STATEMENTS

The following statements were issued on the dates indicated.

9 July 1984

INSPECTION OF MORUROA ATOLL

The Minister for Foreign Affairs, Mr Bill Hayden MP, today announced the release of the Report of the group of scientists that inspected the French nuclear testing site at Moruroa Atoll in October/November 1983.

The scientific team, which included scientists from New Zealand, Australia and Papua New Guinea, paid particular attention in their report to the environmental and health aspects of French nuclear testing.

Mr Hayden said that while he found reassuring the Report's conclusion that the levels of radioactive fallout were relatively low and that these levels did not lead to any expectation that radiation-induced diseases would be detectable, he was concerned at the Report's conclusion that leakage could occur from the detonation chambers in the long term and that the structural integrity of the coral limestones on the upper section of Moruroa Atoll had already been impaired.

Mr Hayden congratulated the team of scientists on their Report which he said added considerably to the amount of information on French testing at Moruroa Atoll. He paid tribute, in particular, to the two Australian scientists (Dr Peter Davies from the Bureau of Mineral Resources, Geology and Geophysics and Mr Des Davy from the Australian Atomic Energy Commission) for their contribution to the Report.

Mr Hayden recalled that when he first announced Australia's agreement to accept the invitation of the French Government to join a team to inspect Moruroa Atoll, he had reaffirmed the Government's view that while the environmental and health effects of nuclear testing were important, the Government's dominant concern was that nuclear testing should not take place by any state in any environment.

Mr Hayden said Australia would continue to work actively for a Comprehensive Test Ban Treaty and was committed to pursue this objective in the Conference on Disarmament in Geneva and the United Nations General Assembly.

A ban on all nuclear testing would be a major step towards inhibiting the spread of nuclear weapons.

Mr Hayden said Australia would maintain its strong opposition to French nuclear testing in the South Pacific. He said the scientists' Report and the continuing program of French nuclear testing would be considered further by the Heads of Government of South Pacific Forum countries when they meet in Tuvalu in late August 1984.

Mr Hayden said copies of the Report were available to the public from the Public Affairs Branch of the Department of Foreign Affairs.

Attached is a copy of the Report's summary and conclusions.

SUMMARY AND CONCLUSIONS

SUMMARY

Chapter 1 reviews the sources and nature of radioactive fallout from atmospheric weapon testing and assesses its radiological significance. It also describes investigations into current levels of environmental radioactivity at Mururoa, and discusses the likelihood of any association between the testing programme in French Polynesia and cancer statistics for the region.

Radioactive fallout in the South Pacific from atmospheric nuclear testing has been made up of two major components: long-lived fission products from largely stratospheric fallout and short-lived fission products from tropospheric fallout. For the southern temperate zone which includes New Zealand the greater contribution to radiation exposure of the population has arisen from long-lived fission products, about 20% of which derived from tests by France at Mururoa and Fangataufa atolls, the remainder largely deriving from northern hemisphere atmospheric tests. In southern tropical regions stratospheric fallout deposition has been lower, and in the northern temperate zone about 3-4 times higher than in the southern temperate region.

Annual dose commitments are assessed for each fallout radionuclide that makes a significant contribution to total dose. Short-lived radionuclides in tropospheric fallout from atmospheric tests in the southern hemisphere have given rise to variable doses from year to year: in New Zealand the dose contribution from this source approached about half that from stratospheric fallout in some years. In the latitude band in which the tests were conducted considerably higher doses were recorded, particularly as a result of occasional rain-out events, notably at Samoa on 12 September 1966 and at Tahiti on 19 July 1974. Maximum annual doses in Pacific islands from fallout however have remained well below the world average annual natural radiation exposure and very much less than annual rates in areas of the world of high natural radioactivity.

Currently annual doses from fallout are estimated to be about 0.5% of the world average natural background rate (2000 μSv/y), in New Zealand and Tahiti, and to be somewhat lower than this in Fiji.

Ambient radiation levels in the Base accommodation area of Mururoa atoll ar generally lower than they are elsewhere in the world because of the v ry low

natural radioactivity concentration of coral soils. Traces of fallout from atmospheric tests are detectable at levels far below those of health significance.

Maximum doses received by personnel involved in handling radioactive material at Mururoa are generally only small fractions of internationally recommended limits for occupational exposure.

