Parliament of the Commonwealth of Australia

No Time to Waste

Report of the Senate Select Committee
on the Dangers of Radioactive Waste

April 1996

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The Senate
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TERMS OF REFERENCE

On 9 March 1995 the Senate Select Committee on the Dangers of Radioactive Waste was established to inquire into:

(a) the extent to which radioactive waste is being produced, stored transported, treated and disposed of in Australia;
(b) the nature, efficiency and effectiveness of the administration, monitoring and control of such production, storage, transport, treatment and disposal, and whether these are adequate to protect the public interest;
(c) what existing guidelines and legislation require revision by government to better protect the future public interest in an area of intrinsic potential danger to public health and the environment.

In considering these terms of reference the committee was to take into account, and where necessary report on, the following issues:

(a) the effectiveness and extent of application, on a national basis, of the following Codes of Practice formulated and approved under the *Environment Protection (Nuclear Codes) Act 1978* for regulating or controlling nuclear activities in Australia:
    (i) the Code of Practice for the Safe Transport of Radioactive Substances (1990),
    (ii) the National Health and Medical Research Council Code of Practice for the Near-Surface Disposal of Radioactive Waste in Australia (1992),
    (iii) the National Health and Medical Research Council Code of Practice for the Disposal of Radioactive Waste by the User (1985), and
    (iv) any related or proposed Code of Practice for regulating or controlling nuclear activities (but not including uranium mining and milling);
(b) the suitability of the *Environment Protection (Impact of Proposals) Act 1974* in protecting the environment and fostering consultation with the community in relation to the handling, transportation and storage of radioactive waste;
(c) the scope for independent inspection or environmental audit of sites used for the storage of radioactive waste;
(d) the significance of the expanded role for the Australian Nuclear Science and Technology Organisation (ANSTO) in conditioning, managing and storing radioactive waste under the *Australian Nuclear*

Science and Technology Organisation Act 1987 and Regulations as amended;

(e) the adequacy of funding for research in, and the training available in Australia for skilled personnel involved in, the handling, transport, storage and security of radioactive waste:

(f) the location, amount, state, age and type of radioactive waste in Australia (excluding material from uranium mining and milling);

(g) the general suitability of each existing location for the storage of radioactive waste including the consideration of such factors as population density, stability of the site in geological and hydrogeological terms, surface flooding and overall environmental significance;

(h) whether each existing location for the storage of radioactive waste has a description to indicate the likely period of duration for its use as a storage site and whether any program or plan exists for future use of the site together with a general assessment of the likely stability of existing methods of storage;

(i) the state of planning and timing for the development of a national repository for the storage of radioactive waste and the likely legislative powers and functions to be vested in the relevant government or non-government agency responsible for the proposed repository;

(j) the extent to which the establishment of a permanent national repository will result in the removal of radioactive waste from storage in areas generally considered to be unsuitable for reasons such as population density, site stability and other relevant factors;

(k) existing and, where known, future arrangements for the permanent or temporary storage of intermediate and high level radioactive waste;

(l) Australia's current and, where known, future obligations under international treaties relevant to nuclear activities;

(m) the extent of Australia's imports and exports of radioactive material (excluding uranium mining), and the adequacy of legislative controls for such material;

(n) the implications of any user-pays system for the management, storage and disposal of radioactive waste;

(o) measures taken by radioactive waste producers to avoid and/or minimise the creation of radioactive waste arising from their activities (but not including uranium mining and milling); and

(p) identification of waste avoidance and/or minimisation procedures that could be followed by these producers (but not including uranium mining and milling).

ACKNOWLEDGMENTS

The Committee wishes to thank all the people who contributed to the Inquiry by preparing written submissions, giving oral evidence or by assisting with the arrangements for public hearings and inspections. The Committee is grateful for the interest shown and the advice provided. Although it was not possible to invite all of those who made submissions to give oral evidence, or to mention all submissions in the report, the Committee took into account all of the material provided in the preparation of its report.

The Committee would also like to thank the temporary staff for their assistance during the course of the Inquiry. The support provided by Sonja Weinberg as Principal Research Officer and Executive Assistants Jan Liddell, Helen De Gail and Yvonne Beaver was greatly appreciated.

