952 and 1956: Moroney, Cooper</p> <ul style="list-style-type: none"> - ARL/TRO62 - The radiological status of the Monte Bello Islands; May 1983: Cooper, Loken, Williams, Toussaint
RC536	30.5.55	Sydney	R L Somers		<p>Report - 'The Feasibility of demonstrating long-term somatic and heritable health effects of ionising radiation on local aboriginal populations';</p> <ul style="list-style-type: none"> - Telegram from Akio Awa to Dr R L Somers re: whole body radiation exposure - Letter 8 July 1985 J Somers to Royal Commission and attachment 'Summary of Ernabella Birth Book'
RC537	5.6.85	Sydney	J R Moroney		<p>Statement and annexures</p> <ol style="list-style-type: none"> 1. Letter 10 May 1985 J Atkinson to Moroney re: appearance before Commission; 2. Letter 15 March 1957 Beale to Prime Minister re: future and establishment AWTSC, reply 4 April 1957 Prime Minister to Beale; 28 March 1957 and 14 December 1967 COA Dept Supply construction of NRAC and AWTSC 3. Letter 1 October 1979 Moroney re: records of the former AWTSC and NRAC and records relating to health physics operations and the Maralinga Range and attached lists of same; 4. Operation Buffalo - Meteorological Report; 5. Letter 1 December 1960 Pilgrim to Titterton re: 1961 Safety Statement, balloon incidents, Vixen B, plutonium; HSC/Trials/31/MEP Note on the determination of safety distances for the MEP; Minute 18 August 1960 Dept Defence Secretary to Minister re: Proposed programme of tests at Maralinga; 6. Appendix A/4 Review of radioactive contamination of the Maralinga Range and measures for its control 5 September 1963; Letter 8 November 1963 Moroney to Pilgrim ref 57/6/27 re: cleanup; Letter 8 November 1963 Moroney to Pilgrim re: cleanup of plutonium; Letter 24 July 1964 N Pearce to Moroney re: cleanup operation, Appendix C - Cleanup of radioactive debris from minor trials sites at Maralinga; Operation Hercules V - RA cleanup; AWTSC 114th Meeting 26 August 1964;

AWTSC 146th Meeting 7 April 1962 Appendix 2; Control of Residual Radioactive Contamination at Maralinga, 12 September 1963 - ref R57/6/27; Letter from Moroney, AWTSC to Secretary, Board of Management for Atomic Weapons Tests.

RC537 Contd

7. Paper - Revised safety levels for contamination from fission product fallout: Titterton;
8. AWTSC 57th Meeting 9 December 1959; Health Physics at Maralinga during inter trial periods meeting 8 October 1956; AWTSC 29th Meeting 8 October 1957; Appendix to Minutes 29th Meeting; Duties of the Health physics representative at Maralinga - Revised 10 April 1961; Letter 13 November 1964 Director General of Health to Secretary, DOS re: Health Physics control;
10. Paper Impact on public health of long-range Fall-out from nuclear tests in Australia 1952-57, Moroney and K N Wise, 26 September 1984
11. Paper - Close in Fall-out from nuclear weapons tests in Australia 1952-57;
12. ARL Report - Environmental radiation from nuclear weapons tests conducted in 1952 and 1956; Moroney, Cooper;
13. H R Marston, FRS and the AWTSC - The controversy over Fall-out from British nuclear tests in Australia in 1956

Attachments:

- Map - Restricted Flying Area 1961 - referring to supposed western boundary
 - Memo for Secretary, Board of Management for Atomic Weapons Tests 12 September 1963 re: Control residual radioactive contamination at Maralinga by Moroney
 - British proposals for clean-up of range
 - Letter 3 July 1964 Moroney to Titterton re: future management of Maralinga
 - Handwritten notes of discussion with Moroney at Swanston Street 18 May 1966
 - Letter 19 August 1966 Moroney to Titterton re: soil sampling
 - Letter 28 September 1966 Moroney to N Pearce re: soil sampling, RADSUR
 - Letter 8 November 1966 P H Bailey to R N Townsend re: proposals for winding up of Maralinga
 - Memo 21 December 1966 Moroney to J H Dolphin re: AWTSC views on draft proposal British cleanup
 - Letter 27 January 1967 Bunting to T D O'Leary re: decontamination and winding up of Maralinga
 - Letter 16 June 1967 Moroney to Titterton re: AAEC radiological clearance of range, Richardson and decontamination operation
 - Telex and Letter 16 June 1967 Moroney to Titterton above and attached signal MS7649 N Pearce to Moroney re: Australian visit and handwritten note of agenda
 - Minutes AWTSC 151st Meeting 19 July 1967 Appendix 2 - Safety Aspects of Residual Radioactive Contamination at Maralinga and Emu
 - Letter 24 August 1967 Titterton to A S Cooley, DOS re: patrols of Maralinga
- Memo 30 April 1956 Secretary Prime Minister's Dept to Secretary Dept of Defence - Maralinga - Memo of Arrangements
- Map - Maralinga 42 - Maralinga Project - Proposed area for atomic tests;
- Map D - 20 December 1951 Specified area declared under S+D Regulation 90 (zone 2);
- Map E - 12 March 1956 Specified area declared under S+D Regulation 90 (Old zone 3);
 - Map G - 10 March 1955 - Specified area declared under S+D Regulation 90;
 - Map H - 27 June 1957 - Woomera Protected Area and Maralinga Protected Area declared under Section B of Defence (Special Undertakings) Act 1952;
 - Map I - 12 December 1957 - Land Grant for Defence Purposes;
 - Map J - 5 December 1968 - Maralinga Protected Area Revoked;
 - Map - Maralinga 42 - Maralinga Project - Proposed area for atomic tests
- Collection of plans referred to Moroney:
- Pu239 Data for Taranaki November 1966 - Fig. 10(a);
 - Pu239 Data for Taranaki November 1966 - Fig. 9(a);
 - Vixen B Layout of stands 5th and 25th Avenues - September 1960;

RC538 7.6.85 Sydney J R Moroney

RC539 7.6.85 Sydney J R Moroney

RC540 7.6.85 Sydney J R Moroney

RC540	Contd			<ul style="list-style-type: none"> - Health Physics Survey - Vixen B - 1961; - Plan Round L1 Fall-out pattern; - Plan Round L2 Fall-out pattern - alpha; - Plan Round L3 Fall-out pattern; - Plan Round L4 Fall-out pattern;
RC541	13.6.85	Sydney	F S B Peach	<ul style="list-style-type: none"> Statement and Plan SP1/L2 Maralinga Range Layout; - Diagrammatic Layout - 11 Mile Camp and amended copy 27 July 1956 after information by Officer in Charge, Construction party; - Notes for Guidance of Buffalo Indoctrinees conditions and requirements at Maralinga; - Appendix C to Buffalo Trials Indoctrinee Force Instruction No. 3 - Camp Staff Group; - Appendix A to Buffalo Trials Indoctrinee Force Instruction No. 8 - Operation Rehearsal; - Appendix D - Instruction No. 8 - Round 2 Operation - Standing Orders 11 Mile Camp - August 1956; Peach; - Letter 18 July 1956 and Accompanying Buffalo Trials - Indoctrinee Force Instruction No. 1 - 16 July 1956 (57/Misc/8858(MT11)); - List of UK indoctrinees
RC542	13.6.85	Sydney	C L J Ireland	Statement
RC543	13.6.85	Sydney	E D McHardie	Statement
RC544	13.6.85	Sydney	G O Thompson	Statement
RC545	13.6.85	Sydney	J B Lockey	Statement
RC546	13.6.85	Sydney		Report on Operation Buffalo by Major W H Walters, September 1956
RC547	13.6.85	Sydney		<ul style="list-style-type: none"> Set of reports published in Australian Journal of Science: - Experiments on the 'Sticky Paper' method of radioactive Fall-out sampling: Keam, Dwyer, Martin, Stevens, Titterton - Vol. 21:4 November 1958 - Search for Fall-out in Australia from the Christmas Island tests: Dwyer, Keam, Stevens, Titterton - Vol. 20:2 August-September 57 - Global Fall-out in Australia during the period 26 November 1956-21 December 1957: Keam, Dwyer, Martin, Stevens, Titterton - Vol. 21:1 July 1958 - Radioactive Fall-out in Australia from Operation Mosaic: Butement, Dwyer, Eddy, Martin, Titterton - Vol. 20:5 December 1957 (formerly RC 266) - Radioactive Fall-out in Australia from Operation Buffalo: Butement, Dwyer, Martin, Stevens, Titterton - Vol. 21: 3 October 1956 - Radioactive Fallout in Australia from Operation Antler: Dwyer, Martin, Stevens, Titterton - September 1959
RC548	14.6.85	Sydney	G I Jenkinson	Statement and annexures
RC549	14.6.85	Sydney	W G Henderson	Statement
RC550	14.6.85	Sydney	F Smith	Statement
RC551	14.6.85	Sydney	D W Colquhoun	Statement
RC552	17.6.85	Sydney	Dr Tonkin	Medical cards and letter 24 May 1983 Dr D O Tonkin to Pitjantjara Council Inc re: J Y Lester
RC553	17.6.85	Sydney	A D Thomas	<ul style="list-style-type: none"> Statement and RAAF Weekly Orders Issue No. 1053, 1 November 1954; - RAAF Air Board Orders - Section N - Temporary Orders and notices 25 October 1954; - RAAF Air Board Orders - Section A - Administrative 8 November 1954 - Photographs - dosimeters, protective clothing, use of dosimeters, showers, HMAS Hawkesbury; ship's cat - Letter 14 November 1952 A D Thomas to Hely re: HMAS Hawkesbury and discharge of J E Nicholls - Minute - Radiation Health during Operation Hurricane (Monte Bello Islands October/November 1952) and Operation Totem (Emu Claypan SA October/November 1953).
RC554	17.6.85	Sydney	N Bernabei	Statement
RC555	19.6.85	Sydney	H R Phillipot	<ul style="list-style-type: none"> Statement and annexures - Diagram - The Monte Bello Islands - NW Australian coastal area