Radiation doses to the French Polynesian population from natural radiation and fallout radioactivity are lower than world average levels and do not lead to the expectation that any radiation-induced diseases would be detectable. While the relatively small population of French Polynesia does not allow very precise estimation of cancer rates, cancer statistics for the region do not support any suggestion of elevated rates for types of cancer which might be associated with excessive exposure to radioactive fallout.

Chapter 2 describes the geological structure and hydrology of Mururoa atoll and discusses effects on these of the underground test series. The first major division of the chapter on structural integrity defines the French view of the geology of the atoll and the effect of testing on its integrity; this is used as the yardstick for verification. In a number of important issues Mission findings have proved to be at variance with French claims.

In the period July 1976 - May 1984 France conducted about 60 underground tests at Mururoa, the detonations taking place in the volcanics at depths probably between 700 and 1200 m and of magnitude up to about 200 kt. The phenomenology of underground nuclear detonations and atoll stratigraphy and structure are described. Calculations are presented of the size of sub-surface physical features induced by detonations of varying magnitude, the data providing a strong indication of containment safety margins in the volcanics.

Mururoa in common with other atolls is made up of two sequences; the upper limestones of 180-500 m thickness overlying volcanics of several thousand metres thickness. For both sequences an assessment is made as to whether their inherent physical attributes are conducive to containment or leakage of radionuclids and whether testing has affected their integrity.

The limestones, comprised of superimposed successions of reefs, are for the most part porous and permeable with many horizons of particularly high

porosity and permeability. The flanks of the atoll however are protected by aprons of low permeability. Hydrologic studies indicate low rate of flow from ocean to atoll of about 1 m y^{-1} and flows in the body of the limestones of 10-100 m y^{-1}. Underground testing may be acting to alter the ambient condition, particularly along the north-east and south-west margins, both areas of particularly severe testing as indicated by fissuring, subsidence and submarine sliding of the limestones. Hydrological consequences of these effects are increases in the vertical transfer rate of water and in the direct lateral exchange rate between ocean and atoll interior. Further if apron limestones are removed in a number of places, a hydrologic system could develop where ocean water could traverse through the sub-reef without imprinting any signature on the lagoon.

The volcanics, occurring at depths varying from about 200 m beneath the lagoon to 500 m around the atoll margins, are divided into upper subaerial and lower submarine sequences. The upper sequence is highly heterogeneous in rock type and porosity variations. The lower sequence is also variable but of generally lower permeability. While both seismic and magnetic data indicate zones of major faulting in the volcanics there is no evidence to suggest that the faults have been reactivated or that there is massive fissuring as a result of testing. However, zones of fracture extend up to a 400 m radius from the detonation points of large tests and the possibility exists for overlap of adjacent fracture zones particularly beneath the SW and NE margins.

The pattern of past testing beneath the atoll rim has produced in the sub-surface a repository of nuclear waste products whose depths probably vary from 500 to 1200 m. The French claim that any leakage from the volcanics to the limestones will be stopped by the impermeable transition zone is not borne out by the data inspected.

The transition zone which occurs between the volcanics and limestones is highly variable in thickness and rock type and this casts doubt on its ability to act as an impermeable barrier to potential radioactive leakage. The potential exists for leakage of water from detonation cavities to the biosphere in less than 1000 years. In chapter 3 account is taken of the geology of Mururoa (outlined in chapter 2) and the phenomenological description of an underground testing programme

[1984] AUSTRALIAN INTERNATIONAL LAW NEWS 638

to obtain predictions on venting and long-term leakage from the test sites. The treatment is, of necessity, qualitative. To be otherwise, cores from re-entry bores would need to have been seen and the Mission would have needed extensive geochemical data. Neither of these requirements was met.

French information on venting is very qualitative and there is no reason to believe their figure that more than 99% of the radioactivity is retained in vitrified material. Their description of venting as inconsequential is almost certainly true but any implicit impression that venting is barely, if not rarely, detectable is almost certainly false. Because of the timing and duration of the Mission's visit only one approach to the detection of venting was possible; it yielded positive results.