CONTENTS

ABBREVIATIONS

AAEC	Australian Atomic Energy Commission
ADI	Australian Defence Industries
AIRP	Australian Institute for Radiation Protection
ALAEV	As Low as Economically Viable
ALARA	As Low as Reasonably Achievable
ALARP	As Low as Reasonably Practicable
ALATA	As Low as Technically Achievable
ANDRA	French Nuclear Authority (Agence nationale pour la gestion des dechets radioactifs)
ANSTO	Australian Nuclear Science and Technology Organisation
ANA	Australian Nuclear Association
ARL	Australian Radiation Laboratory
ASTEC	Australian Science and Technology Council
ATSIC	Aboriginal and Torres Strait Islander Commission
BHP	The Broken Hill Proprietary Co Ltd
CEPA	Commonwealth Environment Protection Agency
CSIRO	Commonwealth Scientific & Industrial Research Organisation
DEST	Department of Environment, Sport and Territories
DFAT	Department of Foreign Affairs and Trade
DHSH	Department of Human Services and Health
DIST	Department of Industry, Science and Technology
DPIE	Department of Primary Industries and Energy
EIS	Environmental Impact Statement
EPA	Environment Protection Agency/ Authority
GATT	General Agreement on Tariffs and Trade
HIFAR	High Flux Australian Reactor
HLW	high level waste
IAEA	International Atomic Energy Agency
ICRP	International Commission on Radiological Protection
ILW	intermediate level waste
LHRL	Lucas Heights Research Laboratories
kBq	1,000 becquerels
LLW	low level waste
mSv	millisievert
NHMRC	National Health and Medical Research Council
NIMBY	Not in my back yard
NIABY	Not in anyone's back yard
NRIC	National Resource Information Centre
NSB	Nuclear Safety Bureau

OECD	Organisation for Economic Cooperation and Development
PER	Public Environment Report
RADWASS	Radioactive Waste Safety Standards
Sv	sievert
μSv	microsievert
UN	United Nations

PREAMBLE

Conduct of the Inquiry

The Senate Select Committee on the Dangers of Radioactive Waste was established on 9 March 1995 and the terms of reference were advertised in newspapers with a national coverage in April 1995. The Committee received 78 submissions and 16 supplementary submissions which are listed in Appendix 1.

The Committee examined 117 witnesses at 11 public hearings representing 70 individuals or organisations (See Appendix 2). The hearings commenced in Canberra on 23 June 1995 followed by hearings in Adelaide on 5 July 1995, Perth on 27 July, Sydney on 2 August, Sutherland on 3 August and Brisbane on 4 August 1995. The Committee then held further hearings in Canberra on 16 and 23 October and 13 November, in Sydney on 11 December and in Kalgoorlie on 13 December 1995.

The Committee also held *in camera* hearings in Canberra on 13, 20 and 30 November and in Sydney on 11 December 1995. During the Inquiry the Committee inspected the temporary storage sites at Woomera, the Australian Nuclear Science and Technology Organisation facilities at Lucas Heights, the Esk temporary storage facility (Queensland) and the Mt Walton repository (Western Australia).

Cooperation by Commonwealth Bodies

Commonwealth Bodies

Most Commonwealth bodies involved in the Inquiry were cooperative and the Committee appreciates the efforts of those officers who provided substantial submissions and additional information on matters relevant to the Inquiry.

Department of Industry, Science and Technology

After the commencement of the Senate Select Committee Inquiry, Senator the Hon. Peter Cook, former Minister for Industry, Science and Technology, announced a parallel inquiry into the transport arrangements for the movement of radioactive material from Lucas Heights and St Marys to Woomera. This inquiry was conducted by Mr Mike Codd who reported to the then Minister on

31 July 1995. This report was not made available to the Committee until 3 October 1995.

The Department of Industry, Science and Technology did not make a submission to the Senate Committee until 25 October 1995 and only reluctantly appeared before the Committee on our insistence. The Department also withheld correspondence from the Committee for four days until the relevant Deputy Secretary had gone overseas. The Department also delayed its reply to concerns of the City of Port Augusta Council until a convenient time after the transport of radioactive waste to Woomera had been completed. The Committee is disappointed at the lack of cooperation by a Commonwealth Department which had a key role in this issue.