RC555	Contd			<ul style="list-style-type: none"> - Operation Mosaic - Joint Operational Plan (MJOP) Section F Meteorology (with amendments) - The meteorological aspects of Operation Mosaic - First Round: Dwyer - Operation Buffalo - Summary Plan Section B28A - Meteorology - Operation Antler - Summary Plan Section G - Meteorology - Map showing locations of coastal radiostations transmitting meteorological data - Map showing surface network of observing stations - Map showing upper air network in observing stations - Operation Mosaic - the meteorological situation affecting the first explosion 16 May 1956 R R Fotheringham and H R Phillpot - Report T8/57 - Operation Buffalo - Vol. 1, text, Vol. 2, illustrations - Meteorological Services, Phillpot - Report T38/58 - Operation Antler - Vol. 1, text, Vol. 2, tables and figures - Meteorological Services, Phillpot - 'The determination of the immediate ground contamination pattern resulting from an atomic weapons trial'. Meteorological Study 56/9009 - ref: RL20.094 - The locations of Australian air sampling stations (chart) - Operation Mosaic - Fallout diagram at the MONTE BELLO ISLANDS and vertical time sections of effective and point winds for Port Hedland for selected periods in April, May and June 1953, 1954, 1955 - ref: RL20.183 - Operation Totem T1 - MSL 700, 500 and 300 mb charts reasonably near the hour of firing on 15 October 1953 - Operation Totem T2 - MSL 700, 500 and 300 mb charts reasonably near the hour of firing on 27 October 1953 - Fig. - Operation Totem T1 - 0150 CST 15 October 1953 - Fig. - Operation Totem T2 - 0310 CST 27 October 1953 - Pure water plume from Newport power station - cloudy/clear - Operation T1 - The surface contamination pattern - Operation T1 - Approximate positions of the high pressure centre - Operation T1 - A sequence of surface synoptic charts (a) to (g) - Operation Mosaic I - Dispersal of radioactivity - Statement by L J Dwyer - Meteorological aspects of the second test at Monte Bello, 19 June 1956: Dwyer - Operation Mosaic G2 - A series of charts and diagrams (a) to (n) all of which assist the interpretation of Attachment 24. - Operation Mosaic - Radioactive rain reports from Kuridala and a ship off the Queensland coast - Operation Antler - Report to Director of Meteorology on the Meteorological Services: Phillpot - Letter 5 August 1955 L J Dwyer to D H Black re: Operation Mosaic - ref: 55/9009 - Extract from Mosaic Joint Operational Plan, pp.13,22
RC556	20.6.85	Sydney	H R Phillpot	<ul style="list-style-type: none"> Four Papers - Meteorological conditions at the Monte Bello Island: 15 August 1985 - Report on cyclones on the NW coast of Western Australia during the years 1935-54 inclusive - The determination of effective winds and their application application to fallout at Port Hedland for the period: April, May, June and July 1950-55 - A further consideration of effective winds at Port Hedland and their application to fallout for Operation Mosaic: 1953-55
RC557	20.6.85	Sydney	A Gordon	Statement
RC558	20.6.85	Sydney		10 bundles of paginated documents collected from the Ministry of Defence, London
RC559	20.6.85	Sydney		Six bundles of paginated documents collected from Foreign Commonwealth Relations Office (FCO), London ref: R119.001, R119.006
RC560	24.6.85	Sydney	J F Richardson	<ul style="list-style-type: none"> Statement and annexures; - Commonwealth X-ray and Radium Laboratory notes on Health Physics

RC560	Contd			<ul style="list-style-type: none"> - Operation Buffalo - Report on the activities of the Australian Health Physics Team - Operation Buffalo - Report on the activities of the Australian Radiation Detection Unit - Instructions for briefing re-entrants 18 September 1956 - Letter 13 August 1957 Director to Secretary, Dept of Supply re: Operation Antler - Training of Australian Radiation Detection Unit - Report to AWTSC on visit to Maralinga 6-9 December 1966 inclusive - Report to AWTSC on visits to Maralinga during Operation Brumby - 'Instruction' 10 September 1956
RC561	26.6.85	Sydney	G M Watson	<ul style="list-style-type: none"> Statement and annexures - Some comments on the AWRE report STDN 8/84 (Roach and Vallis): Watson 27 May 1985 - Two appendices GW1 and GW2 - Notes 23 July 1985 by Watson on AIRAC 9 Documents referred by Messrs James and Eames - Diagrams of mercator projection Totem 1 - Letter 15 June 1976 D R Davy to R Anning AIRAC re: Ad Hoc Committee Report - Report of the Ad Hoc Committee Appointed by AIRAC to Recommend on: Methodology and Scope for a Program on dispersal of radioactivity and absorption into flora and fauna of the Maralinga Range
RC562	2.7.85	Sydney	S J Lloyd	Statement
RC563	2.7.85	Sydney	J G Hooton	Statement
RC564	2.7.85	Sydney	A W Stapleton	Statement
RC565	2.7.85	Sydney	L D Monaghan	Statement
RC566	2.7.85	Sydney	T K Peters	Statement and annexure
RC567	5.7.85	Sydney	C Morrison	<ul style="list-style-type: none"> - photocopy of two newspaper clippings of atomic test suit worn on Monte Bello Islands Statement and annexures - Operation Totem - Security Plan
RC568	5.7.85	Sydney	L G MacDonald	Statement
RC569	5.7.85	Sydney	J W Donovan	<ul style="list-style-type: none"> Four notes - Notes on criticisms of 'Health of Atomic Test Personnel' in ' Report of the Expert Committee on the Review of Data on Atmospheric Fall-out Arising from British Nuclear tests in Australia': September 1984 - Indoctrinee Force - Radiation Exposure - Operation Buffalo: 22 March 1984 - Notes on criticisms of 'Health of Atomic Test Personnel' in letter from AIRAC to Minister of Home Affairs and Environment, 24 May 1984: September 1984 - Notes on criticisms of 'Health of Atomic Test Personnel' in letter of 6 June 1984 from J L Scott, MP to Minister for Health: September 1984
RC570	5.7.85	Sydney	J W Donovan	<ul style="list-style-type: none"> Report - Studies of Participants in Nuclear Tests - Final Report 1 September 1978-31 October 1984: Robinette, Jablon and Preston - May 1985 - ref: DOE/EV/01577
RC571	9.7.85	Sydney	E W Fuller	<ul style="list-style-type: none"> Statement and annexures - Assessment of the Radiological Status of the Maralinga Range and the Emu Site: Fuller, 5 July 1985 - Data for Risk Evaluation
RC572	9.7.85	Sydney	E W Fuller	<ul style="list-style-type: none"> AWRE Report 0-19/69 - Decontamination Aspects of Operation Brumby: Ariss, Thomas, June 1969
RC573	10.7.85	Sydney	Sir E Pochin	<ul style="list-style-type: none"> Statement and annexures - Longterm hazards of radioiodine treatment of thyroid carcinoma. UICC Monograph Series Vol. 21: 1969 - Safety criteria in atomic energy. Proceedings of International Conference on the peaceful uses of atomic energy - Encyclopaedia Medical Radiology 1972: Farmer - Frequency of induction of malignancies in man by ionizing radiation: Pochin - Encyclopaedia Medical Radiology - 1972 - What is a permissible dose?: Pochin - Health Physics 9:1091, 1963

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- Clinical Radiological Pathology, Vol. 1 and 2: Rubin and Casarett - 1968
- Nonstochastic effects of ionizing radiation ICRP Publication 41. Annals of the ICRP 14(3)- 1984 - ref: 8
- The hazards to man of nuclear and allied radiation (UK) Medical Research Council - 1956
- The hazards to man of nuclear and allied radiation: a second report (UK) MRC - 1960 - ref: 11
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- Evidence that natural radioactivity is inadequate to explain the frequency of 'natural' mutations: Muller and Mott-Scott - Proceedings of the National Academy of Science 16:277, 1930
- The effect of varying the duration of x-ray treatment upon the frequency of mutation - Science 71:44, 1930
- The genetic effect of low intensity radiation: Uphoff and Stern - Science 109:609, 1949
- Mutagenic effects of a 5r dose of x-rays in drosophila melanogaster: Glass, Ritterhoff - Science 133:1366, 1961
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- Ionizing radiation: Sources and biological effects, 1982 Report of the United Nations Scientific Committee on the Effects of Atomic Radiation, to the General Assembly, United Nations, New York, 1982 - ref: 20
- Radiation-induced chromosome aberrations in nuclear dockyard workers: Evans, Buckton, Hamilton and Carothers - Nature 277:531, 1979
- The incidence of unstable chromosome aberrations in peripheral blood lymphocytes from unirradiated and occupationally exposed people: Lloyd, Purrott and Reeder - Mutation Research 72:523, 1980
- The relationship between chromosome aberrations and low LET radiation dose to human lymphocytes: Lloyd, Purrott, Dolphin, Bolton, Edwards, Corp - International Journal of Radiation Biology 28:75, 1975
- The dependence of chromosome aberration yields on dose rate and radiation quality: Edwards, Lloyd, Purrott and Prosser National Radiation Protection Board, Research and Development Report 1979-81, 1982
- Sources and effects of ionizing radiation 1977 Report of the United Nations Scientific Committee on the Effects of Atomic Radiation, to the General Assembly - 1977 - ref: 25
- United Nations Demographic Handbook 1981. - 1983
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 - The shape of the dose-response curve for radiation carcinogenesis: Brown - Radiation Research 71:34, 1977
 - Committee on the Biological Effects of Ionizing Radiation The Effects on populations of exposure to low levels of ionizing radiation: 1980 - National Academy Press 1980 - ref: 46
- | | | | | |
|-------|---------|--------|----------------|--|
| RC574 | 11.7.85 | Sydney | Sir E Pochin | Report AAEC/DR20 - Options for Clean-up of the Maralinga Test Site: Environmental Science Division: June 1985; |
| | | | | - Note - Estimation of Cancer and genetic risk from plutonium contaminated areas after clean up to standard of AAEC/DR20 which includes 1) clean up of fragments, 2) fencing: E W Fuller |
| RC575 | 11.7.85 | Sydney | Sir E Pochin | Transcript of Comments made by Lokan during tours of Maralinga Range on 25-26 April 1985 |
| RC576 | 11.7.85 | Sydney | Sir E Pochin | Listing of Summary information concerning Australian participants at UK overseas atmospheric nuclear tests carried out in Australia |
| | | | | - Photocopy of caveats from Blue Book |
| RC577 | 11.7.85 | Sydney | Sir E Pochin | AIRAC Report 1983-84 - AIRAC No. 10: 1985 |
| RC578 | 15.7.85 | Sydney | F Lonis | Statement |
| RC579 | 15.7.85 | Sydney | D W Willes | Statement |
| RC580 | 15.7.85 | Sydney | D Martin | Statement |
| RC581 | 15.7.85 | Sydney | | Four ringback folders. Commonwealth collation re: Monte Bello Islands |
| RC582 | 15.7.85 | Sydney | R B Brown | Statement and map of Emu test area - site map |
| RC583 | 15.7.85 | Sydney | R D Anderssen | Statement |
| RC584 | 15.7.85 | Sydney | H J Affleck | Statement |
| RC585 | 16.7.85 | Sydney | Prof Langlands | Curriculum vitae and four documents; |
| | | | | - Medical Report on the medical records of E K Peck and the statement by E K Peck; |
| | | | | - Effects of low level radiation on Australian Aborigines in the vicinity of Wallatinna and Welbourn Hill, 9 July 1985 |