Prerequisites for radioactivity, initially contained at the underground test site, not to reach the biosphere are very long groundwater transport times and large sorption capacity for the surrounding rock. For fission products such as ^{137}Cs and ^{90}Sr with half lives in tens of years, a low groundwater velocity would suffice. For some transuranics with half-lives of thousands to tens of thousands of years, such as ^{239}Pu, almost any geological media would suffice because of the ease with which they are absorbed. However, for other transuranic activation products, such as ^{237}Np, both restraining factors are needed. The limestone strata provide neither. Groundwater velocities are high (10-100 m y^{-1}) and are being increased by the testing programme. Their cavernous nature offers little opportunity for geochemical processes to equilibrate and this too is being exacerbated by the testing programme. The claim that the transition zone acts as a barrier to long-term leakage can, on the basis of geological evidence, be discounted. The volcanics in their virgin state offer a poor to moderate geo-chemical barrier and a moderate to good hydrological barrier. The testing programme is reducing the effectiveness of both.

If the testing programme were to be terminated now it could be expected that leakage would be detectable, particularly around the southern margins, within a thousand years. It would also be surprising if this leakage were consequential. Continued testing in areas such as the southern margin could give rise to sufficiently accelerated groundwater flow to allow detection of the relatively shorter-lived nuclide ^{90}Sr.

Chapter 4 reviews waste management practices at Mururoa. While it was not possible to verify in any direct way most of the information provided to the

at similar facilities and inspection of French laboratories, gives no reason to doubt its validity.

Radioactive wastes at Mururoa arise from routine operations involving radioactive materials, post-detonation drilling programmes and residual contamination from atmospheric tests and safety trials. The sources, magnitude and disposal of the wastes are outlined. Total environmental releases are not of radiological consequence.

Attempted verification was limited to information supplied on the origin, extent and consequence of plutonium contamination in the lagoon. In the event, this was made next to impossible by the restrictions on sampling imposed by the French which did not allow collection of biota or sediments from the lagoon and restricted the area of the lagoon from which water could be drawn. As the only avenue available for obtaining a historic record of the transport of plutonium from the lagoon to the ocean was to look at the distribution of plutonium in aged corals, there was a need for coral samples from as close to the lagoon as possible. Collection difficulties were compounded by weather conditions.

The Mission was able to verify the quantity of plutonium now being transported from the lagoon and, on the basis of published information on coral atolls used as testing sites by the USA, to conclude that the French information on the inventory of plutonium in the lagoon was reasonable.

CONCLUSIONS

1. *Maximum annual doses in Pacific islands from radioactive fallout from atmospheric tests have remained less than one tenth the world average annual natural radiation exposure. Current annual doses are about 0.5% of background in New Zealand and Tahiti and somewhat less than this in Fiji.*

2. *Ambient radiation levels in the Base accommodation area of Mururoa atoll are generally lower than they are elsewhere in the world and traces of fallout from atmospheric tests are detectable only at levels far below those of health significance.*

3. *Radiation doses to the French Polynesian population from natural radiation and fallout radioactivity are lower than world average levels*

and do not lead to any expectation that radiation-induced diseases would be detectable.

4. Cancer statistics for the region do not support any suggestion of elevated rates for types of cancer which might be associated with excessive exposure to radioactive fallout.

5. The structural integrity of part of the coral limestones forming the upper section of Mururoa atoll have been impaired through fissuring, subsidence and submarine slides.

6. The variation in thickness and composition of the transition zone casts doubt on its ability to act either as a barrier to migrating radionuclides, or as an absorber of and director of seismic energy generated by a nuclear detonation.

7. The volcanic core in which the tests take place has been severely altered in zones surrounding the detonation chambers. The balance of available data suggests that the overall integrity of the volcanics has not been impaired.

8. There is no geological evidence of short-term leakage to date. The hydrology of limestones and volcanics is such as to suggest that leakage could occur from the detonation chambers in a time period of 500 to 1000 years.

9. Venting of gaseous and volatile fission products from the underground test sites does occur at the time of detonation. There is evidence that the amount is greater than would be expected simply through the back-packing of the placement bore being "less than perfect".

10. At the underground test sites water is available for leaching the radioactive material (which can be equated to high-level waste). Mechanisms exist for the transport of this contaminated water to the biosphere at least in the long term (greater than 500 y). The radiological consequence of this leakage depends markedly on the depth of placement of the weapons tested and on their relative placement, one test to another. Precise details of placement are not known.

11. Waste management at Mururoa was poor; it is now very good. Only small quantities of radioactivity are routinely discharged and they are not radiologically significant.

12. There is transfer of dissolved plutonium from the lagoon to the ocean; it is of only minor radiological importance. The Mission was unable to verify that 10-20 kg of plutonium is present in the sediments of the lagoon nor determine its source.