The Committee believes that this approach is not conducive to developing a professional relationship in which to undertake community consultations for the siting of future national facilities. The resentment expressed by the State Government, local councils, the Aboriginal community and the public of South Australia will make it more difficult for other Commonwealth departments to conduct similar exercises in that State in the future.

Australian Federal Police

The Australian Federal Police refused to provide the Committee with important information in relation to the suspected importation of radioactive materials claiming public interest immunity. The Committee did not require that the Senate determine the acceptability of this claim as this information was obtained from another source. The Committee believes, however, that the information relevant to the radioactive material did not constitute a risk in terms of the national interest. The Committee does not think that the claim of public interest immunity was justified.

Senator Grant Chapman
Chairman

RECOMMENDATIONS

Recommendation 1

The Committee recommends that in order to conform with international standards on separating the regulatory body from the regulated industry, the Australian Institute of Radiation Protection as proposed regulator should have no substantive operational functions or commercial activities in nuclear science (Paragraph 2.88)

Recommendation 2

The Committee recommends that the Minister responsible for the proposed Australian Institute of Radiation Protection be required to act to ensure that the administrative arrangements avoid conflicts of interest (Paragraph 2.90).

Recommendation 3

The Committee recommends that the Government should structure the proposed Australian Institute of Radiation Protection to maintain an arm's length relationship with the industry as far as possible having regard to international best practice, and the industry be required to provide the information the regulator needs to perform its functions (Paragraph 2.94).

Recommendation 4

The Committee recommends that the proposed Australian Institute of Radiation Protection structure should include appropriate community representation (Paragraph 2.99).

Recommendation 5

The Committee recommends that the proposed Australian Institute of Radiation Protection legislation should include a provision to the effect that 'any person may take action in court to restrain a breach of this Act' (Paragraph 2.102).

Recommendation 6

The Committee recommends that the Government review current procedures for developing national guidelines to ensure that they are prepared in a more timely manner (Paragraph 2.111).

Recommendation 7

The Committee recommends that the Commonwealth together with the States and Territories should act to expedite revision of national codes and development of a nationally agreed regulatory scheme (Paragraph 2.111).

Recommendation 8

The Committee recommends that Commonwealth regulation of Commonwealth bodies under the proposed Australian Institute of Radiation Protection legislation should conform to a nationally agreed scheme (Paragraph 2.111).

Recommendation 9

The Committee recommends that the Australian Customs Service should consult with the Australian Radiation Laboratory and the State and Territory radiation authorities to develop better procedures for recognising radioactive imports and for co-ordinating licensing procedures (Paragraph 2.121).

Recommendation 10

The Committee recommends that an up to date inventory of all existing and potential radioactive waste be prepared and that this be maintained to detect any changes to the current accumulation rates (Paragraph 3.51).

Recommendation 11

The Committee recommends that the transportation of significant amounts of radioactive materials should require an assessment of the most appropriate transport mode (Paragraph 5.20).

Recommendation 12

The Committee recommends that State governments and local councils en route should be fully notified of the route and contents of radioactive waste consignments and should be given sufficient practical knowledge to be able to devise and implement contingency plans (Paragraph 5.21).

Recommendation 13

The Committee recommends that a feasibility study be conducted into the suitability of disposing of the low level contaminated soil from Fishermens Bend in an active uranium mine (Paragraph 6.102).

Recommendation 14

The Committee recommends that a feasibility study be conducted into disposing in an active uranium mine of that portion of the ANSTO waste that is suitable for disposal at a municipal tip (Paragraph 6.103).

Recommendation 15

The Committee recommends that the Commonwealth Government ascertain the extent to which the States and Territories could benefit from disposal of low level wastes in uranium mines (Paragraph 6.105).

Recommendation 16

The Committee recommends that appropriate maximum emission levels as well as average monthly limits be imposed on emissions of tritium and iodine^{131} from ANSTO (Paragraph 6.120).

Recommendation 17

The Committee recommends a national above ground storage facility be established which has the capacity to take low, intermediate and high level radioactive waste (Paragraph 7.18).