RC585	Contd			- Comments on the evidence of Dr D O Tonkin;
RC586	16.7.85	Sydney	Prof Hamilton	- Copy of RAAF medical records made available to Langlands Statement and paper - 'Socio-cultural factors in health among the Pitjanjatjara - A Preliminary Report (1971)': Hamilton
RC587	23.7.85	Sydney	Prof Kerr	Report - Report of the Expert Committee on the Review of Data on Atmospheric Fallout Arising from British Nuclear Tests in Australia: 31 May 1985 and appended list of references
RC588	23.7.85	Sydney	Ian Blair	Statement
RC589	25.7.85	Sydney		Unclassified Minor Trials Schedule (duplicate of RC 633)
RC590	26.7.85	Sydney		Document - 'A History of British Atomic Tests in Australia': Dr J L Symonds, April 1985 - Australian Government Printing Service
RC591	26.7.85	Sydney		Document - 'A Political Inconvenience: Australian Scientists at the British Atomic Weapons Tests 1952-3': Sherratt - 1984 - University of Melbourne
RC592	26.7.85	Sydney		Document - 'The Evolution of Radiation Protection Recommendations and Control in Australia': Duggleby, Swindon - Australian Radiation Laboratory
RC593	26.7.85	Sydney		Scientists Against Nuclear Arms 1984 - Submission
RC594	26.7.85	Sydney		'Organization for Radiation Protection - the Operations of the ICRP and NCRP 1928-74', 1979: Lauriston S Taylor
RC595	26.7.85	Sydney		Document - 'Ionizing Radiation: Sources and Biological Effects' UNSCEAR (1982)
RC596	26.7.85	Sydney		Files of Press Releases: - R087.094 Atomic Tests - Safety Committee Attitudes - R087.092 Mr R Harris - Press Releases - R087.103 Mr W Worth - Press Releases issued by Beale 1956
RC597	26.7.85	Sydney		Files of Press Cuttings: - R087.102 Atomic Weapons Trials 1953-55 - R087.101 Atomic Weapons Trials 1955 - R087.173 Press Cuttings 1956 - R087.087 Atomic Tests - Safety 1957 - R087.093 Atomic Tests - Radiation and Radioactivity 1957 - R087.099 Atomic Tests - Antler 1957 File R037.003 AHP/2/124 Maralinga Cemetery Records (LA.5.4) Minutes and Agenda of Atomic Weapon Test Committee (R30.10 and R30.11) A critique of 'Health of Atomic Test Personnel': T Sorahan, April 1985 Report - Public Health Impact of Fall-out from British Nuclear Weapons Tests in Australia 1952-1957: Wise, Moroney - July 1985 Hurricane Executive file - ref: ADM 116/6089 Story of Operation Hurricane: McEnhill, 1977 T1/53 - Some Preliminary Results from the Monte Bello Tests, Relevant to Defence, including Civil Defence: Moyce T18/54 - Report on Trial Carried out for Ministry of Food: Stanbury T51/54 - Decontamination of Radioactive Clothing III. Laundry Investigations and Recommendations: Stevenson Report T78/54 - The Effects of an Atomic Explosion on a Centurion Tank Vol. 1: W de L Messenger (Duplicate of RC 446) T85/54 - Collection of Samples for Radiochemical Analysis: Cooper T92/54 - Measurement of Air Blast using Petrol Cans and Toothpaste Tubes: Wright, Warren T109/54 - Radiochemical Decontamination Experiments on Naval Construction Materials I. Evaluation of a Pre-wetting System: Jackson et al. ARL/R3/C - Growth of Fireball and Cloud: Pyne T52/54 - Gamma Radiation Measurements in Field Trials: Dale (Duplicate of RC 285) T67/54 - Operation Totem Photographic Observation: Walker T86/54 - Measurement of Air Blast: Pearce
RC598	26.7.85	Sydney		
RC599	26.7.85	Sydney		
RC600	26.7.85	Sydney		
RC601	26.7.85	Sydney		
RC602	26.7.85	Sydney		
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RC613	26.7.85	Sydney		
RC614	26.7.85	Sydney		

RC615	26.7.85	Sydney		T105/54 - Prevention and Removal of Radioactive Contamination Part V Decontamination Research: Stevenson
RC616	26.7.85	Sydney		T6/56 - Measurement of the Protection Against Gamma Radiation Afforded by Slit Trenches: Cave
RC617	26.7.85	Sydney		Letter 21 February 1985 W T Roach to Treasury Solicitor
RC618	26.7.85	Sydney		Maddock's Diary, Mosaic Trials
RC619	26.7.85	Sydney		Letter 5 October 1956 W R Cook to Jackson, with annexures
RC620	26.7.85	Sydney		Mosaic Joint Trial Orders numbered 1-22, 2 February-1 June 1956
RC621	26.7.85	Sydney		Mosaic/A/TT - Joint Operational Plan Part A9. Timetable of scientific activities at Monte Bello
RC622	26.7.85	Sydney		T30/57 - Air sampling Equipments and Techniques: Eyre
RC623	26.7.85	Sydney		Review of Trials Facilities Available at Maralinga and Christmas Island: Jones
RC624	26.7.85	Sydney		T18/57 - Operation Buffalo Interim Report Target Response - Biology Group: Scott Russell
RC625	26.7.85	Sydney		T19/57 - Measurement of the Beta/Gamma Ratio of the Radiations from Fall-out: Barnaby
RC626	26.7.85	Sydney		T36/57 - Gamma Ray Spectrum of Fall-out from Buffalo Round 1: Peirson and Sinton
RC627	26.7.85	Sydney		T50/57 - The Remote Measurement of the Variation with Time of Gamma Dose-Rate from Fall-out: Jones
RC628	26.7.85	Sydney		T60/57 - The Measurement of the Gamma Dose-Rate and the Beta/Gamma Ratio in the Radio-active Clouds: Barnaby
RC629	26.7.85	Sydney		T57/58 - (Appendix A) Target Response Tests: Drake Seager (Appendix to RC 445)
RC630	26.7.85	Sydney		T14/58 - Target Response Tests Ordnance Group Part 1: Hearn
RC631	26.7.85	Sydney		Sanitised Blue Book: British Listing
RC632	26.7.85	Sydney		'Independence and Deterrence - Britain and Atomic Energy 1945-1952' Vol. 1-2: Gowing
RC633	26.7.85	Sydney		Unclassified Minor Trials Schedule (Duplicate of RC 589)
RC634	26.7.85	Sydney		Drake-Seager letter on visit to Australia (sanitised) together with transcript and video
RC635	26.7.85	Sydney	C Adams	Statement
RC636	26.7.85	Sydney		T57/57 - Health Physics Report TIM Series 2: Holmes
RC637	26.7.85	Sydney		T16/62 - Decontamination of Cloud Sampling Aircraft: Oldbury
RC638	26.7.85	Sydney		Extract from Operations Record Book, 1439 Flight
RC639	26.7.85	Sydney		Living with Radiation (NRPB)
RC640	26.7.85	Sydney		T28/63 - Operation Ayres 2: Oldbury (Duplicate of RC 379)
RC641	26.7.85	Sydney		O-44/55 - A Review of the Mechanism of Diffusion in the Free Atmosphere: MacDougall
RC642	26.7.85	Sydney		O-3/56 - Examination of Fall-out Pellets from Totem 2: Ault
RC643	26.7.85	Sydney		E6/56 - The Dispersion of Radioactivity in the Sea after the Explosion of an Atomic Weapon: Steel (Duplicate of RC 462)
RC644	26.7.85	Sydney		Bundle of sundry letters from MOD file 497/094/51 Part 3
RC645	26.7.85	Sydney		Bundle of sundry signals on incidents involving balloons 1960-1961
RC646	26.7.85	Sydney		Report 1/48 Part 8 - Crossing of an Area of Contaminated by Fission by-products: Liston et al.
RC647	26.7.85	Sydney		E4/53 - Particles Resulting from an Atomic Explosion: Woodcock
RC648	26.7.85	Sydney		A10 - Gamma-activity of the Products of an Atomic Bomb Explosion: Cave
RC649	26.7.85	Sydney		E1/54 - Rise of the Cloud Produced in an Atomic Explosion: Siddons
RC650	26.7.85	Sydney		O-44/55 - A Review of the Mechanism of Diffusion in the Free Atmosphere: MacDougall (Duplicate of RC 641)
RC651	26.7.85	Sydney		TPN81/55 - On estimating the cross-wind spread of Fall-out: Matthewman
RC652	26.7.85	Sydney		TPN92/55 - Estimates of Ground Contamination for Operation Buffalo: MacDougall
RC653	26.7.85	Sydney		TPN103/55 - Dependence on Ground Contamination at Large Distances on the Height of Burst of an Atomic Bomb: MacDougall (Duplicate of RC 418)
RC654	26.7.85	Sydney		TPN121/55 - Debris Content of the Totem 1 Cloud: MacDougall
RC655	26.7.85	Sydney		TPN59/56 - Alternative Formula for the Amount of Ground Contamination from Fall-out at Medium Ranges following an Atomic Explosion: Beale
RC656	26.7.85	Sydney		TPN28/57 - Hazards to Civil Aircraft from Atomic Clouds from Test Weapons: MacDougall