Recommendation 18

The Committee recommends that the national facility be adequately engineered to withstand all possible climatic conditions, no matter how unlikely (Paragraph 7.35).

Recommendation 19

The Committee recommends that the public, particularly the local community, should be involved in consultation on the construction of a national storage facility and the transport arrangements to any such facility (Paragraph 8.62).

Recommendation 20

The Committee recommends that a management committee for the facility be established including an equal number of representatives from the local community and the users of the national storage facility, together with a representative from the Australian Institute of Radiation Protection and one from the relevant State or Territory authority. This Committee should oversee the design, construction and management of the facility (Paragraph 8.63).

Recommendation 21

The Committee recommends that the managers of the national storage facility be required to produce an annual report to Parliament (Paragraph 8.64).

Recommendation 22

The Committee recommends that the Commonwealth Government establish a Committee with representatives from a cross section of relevant bodies to recommend the allocation of research funding for radiation issues. The Committee could comprise representatives from the Australian Institute of Radiation Protection, the National Health and Medical Research Council and Commonwealth authorities, State and Territory authorities, the academic community and industry with relevant expertise (Paragraph 9.22).

CHAPTER 1

INTRODUCTION

1.1 Ionising radiation is released when the nucleus of an atom becomes unstable and disintegrates, releasing excess nuclear energy in the form of energetic radiation.[1] The rate at which atoms disintegrate in radioactive material determines the half life, which is the time it takes for the radioactivity of the material to decline by half. The half life of different radioactive materials varies from a fraction of a second to billions of years.

1.2 Everyone is exposed to background radiation from natural sources. As well, people may be exposed to radiation in their work, through contamination of the environment or during medical treatments. This Inquiry looked only at those aspects of radiation relevant to the management of radioactive waste.

1.3 For the purposes of this report the Committee has defined radioactive waste as all radioactive material for which no future use is foreseen. However, the Committee recognises that material currently regarded as waste under this definition may be a future resource.

1.4 Radioactive wastes arise from mining and milling operations, nuclear fuels, the disarmament of nuclear weapons or the dismantling of nuclear reactors. Relatively small amounts of waste are also created through the use of radioactive sources in medicine, industry and research. The management of this radioactive waste management must protect workers' safety, public health and the environment in a manner that also minimises the burden placed on future generations.[2]

Biological Effects of Radiation

1.5 Ionising radiation creates electrical charge imbalances in atoms, which in the body can damage living cells. The long term health effects of radiation exposure are manifested by mutation of cells, increased aging capacity of the body, and increased incidence of leukemia, birth defects and cancer.[3] The

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1 This radiation is called *ionising* because it may turn atoms which it comes into contact with into electrically charged variants called ions. Hereafter in this report 'radiation' and 'radioactivity' refers to ionising radiation.

2 Organisation for Economic Co-operation and Development, *Environmental and Ethical Aspects of Long Lived Radioactive Waste Disposal*. Proceedings of an International Workshop, the Nuclear Energy Agency in Co-operation with the Environment Directorate, 1-2 September 1994, Paris, p. 17

3 Lannstrom, Transcript of Evidence, p. 190

extent of effects varies according to the dose, radiation type, duration of exposure, and whether the exposure is external or arises from inhaling or ingesting radioactive materials.

1.6 The three forms of radiation - alpha, beta and gamma - are all potentially harmful, but differ in penetrating power and effect on human tissue. *Alpha radiation* consists of relatively large particles which do not easily penetrate the outer skin layers but are highly dangerous within the body. Alpha sources, some of which are extremely long-lived, include heavy elements such as uranium, thorium, radium and plutonium. *Beta radiation* consists of energetic electrons which have more penetrating power (they can pass through one centimetre of human tissue), but are less damaging to tissues than alpha radiation. *Gamma radiation* is highly penetrating, however damage to tissues is much less than that caused by alpha particles.