RC657	26.7.85	Sydney	E1/58 - Computation of Fall-out Patterns Part 1. General Theory: Beale
RC658	26.7.85	Sydney	E2/58 - ibid Part 2. Numerical Details: Beale
RC659	26.7.85	Sydney	E3/58 - Summary of British Atomic Cloud Rise Data and a Comparison with Theoretical Predictions: Cheeseman (Duplicate of RC 429)
RC660	26.7.85	Sydney	E6/63 - Gamma Dose-Rate above an Infinite Plane Source: Holme, Stewart
RC661	26.7.85	Sydney	AWEC/P(57) - On the Prediction and Interpretation of Fall-out Patterns: MacDougall
RC662a	26.7.85	Sydney	AWRE Explanatory Notes on Alice Road Survey
RC662b	26.7.85	Sydney	Article: Close-in Fall-out (Journal of Meteorology 14(1)): Kellogg, et al., 1-8 February 1957
RC663a	26.7.85	Sydney	Article: Criteria for Evaluating Gamma Radiation Exposures from Fall-out following Nuclear Detonations (Radiology 66(4), 585-594): Dunning, April 1956
RC663b	26.7.85	Sydney	TPN37/56 - On the Causes of Cross-Wind Scattering of Medium Range Fall-out: Beale, Reid
RC664	26.7.85	Sydney	TPN95/55 - Some Comments on TPN78/55: Hicks
RC665	26.7.85	Sydney	TPN92/55 - Estimates of Ground Contamination for Operation Buffalo: MacDougall (Duplicate of RC 652)
RC666	26.7.85	Sydney	TPN57/56 - An Alternative Approximation to the Effect of Fall-out from the Upper Part of the Stem: Beale
RC667	26.7.85	Sydney	TPN60/56 - A Comparison of Alternative Formulae for Medium Range Fall-out: Beale
RC668	26.7.85	Sydney	TPN91/56b- The Estimation of Medium Range Fallout from a Near Surface Nuclear Explosion: Hicks
RC669	26.7.85	Sydney	TPN11/57 - A Comparison of Two Formulae for the Height of Rise of an Atomic Cloud: Matthewman
RC670	26.7.85	Sydney	TPN18/57 - Notes on fallout calculations: Hicks
RC671	26.7.85	Sydney	TPN55/57 - On Predicting the Height of Rise of an Atomic Cloud: Cheeseman, Sams
RC672	26.7.85	Sydney	Paper - The compositions, structures and origins of radioactive fallout particles - Geochimica et Cosmochimica Acta 18, 42-56 1960: Adams et al.
RC673	26.7.85	Sydney	Paper - The characterization of radioactive particles from nuclear weapons tests - In: Radionuclides in the Environment, E C Freling (ed) American Chemical Society 1970, p254-282: Heft
RC674	26.7.85	Sydney	Paper - Calculation of the concentration of any radionuclide deposited on the ground by offsite fallout from a nuclear detonation - Health Physics 42, 585-600 1982: Hicks
RC675	26.7.85	Sydney	Paper - Some studies on the evaluation of gummed paper collections used in determining radioactive fallout: Rosinski - Trans American Geophysical Union, 38, 857-863 1957
RC676	26.7.85	Sydney	Paper - The effects of ionising radiations on the eye - Frontiers of Radiation Therapy and Oncology 6, 346-385 1972: Merriman et al.
RC677	26.7.85	Sydney	Extracts on Beryllium Toxicity: - Beryllium alloys and compounds, Encyclopaedia of Occupational Health and Safety, International Labor Office - Beryllium and its compounds (Environmental and Industrial Health Hazards, a practical guide) - Heineman Medical Books Ltd
RC678	26.7.85	Sydney	- Distribution, Characteristics and Biotic Availability of Fallout, Operation Plumbbob - WT-1488, July 1966 Microfiche: K H Larson et al.
RC679	26.7.85	Sydney	E C Giles Statement
RC680	26.7.85	Sydney	J G Moffat Statement
RC681	26.7.85	Sydney	I Walsworth-Bell Statement
RC682	26.7.85	Sydney	C P Weaver Statement
RC683	26.7.85	Sydney	C A Adams Statement (duplicate of RC 635)
RC684	26.7.85	Sydney	B G Adlington Statement
RC685	26.7.85	Sydney	M H Aitken Statement
RC686	26.7.85	Sydney	Mrs J Ayres Statement
RC687	26.7.85	Sydney	Mrs O J Bear Statement
RC688	26.7.85	Sydney	W A Beauglehole Statement

RC689	26.7.85	Sydney	G Black	Statement
RC690	26.7.85	Sydney	M Blinco	Statement
RC691	26.7.85	Sydney	Mrs G E Bock	Statement
RC692	26.7.85	Sydney	L R Brennan	Statement
RC693	26.7.85	Sydney	H Buetefer	Statement
RC694	26.7.85	Sydney	I M Burnside	Statement
RC695	26.7.85	Sydney	H Busby	Statement
RC696	26.7.85	Sydney	L R Callaghan	Statement
RC697	26.7.85	Sydney	V Cannon	Statement
RC698	26.7.85	Sydney	Mrs P D Cassidy	Statement
RC699	26.7.85	Sydney	H J Clatworthy	Statement
RC700	26.7.85	Sydney	Mrs R D Coleman	Statement
RC701	26.7.85	Sydney	B L Collins	2nd Statement
RC702	26.7.85	Sydney	C A Comas	Statement
RC703	26.7.85	Sydney	E J Coulton	Statement
RC704	26.7.85	Sydney	H J Crosbie	Statement
RC705	26.7.85	Sydney	P J Cubillo	Statement
RC706	26.7.85	Sydney	B Dickinson	Statement
RC707	26.7.85	Sydney	P Dnersi	Statement
RC708	26.7.85	Sydney	V J Douglas	Statement
RC709	26.7.85	Sydney	P Draisey	Statement
RC710	26.7.85	Sydney	L C Dutton	Statement
RC711	26.7.85	Sydney	I J Findlay	Statement
RC712	26.7.85	Sydney	N R Gates	Statement
RC713	26.7.85	Sydney	C N Geschke	Statement
RC714	26.7.85	Sydney	K Ginnane	Statement
RC715	26.7.85	Sydney	E Glover	Statement
RC716	26.7.85	Sydney	A W Gostelow	Statement
RC717	26.7.85	Sydney	F J Gould	Statement
RC718	26.7.85	Sydney	A E Gunnourie	Statement
RC719	26.7.85	Sydney	J B Hampshire	Statement
RC720	26.7.85	Sydney	J B Hedrick	Statement
RC721	26.7.85	Sydney	T J Howard	Statement
RC722	26.7.85	Sydney	D R C Humphrey	Statement
RC723	26.7.85	Sydney	K H Jackson	Statement
RC724	26.7.85	Sydney	H H F Johnstone	Statement
RC725	26.7.85	Sydney	O L Jones	Statement
RC726	26.7.85	Sydney	B B Joyner	Statement
RC727	26.7.85	Sydney	K C Kareta	Statement
RC728	26.7.85	Sydney	V T Kittle	Statement
RC729	26.7.85	Sydney	J W Lane	Statement
RC730	26.7.85	Sydney	G W Lang	Statement (duplicate of RC 87)
RC731	26.7.85	Sydney	W T Lee	Statement
RC732	26.7.85	Sydney	M P Lindschau	Statement
RC733	26.7.85	Sydney	E J Ludwig	Statement
RC734	26.7.85	Sydney	W L McGee	Statement
RC735	26.7.85	Sydney	R N McLean	Statement
RC736	26.7.85	Sydney	L G MacDonald	Statement
RC737	26.7.85	Sydney	V MacLean	Statement
RC738	26.7.85	Sydney	J Maynell-James	Statement
RC739	26.7.85	Sydney	J Muxworthy	Statement (duplicate of RC 498)
RC740	26.7.85	Sydney	W R Nicholls	Statement
RC741	26.7.85	Sydney	N Nickol	Statement
RC742	26.7.85	Sydney	O'Brien	Statement

RC743	26.7.85	Sydney	R J Plummer	Statement
RC744	26.7.85	Sydney	C P Pont	Statement
RC745	26.7.85	Sydney	D Prior	Statement
RC746	26.7.85	Sydney	R W Pywell	Statement
RC747	26.7.85	Sydney	S G Rae	Statement
RC748	26.7.85	Sydney	R T Raph	Statement
RC749	26.7.85	Sydney	C S Raymond	Statement
RC752	26.7.85	Sydney	R P Roberts	Statement
RC750	26.7.85	Sydney	J Rock	Statement
RC751	26.7.85	Sydney	N W Sharpe	Statement
RC752	26.7.85	Sydney	A F Sirotzki	Statement
RC753	26.7.85	Sydney	K M Slattery	Statement
RC754	26.7.85	Sydney	J B Stacey	Statement
RC755	26.7.85	Sydney	E B Stanton	Statement
RC756	26.7.85	Sydney	Mrs R Stoncius	Statement
RC757	26.7.85	Sydney	Mrs M L Stuart	Statement
RC758	26.7.85	Sydney	J Szymanski	Statement
RC759	26.7.85	Sydney	Mrs S Taudevin	Statement
RC761	26.7.85	Sydney	G A Taylor	Statement
RC762	26.7.85	Sydney	F Tomerini	Statement
RC763	26.7.85	Sydney	R E Walker	Statement
RC764	26.7.85	Sydney	R Wallington	Statement
RC765	26.7.85	Sydney	K Walton	Statement
RC766	26.7.85	Sydney	G E Ward	Statement
RC767	26.7.85	Sydney	T H Ward	Statement
RC768	26.7.85	Sydney	R C Whitfield	Statement
RC769	26.7.85	Sydney	Mrs D J Whyte	Statement
(Exhibit Nos RC 770 to 779 omitted as per transcript)				
RC780	26.7.85	Sydney	B J Wilson	Statement
RC781	26.7.85	Sydney	D J Wilton	Statement
RC782	26.7.85	Sydney	J Winton	Statement
RC783	26.7.85	Sydney	K Wolf	Statement
RC784	26.7.85	Sydney	J W Wood	Statement
RC785	26.7.85	Sydney	N C Simister	Statement
RC786	26.7.85	Sydney	L W Stahl	Statement
RC787	26.7.85	Sydney	R A Jones	Statement (duplicate of RC 197)
RC788	26.7.85	Sydney	S Cotton	Statement
RC789	26.7.85	Sydney	B D Griffiths	Statement
RC790	26.7.85	Sydney	S B Aldridge	Statement
RC791	26.7.85	Sydney	A E Blinco	Statement
RC792	26.7.85	Sydney	E J R Flynn	Statement
RC793	26.7.85	Sydney	K C Gore	Statement
RC794	26.7.85	Sydney	R Haffert	Statement
RC795	26.7.85	Sydney	R M Harper	Statement
RC796	26.7.85	Sydney	T C Mackaway	Statement
RC797	26.7.85	Sydney	J McClure	Statement
RC798	26.7.85	Sydney	W F Sullivan	Statement (duplicate of RC 500)
RC799	26.7.85	Sydney	R F Willie	Statement
RC800	26.7.85	Sydney		Australian collation
RC801	26.7.85	Sydney	D R Davy	Note of fallout effects
RC802	26.7.85	Sydney		Treaty banning Nuclear Weapon Tests in the Atmosphere, in Outer Space and Under Water Moscow, August 1963 [Treaty Series No. 3 (1964)]
RC803	26.7.85	Sydney		Treaty on the Non-Proliferation of Nuclear Weapons, London, Moscow and Washington, 1 July 1968 [Treaty Series No. 88 (1970)]

RC804	26.7.85	Sydney		Report - Aboriginal Social Indicators 1984 (Dept of Aboriginal Affairs);
RC805	26.7.85	Sydney		Aborigines and Change - Australia in the '70s: Berndt;
RC806	26.7.85	Sydney		- Extract from Aborigines and Change - Decentralisation trends in Arnhem Land: Gray
RC807	26.7.85	Sydney	T K Maguire	Submission by the Bureau of Meteorology
RC808	26.7.85	Sydney	R F Norris	Statement
RC809	26.7.85	Sydney		Statement
RC810	26.7.85	Sydney		Maps drawn by Dr J Harries showing fallout over Australia for major tests
				Six charts of fallout patterns from Operation Plumbbob, 28 May-31 July 1957
				- Extract from K H Lasseur et al. - 'Distribution Characteristics and Biotic
				Availability of Fallout Operation Plumbbob' (WTL488 July 1966, see RC 678)
RC811	26.7.85	Sydney		Listing of summary information concerning UK participants at UK overseas atmospheric
				nuclear tests carried out in Australia (Computer generated listing).
RC812	26.7.85	Sydney	E L Crawford	Statement
RC813	26.7.85	Sydney	A F Tucker	Statement
RC814	26.7.85	Sydney	M S Clark	Statement
RC815	26.7.85	Sydney	A L Edwards	Statement
RC816	26.7.85	Sydney		Report to the Congress by the Comptroller General of the United States entitled:
				'Enewetak Atoll - Cleaning up Nuclear Contamination'
RC817	26.7.85	Sydney		Report by the Bikini Atoll Rehabilitation Committee entitled: 'Resettlement of Bikini
				Atoll: Feasibility and Estimated Cost of Meeting the Federal Radiation Protection
				Standards'
RC818	26.7.85	Sydney		Report entitled: 'Assessment of Radiation Health Effects of the Resettlement of
				Enewetak Atoll' (National Cytogenetics Inc)
RC819	26.7.85	Sydney		Aboriginal collation
RC820	26.7.85	Sydney		Three pages entitled: 'Useful Data' prepared by Dr J Harries
RC821	18.9.85	Sydney		Report - 'Residual contamination of the Maralinga and Emu sites': Chalk River Nuclear
				Laboratories Atomic Energy of Canada Limited, 30 July 1985
				Attachments 'Dose conversion factors used in the current Canadian high level waste
				disposal assessment study' - ref: AECL 7869: Johnson
RC822	18.9.85	Sydney		Letter 27 July 1985 B W Church to Harries and six enclosures;
				- 'Briefing on cleanup of TRU contaminated soil January 17 1984 - Enewetak Atoll
				Cleanup': McCraw
				- Briefing on the Enewetak cleanup project: Church
				- Overlays of data from discrete soil samples, portable instrument and aerial measure-
				ments from a safety-test area on the Nevada test site
				- Publications of Nevada Applied Ecology Group, US Dept of Energy Las Vegas, Nevada
				- Environmental aspects of transuranics A selected annotated bibliography,
				Vol.9, October 1978
				- Letter 7 May 1985 G Burley, Science Adviser, Office of Radiation Programs (US
				organisation) to T McCraw re: Summary report 'Interim Recommendations on Doses to
				Persons Exposed to Transuranium Elements in the General Environment'
RC823	18.9.85	Sydney		Report - Environmental radiation of the Monte Bello Islands and other remnants from
				the nuclear weapons tests conducted in 1952 and 1956: Moroney - July 1985
RC824	18.9.85	Sydney		Report - Hedley R Marston, FRS and the AWTSC - The controversy over the fallout from
				British nuclear tests in Australia in 1956 - A chronological overview of the
				controversy: Hammersley, Moroney - July 1985
RC825	18.9.85	Sydney		Letter 13 August 1985 F Bett to B Gillin enclosing statement on safeguards aspects of
				radioactive contamination at Maralinga
RC826	18.9.85	Sydney		Letter and reports 9 August 1985 D Davy to J Harries giving references to papers on
				gut transfer
RC827	18.9.85	Sydney		Letter 6 September 1985 D Davy to Harries in response to comments offered by Sir
				Edward Pochin and comments on review of AAEC/DR20 by Chalk River Nuclear
				Laboratories

RC828	18.9.85	Sydney		Copy of Maralinga Land Grant including description of areas included and excluded from grant, 6 December 1984
RC829	18.9.85	Sydney		Report - Management of Hazardous Waste in Australia, conducted by ANVA New South Wales: Knight - August 1985
RC831	18.9.85	Sydney	R C Blunt	Statement
RC831	18.9.85	Sydney	J Britton	Statement
RC832	18.9.85	Sydney	T W Chalomer	Statement
RC834	18.9.85	Sydney	E R Cheney	Statement
RC835	18.9.85	Sydney	S W F Darke	Statement
RC836	18.9.85	Sydney	R V Fitzgerald	Statement
RC837	18.9.85	Sydney	L D Gordon	Statement
RC838	18.9.85	Sydney	W J Goulding	Statement
RC839	18.9.85	Sydney	E M Guthrie	Statement
RC840	18.9.85	Sydney	J A Haines	Statement
RC841	18.9.85	Sydney	D Ingall	Statement
RC842	18.9.85	Sydney	G F A Irvine	Statement
RC843	18.9.85	Sydney	A L McClure	Statement
RC844	18.9.85	Sydney	H M McKinnon	Statement
RC845	18.9.85	Sydney	H D Marsh	Statement
RC846	18.9.85	Sydney	L J Martin	Statement
RC847	18.9.85	Sydney	C W Meech	Statement
RC848	18.9.85	Sydney	J E Nicholls	Statement
RC849	18.9.85	Sydney	R E Noblett	Statement
RC850	18.9.85	Sydney	A J O'Connell	Statement
RC851	18.9.85	Sydney	K Pearson	Statement
RC852	18.9.85	Sydney	H C W Piesse	Statement
RC853	18.9.85	Sydney	R H Potrzeba	Statement
RC854	18.9.85	Sydney	R W Shaw	Statement
RC855	18.9.85	Sydney	C M Smith	Statement
RC856	18.9.85	Sydney	D Smith	Statement
RC857	18.9.85	Sydney	I W Sutherland	Statement
RC858	18.9.85	Sydney	A F Tucker	Statement (duplicate of RC 813)
RC859	18.9.85	Sydney	P Webb	Statement
RC860	18.9.85	Sydney	E H Williams	Statement
RC861	18.9.85	Sydney		Final submission of Counsel Assisting the Royal Commission
RC862	18.9.85	Sydney		Final submission on behalf of Aboriginal groups and individuals
RC863	18.9.85	Sydney		Final submission from AIRAC
RC864	18.9.85	Sydney		Final submission by Nuclear Veterans Association (SA) and Maralinga and Monte Bello Islands Ex-Servicemen's Association Vol. 1 and 2
RC865	18.9.85	Sydney		Final submission from the Government of the United Kingdom
RC866	18.9.85	Sydney		Final submission from ANVA (NSW) and letter 16 September 1985 from Cambridge Clinic re: medical survey on behalf of ANVA
RC867	18.9.85	Sydney		Two reports - Loss of Captive Balloons at Maralinga - October 1960 - Breakaway and deflation of bedded down balloons - April 1961
RC868	18.9.85	Sydney		Report commissioned by ANVA(SA) - September 1985
RC869	18.9.85	Sydney		AERE paper The Monte Bello Rat: Barnes, Harrison et al.: SPAR/1 - November 1953
RC870	18.9.85	Sydney		Letter Treasury Solicitor to Secretary, Royal Commission enclosing Pochin note referring to Maximum limits given in RC 529 on contemporary ICRP recommendations, August 1985 and note on RC 801 referred to at para.15.204-5 of UK submission
RC871	18.9.85	Sydney		Report - Feasibility and alternative procedures for decontamination and post treatment management of Pu-contaminated areas in Nevada - Laboratory of Nuclear Medicine and Radiation Biology, University of California - September 1984
RC872	18.9.85	Sydney		Note by E W Fuller 12 September 1985 - Radiological consequences of Totem 1