1.7 At very low doses the effects of radiation on human health are not discernible; but whether there are *no* effects is unknown. As a precautionary measure the International Commission on Radiological Protection (ICRP) and most other observers assume that the effects are proportional to dose and that there is no safe dose. This approach ensures that standards for controlled exposures to artificial radiation are conservative.[4]

1.8 Recent research suggests that previous standards for exposure to radiation should be tightened. In a long term study of 110 000 Japanese atomic bomb survivors, it is now thought that the victims were exposed to doses only about half as great as previously thought; and current estimates of future deaths from fatal cancers are one and a half times greater than estimates a decade ago. The United Nations Scientific Committee on the Effects of Atomic Radiations published these findings in 1988. The ICRP subsequently recommended reducing the limits for occupational exposure by a factor of three.[5]

1.9 Exposure to hazardous radiation doses may result from accidents or inadequate safety measures. The safety measures required depend on the radioactive half life, concentration, heat generating characteristics, chemical form, radiotoxicity, physical form, method of encapsulation and the pathway via which the radiation enters the body.

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4 Higson D (1995) *The Biological Effects of Low Level Radiation*, Paper prepared for the Australian Nuclear Association, 17 July 1995, p. 3

5 Lokan, Transcript of Evidence, p. 98

1.10 The internationally accepted classification of radioactive wastes into different categories which has been developed is based on the types of hazard, to ensure that no one receives more than a permitted dose of radiation. The major categories are: *high level waste*, which generates significant quantities of heat; *intermediate level waste*, which requires shielding but which does not generate significant heat; and *low level waste* which requires no shielding during handling and transport, but whose radioactive content means that it cannot be disposed of as ordinary waste. A fourth category of *exempt waste* applies to waste with radioactivity so low that it is regarded as safe for disposal into the general waste stream.

1.11 The International Atomic Energy Agency's (IAEA) latest Safety Series has modified the categories, recommending periods of isolation needed to ensure the protection of workers and the public, depending on the activity and half life of the radioactive materials to which they are exposed.[6] The revised IAEA classification system distinguishes short lived and long lived intermediate level waste.[7]

1.12 Because the definitions are qualitative rather than quantitative, problems can arise over different views of which category a particular material belongs in. The Committee heard claims that the nuclear industry may try to reduce problems of handling waste by reclassifying it to a lower level.[8] The Committee believes it is essential that problems relating to definitions and categories be addressed as a matter of urgency because of their significance in developing a long term plan for managing radioactive waste.

Background to the Inquiry

1.13 In 1990 and 1991 the Australian Nuclear Science and Technology Organisation (ANSTO) accepted for storage at the Lucas Heights Research Laboratories, 2000 cubic metres of low level radioactively contaminated soil from CSIRO's Fishermens Bend property in Victoria.

1.14 In July 1991 ANSTO contracted with Australian Defence Industries (ADI) to store and condition at Lucas Heights about 17 cubic metres of radioactive material from ADI's St Marys property. The planned closure of the

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6 International Atomic Energy Agency (1994) Safety Series No 111-G.1.1, *Classification of Radioactive Waste, A Safety Guide,* Vienna, 1994, p. 9

7 Ibid, pp. 10-11

8 Sutherland Shire Environment Centre, Submission No. 7, p. 2; Cohen, Transcript of Evidence p. 318

St Marys property and the release of the land for residential development meant that the radioactive waste on site had to be relocated.

1.15 In September 1991 the Shire of Sutherland challenged these actions in the New South Wales Land and Environment Court on the grounds that they contravened the *NSW Environment Planning and Assessment Act* 1979. In 1992, the Court ordered ANSTO not to store radioactive waste from any other source at Lucas Heights, and to remove the Fishermens Bend soil within three years.[9] The Commonwealth complied with the Court's order and the Fishermens Bend soil and St Marys waste were moved to Woomera Rangehead in South Australia.

1.16 The soil from Fishermens Bend was moved to Woomera between 17 November 1994 and 7 January 1995. During the transportation, a drum lid in one load became loose and water leaked from the drum while the waste was in transit through Port Augusta. The radioactive waste from St Marys was moved to Woomera on 18-19 May 1995. Public concern and publicity surrounding the transfer of this material prompted the establishment of the Senate Select Committee on the Dangers of Radioactive Waste on 9 March 1995.