RC873	18.9.85	Sydney	Final submission by Australian Nuclear Veteran's Association (Qld) and Australian Nuclear Veteran's Association (WA)
RC874	18.9.85	Sydney	Final submission by the British Nuclear Tests Veteran Association
RC875	18.9.85	Sydney	Final submission by the Government of the Commonwealth of Australia
RC876	23.9.85	Sydney	List of files held by the Royal Commission, pp.1-85
RC877	23.9.85	Sydney	Reply to final submissions by ANVA (NSW)
SA1	11.9.84	Adel	- Maralinga Tjaratja Land Rights Act, 1984
SA2	11.9.84	Adel	- Annexure to Report of Atomic Weapons Safety Committee (July 1967) to the Prime Minister
SA3	30.11.84	Adel	- SA Submission

Place Name Abbreviations

Adel	Adelaide
Bris	Brisbane
K'atha	Karratha
Lond	London
Mar'ga	Maralinga
Marla	Marla Bore
Melb	Melbourne

APPENDIX F

THE MODUS VIVENDI

[Source: Gowing 1974, Vol.1, pp.266-272]

1. All agreements between the three governments or any two of them in the field of atomic energy shall be regarded as null and of no effect, with the following exceptions:

- (a) The Patent Memorandum of 1 October 1943 as modified by subsequent agreement on 19 September 1944 and 8 March 1945.
- (b) The Agreement and Declaration of Trust dated 13 June 1944.
- (c) The exchange of letters between the Acting Secretary of State and the British Ambassador of 19 and 24 September 1945, concerning Brazil.
- (d) The agreed public Declaration by the President of the United States, the Prime Minister of the United Kingdom, and the Prime Minister of Canada of 15 November 1945.

2. The Combined Policy Committee, already established, and subject to the control of the three governments, shall continue as an organ for dealing with atomic energy problems of common concern. The Committee shall consist of three representatives of the United States, two of the United Kingdom, and one of Canada, unless otherwise agreed.

3. The Committee shall *inter alia*:

- (a) Allocate raw materials in accordance with such principles as may be determined from time to time by the Committee, taking into account all supplies available to any of the three governments.
- (b) Consider general questions arising with respect to co-operation among the three governments.
- (c) Supervise the operations and policies of the Combined Development Agency referred to in paragraph 4 below.

4. The Combined Development Trust, created on the thirteenth of June 1944 by the Agreement and Declaration of Trust signed by President Roosevelt and Mr Winston Churchill, shall continue in effect except that it shall henceforward be known as the Combined Development Agency. Of the six persons provided for in Clause 1(2) of the Declaration of Trust, three shall represent the United States, two the United Kingdom, and one Canada.

5. The United States, the United Kingdom and Canada will, within the limits of their respective constitutions and statutes, use every effort to acquire control of supplies of uranium and thorium situated within their respective territories. The United Kingdom will, in so far as need exists, communicate with the governments of the British Commonwealth for the purpose of ensuring that such governments exercise control of supplies of uranium and thorium situated in their respective territories. The United Kingdom will consult with the Commonwealth Governments concerned with a view to encouraging the greatest possible production of uranium and thorium in the British Commonwealth, and with a view to ensuring that as large a quantity as possible of such supplies is made available to the United States, United Kingdom and Canada.

6. It is recognised that there are areas of information and experience in which co-operation would be mutually beneficial to the three countries. They will therefore co-operate in respect of such areas as may from time to time be agreed upon by the CPC and in so far as this is permitted by the laws of the respective countries.

7. In the interests of mutual security, classified information in the field of atomic energy will not be disclosed to other governments or authorities or persons in other countries without due prior consultation.

8. Policy with respect to international control of atomic energy remains that set forth in the Three-Nations Agreed Declaration of 15 November 1945. Whenever a plan for the international control of atomic energy with appropriate safeguards which would ensure use of atomic energy for peaceful purposes only shall be agreed upon, and shall become fully effective, the relationship of these countries in atomic energy matters will have to be reconsidered in the light thereof.

ANNEX I

Allocations

1. The agreed objective is the maintenance of the United States, United Kingdom and Canadian minimum programmes with reasonable pipeline and reserve stocks.

2. In 1948 and 1949 all supplies available from the Belgian Congo will be allocated to the United States, subject to para.4 below.

3. In 1948 and 1949, if supplies additional to those which will flow from existing sources are required to maintain the United States minimum programme, they will be provided, subject to para.4 below, from the unprocessed and presently unallocated supplies now in the United Kingdom, according to the following arrangements:

- (a) The United States requirement is 2547 tons in 1948 and 2547 in 1949, including capital charge of 370 tons for one pile in each year, a pipeline stock of 2800 tons and a reserve stock of 2547 tons throughout 1948, diminishing to 2176 tons at the end of 1949.
- (b) The United Kingdom requirement to the end of 1949 is as follows: capital charge for two piles 600 tons, pipeline stock of 770 tons, reserve stock of 660 tons.
- (c) At the end of each quarter a balance will be struck and submitted to the CPC. If the reserve stock in the USA is below the agreed minimum, an amount equivalent to the deficit will be ear-marked from the unallocated and unprocessed stocks in the United Kingdom. At the end of the third quarter in 1948 and 1949, a review of the situation will be made by the CPC in the light of the current position and the prospective shipments in the fourth quarter of each year. In striking this balance supplies will be taken into account which are in transit from the port of shipment. Should stocks at any time before the end of the third quarter fall below seven months' supply, emergency shipments to safeguard continued operation will be made.
- (d) According to the result of this review a shipment will be made or ear-marked supplies will be released as the case may be. A similar arrangement will apply in due course in respect of the United Kingdom programme.
- (e) From its allocation during 1948 and 1949, the United States will furnish metal to Canada as required for the Canadian programme in amounts not to exceed the equivalent of 20 tons of U_3O_8 per year.
- (f) It is understood that when depleted sludges are available for re-use the quantities thrown up should be taken into account.

4. An immediate review of these arrangements may be requested by any of the three governments:

- (a) If the total unallocated supplies seem likely to be insufficient to support the agreed programme or alternatively to be materially in excess of the estimates* contained in Tab. CCC annexed to the minutes of the CPC meeting of 15 December 1947; or

(b) in the event of a state of emergency; or

(c) in the event of a change of circumstances bringing about a substantial alteration in the relationships established at this time by the CPC.

***Estimates of Uranium Ore Production 1948-52**
(Dated 12 December 1947)

	1948	1949	1950	1951	1952	Total
Congo	2,200	1,200	1,200	1,200	1,200	7,000
United States	100	200	200	200	200	900
Canada	150	150	150	150	150	750
South Africa	-	-	125	320	825	1,270
Portugal	-	-	-	50	50	100
Total	2,450	1,550	1,675	1,920	2,425	10,020

(All in short tons U_3O_8)

ANNEX 2

**Areas of Co-operation between Members of the
British Commonwealth**

(Approved by the Combined Policy Committee
at its meeting on 7 January 1948)

Apart from the arrangements which already exist between the United Kingdom and Canada, the question has arisen of co-operation between the United Kingdom and other members of the British Commonwealth.

As a part of the combined effort during the war years, assistance to the British atomic energy project was given by scientists from New Zealand, Australia and South Africa. Some of these have worked in Canada and some in United States and from there have moved to Harwell. Several of them will shortly be returning to New Zealand and at a later stage - one year or more - there will be a similar return to Australia. It is intended to admit further scientists from these Dominions to work at Harwell.

The three CPC governments are also actively co-operating with the Dominions in the field of raw materials. South Africa in particular is likely to become an important source of raw materials and is carrying out active work on beneficiation of ores. In due course South African interests may be expected to extend.

With a view particularly to making secure the information held by Dominion scientists on their return to their respective countries, and of furthering full co-operation in the field of raw material investigation and supply, it is recommended that the areas of co-operation outlined below should be recognised:

- (a) The subjects covered in Sections I and II of the proposed Declassification Guide and which are listed as 'Topics for immediate declassification'.
- (b) **The field of health and safety**, including
 1. Experimental work from which radiation tolerances may be established.
 2. Genetics.
 3. General medical and biological studies.
 4. Instruments, laboratory design and techniques of this field.
- (c) **Research uses of radioactive isotopes and stable isotopes**, including
 - preparation, techniques for handling, instruments, mutual availability for research purposes.
- (d) **Detection of a distant nuclear explosion**
 - Operation of recording stations.
- (e) Survey methods for source materials.
- (f) Benefication of ores - co-operation with South Africa and with other Dominions of [sic] the work developed there.
- (g) Extraction of low-grade ores - within the fields defined by the ores locally available.
- (h) **Design information on research reactors**
 - Design information on the low-power graphite reactor build at Harwell (Gleep) to be communicated by United Kingdom to New Zealand. It is recognised that this information will be effectively available to the New Zealand Government on the return of its staff in early 1948.

- (i) **General research experience** with the following reactors Harwell, Gleep, to be communicated by United Kingdom to New Zealand.

Co-operation within the above classified fields will be subject to an understanding between Governments to adopt common standards in holding information secure. Transmission would also be subject to the principle of current usability.

ANNEX 3

Technical Co-operation

(Memorandum to Combined Policy Committee, approved at the meeting on 7 January 1948 as the basis of co-operation)

The sub-group has considered a wide range of subjects of common interest within the field of atomic energy and from among these has selected certain topics which were agreed upon for presentation to the Combined Policy Committee as suitable subjects in which co-operation and the exchange of information, at the present time, would be mutually advantageous.

1. Those subjects covered in Sections I and II of the 'Proposed Declassification Guide' which are listed as 'Topics for immediate declassification'.

2. **The entire field of health and safety**, including

- (a) experimental work from which radiation tolerances may be established;
- (b) genetics;
- (c) general medical and biological studies; therapy of over-exposure to radiation;
- (d) health hazards associated with reactors, such as effluent gases and their ecological effects, disposal of wastes, toxic effects of reactor materials including Be and Pu; tolerances for the various toxic substances and the various radiations;
- (e) instruments, laboratory design and techniques of this field.

3. **Research uses of radio-isotopes and stable isotopes** including preparation, techniques for handling instruments; mutual availability for general research purposes.

4. **Fundamental nuclear and extra-nuclear properties of all the elements** including experimental methods and instruments (e.g. particle accelerators, detection devices).

5. **Detection of a distant nuclear explosion**, including meteorological and geophysical data; instruments (e.g. seismographs, microbarographs); air sampling techniques and analysis; new methods of possible detection.

6. **Fundamental properties of reactor materials (i.e. solid state physics, basic metallurgy)** including moderators, fuel elements, structural materials, also liquid metal and other coolants; the reactions of materials to radiations; the preparation of moderator materials, e.g. graphite, heavy water.

7. **Extraction chemistry** including basic chemistry of processes, problems of 'scale up' of laboratory methods, techniques of remote control, concentration and storage of fission products.

8. **The design of natural uranium reactors** in which the power generated is not wasted. The economy of operation of such reactors, e.g. preferred schemes for enrichment of depleted fuel for re-use.

9. **General research experience with the following (low power) reactors:** Clinton (graphite), Argonne (graphite, heavy water), Chalk River (heavy water), Harwell (graphite).

In furthering these objectives it is considered desirable to encourage the exchange of technical experience and information in these fields. Administrative arrangements should be followed which apply the general principle that classified information shall be currently usable by the recipient.

United Kingdom:
Canada:
United States:

J. D. COCKCROFT
C. J. MACKENZIE
V. BUSH

F. N. WOODWARD
GEORGE IGNATIEFF
J. B. FISK

APPENDIX G

CHRONOLOGY

1950

- 16 Sep British Prime Minister Attlee's message to Menzies requesting agreement in principle to the testing of the first British atom bomb on Australian soil.
- Oct-Nov Survey of the Monte Bello Islands goes ahead (Operation Epicure).

1951

- Feb UK Chiefs of Staff agree on shipborne A-bomb test in the Monte Bellos in late 1952 if test not possible in the US.
- 27 Mar Attlee's message to Menzies seeking formal agreement to the proposed trial.
- 11 May Menzies wins Federal election; agrees to preparations proceeding.
- 28 May UK authorities set up the Hurricane Executive.
- Jul-Aug UK-Australian team undertakes detailed survey mission of the Monte Bello Islands on HMAS Warrego.
- 22 Aug Australian Hurricane Panel formed.
- Oct UK General Election - Conservative Government under Churchill formed.
- Nov UK Ministry of Supply accepts levels of radiation dosage put forward by Penney.
- 27 Dec UK decides to go ahead with test in Australia.

1952

- 19 Feb Joint announcement of intention to test atomic weapon '...in the course of this year...at a site in Australia'.
- 8 Apr Dr Penney, Director of UK Atomic Weapons Research Establishment (AWRE), requests the services of E W Titterton and two junior Australian scientists at proposed trial.
- 1 May Prohibited area extending for 45 miles radius around Flag Island declared in Commonwealth Gazette.
- 15 May Official announcement of test in the Monte Bellos. It is to be a Naval Operation under the command of Rear Admiral Torlesse and the scientific direction of Dr William Penney.
- Jun Beadell reconnoitres bush north-west of Woomera for potential inland test site.
- 10 Jun Defence (Special Undertakings) Act 1952 given assent.
- 31 Jul HMS Campania, the Task Force flagship, arrives at Fremantle.
- 18 Sep Penney, Solandt (Canada), Butement and others meet on Dingo Claypan, Emu Field.
- 22 Sep Penney takes up duty on HMS Campania accompanied by Butement and Solandt.
- 29 Sep Martin takes up invitation to attend and arrives on HMS Campania.
- 3 Oct Hurricane bomb detonated, 0800 hours WAST, Monte Bello Islands.
- 3-4 Oct RAAF Lincoln aircraft undertake air sampling flights.
- 4 Oct RAAF Dakota aircraft undertake aerial surveys from Onslow to Broome.
- 9 Oct Dr Penney and key staff leave Monte Bellos for the UK.
- 27 Oct Joint Services Training Unit (JSTU) arrives at South East Island in the Monte Bellos to carry out training in radiation safety in contaminated areas.
- 10 Nov Declaration of Emu area under Defence (Special Undertakings) Act 1952 prepared.

Dec UK prepares plans for sites at Emu.

12 Dec British Prime Minister Churchill asks for Menzies' agreement in principle to a test series at Emu in October 1953. Agreement is forthcoming on 13 December.

16 Dec JSTU leaves Monte Bellos. The Royal Australian Navy undertakes periodic security patrols.

18 Dec Totem Executive set up in London initially under Admiral Brooking (later Air Marshal Sir Thomas Elmhirst is appointed chairman).

1953

12 Jan Totem Panel (Australia) established under the chairmanship of J E S Stevens, Secretary of the Department of Supply.

Feb Four-man Australian mission led by Brigadier L C Lucas visits the UK for Operation Totem planning and co-ordination.

Mar UK reconnaissance party visits Emu.

May Penney provides Martin with a paper on assessment of safety for Totem tests. Martin and Titterton review paper.

8 Jun Totex Chairman notes that RAAF and RNZAF have accepted air sampling commitment and RAAF has accepted low-level aerial survey commitment.

26 Jun 'D' Notice is issued to the Press regarding Operation Totem.

Aug Security officer for Project X200 briefs owners of cattle and sheep stations to the north and north-east of Emu and notes Aboriginal movement in particular.

13 Aug Radiation Safety Orders for Operation Totem issued.

Sep UK scientific staff begin arriving at Emu.

10 Sep After considerable pressure, limited representation by the Press is agreed for Totem 1.

26 Sep Kittens 1 trial, Emu.

29 Sep Penney arrives at Emu.

30 Sep Kittens 2 trial, Emu.

Oct Reconnaissance by Butement (Chief Scientist, Department of Supply), Penney and others of potential permanent test site NW of Ooldea, subsequently to be named Maralinga.

6 Oct Kittens 3 trial, Emu.

14 Oct Kittens 4 trial, Emu.

15 Oct Totem 1 bomb detonated, 0700 hours CST, Emu. RAAF Lincoln and USAF B29 aircraft undertake air sampling tasks. They return considerably contaminated.

17 Oct Kittens 5 trial, Emu.

18 Oct Centurion tank driven off close proximity area after radiation and contamination checks.

19 Oct Radiation Hazards Group officers fly from Emu to Woomera to direct decontamination of Lincoln aircraft.

24 Oct Two RAAF Dakotas undertake aerial radiation survey task out to 400 miles from Totem 1 Ground Zero.

27 Oct Totem 2 bomb detonated, 0700 hours CST, Emu.

30 Oct Formal notification by UK of the desire for a permanent testing site in Australia.

Nov Squadron Leader A D Thomas prepares Radiological Safety Orders for personnel remaining at Emu.

Nov Australian-UK scientific party visits the Monte Bello Islands to carry out biological, entomological and zoological scientific studies and to survey radiation levels.

1954

Feb Australian Dept of Supply provides a report on estimates for a special test site at Maralinga and a comparison with alternative sites.

Mar Decontamination building and facilities constructed at RAAF Amberley by the Department of Works.

29 May UK advises Secretary of Prime Minister's Department, that it may wish to conduct experiments with initiators

(Kittens trials) during 1955, and seeks agreement to hold tests in the Maralinga area.

- Jun UK is requested to provide information for assessing safety of proposed initiator experiments.
- Jul-Aug Martin, Baxter and Stevens in London. Discussions held on safety aspects of proposed minor trials.
- 2 Aug UK seeks agreement in principle from Australian Government to conduct atomic trials in Australia in the autumn of 1956. Also mentioned is the question of establishing a permanent proving ground.
- 26 Aug Australian Cabinet agrees to the establishment of a permanent proving ground at Maralinga. Kittens trials in 1955 are agreed.
- 1 Nov Australian Air Board Order No. A125, 'Radiological Safety in Relation to the Results of Atomic Explosions', is issued by RAAF.