Scope of the Inquiry

1.17 The complexity of issues involving radioactive waste management are reflected in the terms of reference. Australia has a significant role in the nuclear fuel cycle which has been described as:

> a uranium producer, as a signatory to international and national agreements relating to the use of nuclear materials and the prevention of nuclear weapons proliferation, and as a nation carrying out research and development in nuclear science and technology.[10]

1.18 The Australian Atomic Energy Commission (AAEC) was established in 1953 to supply uranium to Britain and the United States for nuclear weapons production. However, Australia's uranium exports are now restricted to use in the nuclear power industry. The AAEC also provided a body of expertise in the expectation of a nuclear power program in Australia, for which the HIFAR

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9 *Environmental Law Reporter*, 27 March 1992, p. 34

10 Australian Science and Technology Council (1984) *Australia's Role in the Nuclear Fuel Cycle*, AGPS Canberra, p. 1

research reactor was built at Lucas Heights in the 1950s as a materials testing reactor.

1.19 In 1986 the AAEC was restructured and became the Australian Nuclear Science and Technology Organisation (ANSTO). ANSTO is a statutory body with both research and commercial activities. It produces radioisotopes for medical, industrial and research purposes. In 1992 a review of the replacement of the HIFAR nuclear reactor found that the disposal of the radioactive waste generated must be addressed before a decision could be made on HIFAR's future.[11] This and other issues relating to the radioactive waste currently stored on site and that likely to arise from ANSTO's future activities have been central to the Committee's deliberations.

1.20 The Committee also looked at the difficulties being faced by the State and Territory governments, hospitals, universities and industries in the management of radioactive waste.

The Report

1.21 Radioactive waste must be managed in such a way as to protect human health and the environment and to limit any burden placed on future generations. It is important when considering disposal and management options of radioactive waste that the whole burden on the biosphere is taken into account. Decisions made now must have sufficient flexibility not to close off options which may arise with future technological developments.

1.22 The Terms of Reference of the Inquiry were wide ranging and designed to include all aspects of the management of radioactive waste except waste generated by the uranium mining industry. An important issue was the nature, efficiency and effectiveness of the administration, monitoring and control of radioactive waste. The Committee briefly looked at the existing guidelines and legislation, most of which is currently under revision. There was a strong call for a nationally agreed system.

1.23 One of the issues which arose was whether radioactive waste disposal costs should be met by the private sector or whether they should receive some public sector subsidy if the broader community benefits from the source of the waste. It was also considered essential to ensure that issues relating to Lucas Heights waste were not permitted to overshadow policies developed to address

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11 Research Reactor Review (1993) *Future Reactions, Report of the Research Reactor Review*, August 1993, p. 216

the difficulties faced by hospitals, universities and small industries or the sand mining industry. It became apparent to the Committee at an early stage that there was no single solution and that a number of options would need to be considered.

1.24 The report treats the matters of creation, minimisation, transport, storage and disposal of radioactive waste separately, and in each context comments relate to the need for a national facility. Matters of risk assessment and community concerns are addressed in the latter part of the report. The last Chapter provides an overview of the Committee's findings.

CHAPTER 2

REGULATION OF RADIOACTIVE WASTE MANAGEMENT

Introduction

2.1 Control of radioactive materials and radioactive waste is, in principle, the responsibility of the States and Territories. All States and Territories have laws which explicitly control the use of radioactive materials.

2.2 In practice, Commonwealth bodies - primarily the Australian Nuclear Science and Technology Organisation - are responsible for about 90 per cent of Australia's radioactive waste (other than that arising from mining and milling operations). There is no Commonwealth legislation comparable with the State laws controlling the use of radioactive materials, therefore Commonwealth bodies' creation and use of radioactive materials is mostly not subject to external monitoring or legal control.[1] Some Commonwealth laws are relevant, and are mentioned below, but these do not constitute a complete regime of licensing and monitoring comparable to that which applies to private persons and organisations under State laws.

2.3 Sometimes Commonwealth bodies comply with State laws as a matter of policy, as good corporate citizens, but the 'regulatory gap' was a major concern in many submissions, and the means of addressing the situation is a major issue in the proposal to establish an Australian Institute of Radiation Protection.

2.4 A second theme in this chapter concerns the number of bodies that are involved in radiation policy or administration at the Commonwealth level. Interested departments are Primary Industries and Energy; Industry, Science and Tourism; Health and Family Services; Industrial Relations; Environment, Sport and Territories; Transport and Regional Development; Defence; and Foreign Affairs and Trade (details are in APPENDIX 3).[2]

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1 This situation arises because of the legal principle that the Commonwealth is not bound by State laws. However the situation varies according to the circumstances, and the law has developed in recent years and contains some uncertainties. See Senate Standing Committee on Legal and Constitutional Affairs, *The Doctrine of the Shield of the Crown*, December 1992. In the case of ANSTO, which is most relevant to the discussion in this chapter, any uncertainty is removed by section 7A of the *Australian Nuclear Science and Technology Act 1987*, which explicitly exempts ANSTO from State laws on environment, landuse planning, radioactive materials and dangerous goods, and licensing of business or employment.

2 These are portfolios established by the administrative arrangements gazetted on 11 March 1996. Submissions to the Inquiry are cited under former portfolio names.

2.5 The need for and the means of simplifying this situation has implications for the structure of the proposed Australian Institute of Radiation Protection. It raises the general question: to what extent radiation control, because of its special features, should be concentrated in a special purpose body; alternatively, to what extent *aspects* of radiation control (such as occupational health and safety, environmental protection) should be shared by departments (such as Industrial Relations, Environment) which already have general responsibility for such aspects.

National Codes on Radioactive Waste

2.6 Relevant codes are those promulgated under the *Environment Protection (Nuclear Codes) Act 1978,* and the codes of the National Health and Medical Research Council. None have legal force unless they are taken into State/Territory law[3] or used to inform State/Territory administrative decisions (such as licensing decisions); there are some inconsistencies in the approach and application from State to State.

Codes under the Environment Protection (Nuclear Codes) Act 1978

2.7 Under the *Environment Protection (Nuclear Codes) Act 1978 Act* the Commonwealth, subject to consultation with the States/Territories, may promulgate codes of practice relating to nuclear activities. The Act authorises regulations which may give a code the force of law in any State which does not have equivalent State law, but only at that State's request, and subject to the overriding limits on the Commonwealth's legislative powers under the Constitution.

2.8 Three codes of practice have been promulgated. They are the *Code of Practice for the Safe Transport of Radioactive Substances* (1982, revised 1990), and two codes on mining and milling of radioactive ores (1982 and 1987). Although uranium mining is outside the terms of reference of this inquiry, the latter two codes are mentioned here briefly because they are relevant to the extent that they apply to sand mining.

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3 Or, in the case of codes under the *Environment Protection (Nuclear Codes) Act 1978,* unless a State requests the Commonwealth to make a regulation that gives a code legal force in that State.

Code of Practice for the Safe Transport of Radioactive Substances (1982, revised 1990) ('the Transport Code')

2.9 This Code sets out standards for packaging, storing and segregation of radioactive materials during transport, testing, monitoring and administrative arrangements. It is based on *Regulations for the Safe Transport of Radioactive Material* (1988) by the International Atomic Energy Agency, with some local modifications. Transport by air shall be in accordance with the *Civil Aviation Act 1988,* transport by sea shall be in accordance with the *Navigation Act 1912* and the international standards for radiation protection[4] are superseded by National Health and Medical Research Council standards.[5]

Code of Practice on Radiation Protection in the Mining and Milling of Radioactive Ores (1980, revised 1987)

2.10 The Code sets out administrative procedures for training, certification, allocation of responsibilities and monitoring which are designed to ensure that exposure to radiation doses as a result of mining and milling are 'as low as reasonably achievable, economic and social factors being taken into account'.[6]

2.11 Dr Hartley was critical of the Code, commenting:

> [The Code] was originally produced in a political climate when Roxby Downs uranium mine was about to be established... Much of the detail is dictated by the politics of the time and is not really suited to control Radiation Health in mining in a proper scientific way.[7]

On the other hand, in its evidence, the Western Australia Department of Minerals and Energy pointed to 'very great reductions in occupational exposure' since the introduction of the Code.[8]

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4 International Atomic Energy Agency (1982) *Basic Standards for Radiation Protection*, Safety Series No. 9, IAEA, Vienna 1982, referred to in paragraph 201 of the IAEA's *Regulations for the Safe Transport of Radioactive Material*, Vienna 1988