1955

- 6 Jan Australian Prime Minister discusses with Ministers the terms of a draft letter regarding a set of conditions for the Maralinga proving ground and its programs.
- 23 Feb Kittens Safety Assessment document arrives from UK and is referred to Martin for assessment.
- Apr Sir Anthony Eden succeeds Sir Winston Churchill as UK Prime Minister.
- 27 Apr Atomic Weapons Tests Committee (AWTC) established by Australian Department of Supply to co-ordinate activities at Maralinga. First meeting held 9 May 1955.
- May-Jun Kittens trials held at Maralinga.
- 16 May Second AWTC meeting notes that although Atomic Weapons Test Safety Committee (AWTSC) not yet established, Martin and Titterton are to advise on the safety of the proposed Kittens initiator tests to be held in May-July.
- 16 May Eden seeks agreement in principle from Menzies for holding two tests in the Monte Bello Islands in April 1956, (to be known as Operation Mosaic). The tests

will consist of atomic explosions with the inclusion of light elements as a boost.

- 20 Jun Menzies agrees in principle to the Mosaic proposal and seeks discussion of details, particularly safety factor.
- Jul Tims trials, Maralinga.
- 8 Jul First meeting of the AWTSC; consideration given to Terms of Reference and the scope and hazards of Kittens trials.
- 27 Jul UK Scientific Director C A Adams meets with Butement to discuss safety and scope of Mosaic. Butement hands over documents to AWTSC for consideration.
- 12 Sep Joint UK/Australian statement announcing tests in the Monte Bello Islands about Apr 1956, to be mounted as a Royal Naval operation.
- 13 Sep Sub-committee of the AWTC, the Monte Bello Working Party, holds its first meeting. Chairman is Captain Marks, Royal Australian Navy.
- Oct-Nov Radiation survey of appropriate areas by UK party is carried out in the Monte Bello Islands.
- 8 Oct HMA ships Warrego and Karangi arrive at the Monte Bellos to lay moorings, erect navigational marks and carry out other duties for the Royal Navy Task Force.

1956

- Jan UK puts forward a proposal for an indoctrination program for about 250 Service personnel from UK, Australia and New Zealand at the first round of the Buffalo series.
- Jan Maralinga Radiological Safety Orders are promulgated for comment.
- 23 Feb Task Force flagship HMS Narvik arrives at Fremantle.
- Mar Kittens trials, Maralinga (Naya site).
- Apr Main scientific party arrives for Mosaic and Adams reaches Monte Bello Islands on 22 April.
- 14 May AWTSC members taken on board Narvik.

- 16 May Mosaic G1 bomb detonated, 1150 hours WAST, Trimouille Island, Monte Bellos.
- 19 Jun Mosaic G2 bomb detonated, 1014 hours WAST, Alpha Island, Monte Bellos.
- 1 Jul Australian Minister for Defence agrees to an Australian Indoctrinee Force component of 62 officers and men at the Buffalo trials. UK and New Zealand officers are also to be included.
- 13 Aug The AWTSC reports to Menzies on safety matters to be considered for the Buffalo tests at Maralinga.
- 18 Sep UK accepts Australian conditions for control of the range and formally accepts the Memorandum of Arrangements.
- 18 Sep UK Government proposes a 1957 program of major tests and minor trials for Maralinga.
- 27 Sep Buffalo 1 bomb detonated, 1700 hours CST, Maralinga (One Tree site).
- 4 Oct Buffalo 2 bomb detonated, 1630 hours CST, Maralinga (Marcoo site).
- 11 Oct Buffalo 3 bomb detonated, 1427 hours CST, Maralinga (Kite site).
- 22 Oct Buffalo 4 bomb detonated, 0005 hours CST, Maralinga (Breakaway site).
- 8 Nov Hand-over of range health control in inter-trial period to Australian Health Physics Representative (AHPR) O H Turner. He is directly responsible to the UK Atomic Weapons Research Establishment (AWRE).
- 14 Dec Submission put to Federal Cabinet outlining trials proposed for 1957. Also a proposal was made for a Maralinga Board of Management, subsequently endorsed.

1957

- Jan AWTSC submits report to Prime Minister on Buffalo tests.
- 4 Jan Martin, Chairman AWTSC, proposes splitting weapon safety role from role of studying effects of ionising radiation on the Australian community.

Mar-Jul Kittens trials (Naya site) and Tims trials (Kuli and Naya sites).

2 May Newly constituted AWTSC, comprising Titterton (Chairman), Stevens and Dwyer. National Radiation Advisory Committee (NRAC) established, chaired by Sir Macfarlane Burnet and including Martin, formerly of the AWTSC.

20 May Maralinga Circular No. 3, 'Control and Operation of the Range', is issued.

14 Sep Antler 1 bomb detonated, 1435 hours CST, Maralinga (Tadje site).

25 Sep Antler 2 bomb detonated, 1000 hours CST, Maralinga (Biak site).

Sep-Nov Tims trials (Kuli site).

9 Oct Antler 3 bomb detonated, 1615 hours CST, Maralinga (Taranaki site).

1958

Apr-Jul Tims (Kuli site) and Rats (Naya site) trials.

Sep-Nov Tims (Kuli site) and Rats (Naya site) trials.

1959

Mar-Jul Rats (Dobo site) and Kittens (Naya site) trials.

May-Nov Tims trials (Kuli site).

Jun-Aug Vixen A trials (Wewak site).

1960

Dec 59- The Board of Management considers proposals for the
Apr 60 Maralinga Experimental Programme (MEP) 1960. The AWTSC agrees in principle to the tests and asks that it be

informed beforehand of firings and be given more information on contamination of the Range.

- Feb-Mar Operation Ayres 1 - decontamination of Building DC12 at Maralinga.
- Apr-Oct Tims trials (Kuli site).
- 25 Jul Menzies and the Minister for Defence agree that in future Federal Cabinet approval should be sought for trials involving nuclear explosions; and that proposals not involving nuclear explosions such as Vixen A and Vixen B should be submitted to specified officers of the Department of Defence for recommendation and for approval by the Minister for Defence.
- May-Aug Vixen A trials (Wewak site).
- Sep Rats trials (Naya and Dobo sites).
- 2 Sep Approval for Vixen B trials is given by Minister for Defence after protracted discussions.
- Sep-Oct Three Vixen B trials (Taranaki site).
- 24 Nov Australian officials indicate that they are not satisfied with form of UK statement for 1961 program and request that documents be supplied to nominated officers of the Australian Department of Defence.

1961

- 31 Jan Copies of 1961 UK Safety Statement (dated early December 1960) forwarded by UK High Commission in Canberra.
- 2 Feb UK Safety Statement for proposed 1961 trials is considered inadequate - data provided were too meagre to allow the features of the trials to be accepted.
- Mar Operation Ayres 2 - dismantling of Building DC12.
- 2 Mar UK is advised that more information is required and that UK officials had been aware for some time that Australia required adequate information on the Maralinga trials.
- Mar(late) Vixen B trials approved.
- Mar-Apr Vixen A trials (Wewak site).

Apr-May Five Vixen B trials (Taranaki site).
May Kitten trials (Naya site).
Aug Tims trials (Naya and Kuli sites).

1962

25 May AHPR reports the presence of radioactive contamination at Maralinga which may be difficult to remove and be a danger to health if not secured. The main radiological hazard is plutonium-239, deposited during minor trials undertaken from 1959.

1963

Mar-Apr Tims trials (Kuli site).
Mar-Apr Four Vixen B trials (Taranaki site).
5 Sep A paper prepared by the Secretary of the AWTSC, reviewing contamination at Maralinga and measures for its control.

1964

Aug-Nov Operation Hercules V - clean-up operations to allow reduction of Range staff to a care and maintenance level. Series of drawings produced to show radiation levels at various locations, positions of burial pits, and statement of hazards.

1966

Mar-Nov Operation Radsur - radiological survey of the various contaminated areas of the Range, preparatory to Operation Brumby.

1967

Mar-Jun Operation Brumby carried out by Royal Engineers and AWRE staff to reduce residual contamination and mark hazardous areas.

1968

23 Sep Signature of 'Memorandum Respecting the Termination of the Memorandum of Arrangements between the United Kingdom and Australian Governments of 7 March 1956 concerning the Atomic Weapons Proving Ground - Maralinga'.

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APPENDIX I

ROYAL COMMISSION HEARINGS

1. **Sydney**
22 August 1984
2. **Adelaide**
11 September 1984
3. **Sydney**
2-4 October 1984
4. **Brisbane**
8-13, 15, 17-19 October 1984
5. **Sydney**
23-26 October 1984
6. **Melbourne**
29-31 October; 1-2, 5-8 November 1984
7. **Sydney**
13-15 November 1984
8. **Adelaide**
19-23, 28-30 November 1984
9. **London**
3-4, 7, 10-11, 14-15, 21-22, 28-31 January 1985; 1, 4-7,
11-14, 18-22, 25-28 February 1985; 4-8, 11-15, 18 March 1985
10. **Sydney**
17 April 1985
11. **Marla Bore**
20 April 1985
12. **Wallatina Homestead**
21 April 1985
13. **Maralinga Camp**
24-25 April 1985
14. **Perth**
30 April; 1-2 May 1985
15. **Karratha**
5 May 1985
16. **Sydney**
14-15, 20-21, 27-28, 30 May 1985; 5-7, 12-14, 17, 19-20, 24,
26 June 1985; 2, 5, 9-11, 15-16, 19, 23-26 July 1985; 18, 23-26
September 1985