5 National Health and Medical Research Council, *Recommended Radiation Protection Standards for Individuals Exposed to Ionising Radiation*, 1981, as amended

6 *Code of Practice on Radiation Protection in the Mining and Milling of Radioactive Ores* (1987), section 2

7 Hartley, Submission No. 24, p. 3

8 Hewson, Transcript of Evidence, p. 271

Code of Practice on the Management of Radioactive Wastes from the Mining and Milling of Radioactive Ores (1982)

2.12 The Code provides for approval of a waste management program for each mining or milling operation, to ensure 'an approach to waste management which is best suited to the particular circumstances of each operation'.[9] The code is focussed more on administrative procedures than technical details as is the case in the radiation protection code and it relies on phrases like 'best practicable technology', radiation exposure to be 'as low as reasonably achievable', and procedures to be 'to the satisfaction of the appropriate authority.'

2.13 As with the radiation protection code, opinions on the usefulness of this code were mixed.[10]

> ...the code is a general road map. If you want to get to a particular destination, you might need to look at a much more detailed map, and I believe the regulations which prevail at state level do that. [11]

Codes of the National Health and Medical Research Council

2.14 The National Health and Medical Research Council (NHMRC) has published about 40 codes or recommendations on particular aspects of radiation safety. They are listed in APPENDIX 4. Underpinning them are basic standards for radiation exposure expressed in *Recommended Radiation Protection Standards for Individuals Exposed to Ionising Radiation* (1980, as amended). The 1980 basic standards were superseded in 1995,[12] and the detailed codes are being revised accordingly.

2.15 The codes most relevant to the Committee's inquiry are the *Code of Practice for the Disposal of Radioactive Wastes by the User (1985)* and the

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9 *Code of Practice on the Management of Radioactive Wastes from the Mining and Milling of Radioactive Ores* (1982), foreword

10 Hartley, Submission No. 24, p. 3; Transcript of Evidence, p. 371; Hewson, Transcript of Evidence, p. 271

11 Schache, Transcript of Evidence, p. 283

12 The 1980 standards were replaced by National Health and Medical Research Council, *Recommendations for Limiting Exposure to Ionising Radiation (1995) and National Standard for Limiting Occupational Exposure to Ionising Radiation.*

Code of Practice for the Near Surface Disposal of Radioactive Waste in Australia (1992).[13]

Code of Practice for the Disposal of Radioactive Wastes by the User (1985) ('the User Code')

2.16 The Code recommends conditions for disposing of low level radioactive waste in municipal tips, incinerators, the sewer or the atmosphere. Temporary storage is envisaged to allow materials with short half lives to decay to a level of radioactivity low enough that they can be disposed of by these means.

2.17 The Code is used in all States and Territories except New South Wales and Western Australia. Although the Code has not been adopted in Western Australia the *Radiation Safety Act* 1975 and Regulations have a similar outcome.[14] In the Australian Capital Territory the maximum allowed radioactivity of solid radioactive waste to landfill is more lenient than that in the Code and in Tasmania and Victoria an additional requirement applies to the concentration of liquid radioactive effluent being discharged to sewer.[15]

Code of Practice for the Near Surface Disposal of Radioactive Waste in Australia (1992)

2.18 This Code recommends conditions for disposing, by shallow burial, of waste[16] such that the dose received by anyone in the vicinity of the disposal site should be within limits recommended by the NHMRC (currently 1 millisievert per year for members of the public, and 20 millisieverts per year on average for radiation workers). It is assumed that an increase of one millisievert per year over the background levels of exposure (also about 1-2 millisieverts per year) falls within the acceptable range of risk as perceived by the public.[17]

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13 In the hospital context the National Health and Medical Research Council's *National Guidelines for the Management of Clinical and Related Wastes* (1988), *Recommendations relating to the Discharge of Patients Undergoing Treatment with Radioactive Substances* (1983) and *Code of Practice for the Safe Handling of Corpses Containing Radioactive Materials* (1986) are also relevant; St George Hospital, Submission No. 66, p. 4; Australian Radiation Laboratory, Submission No. 21, p. 2

14 University of Western Australia, Submission No. 22, p. 4

15 Australian Radiation Laboratory, Submission No. 21, p. 2

16 other than waste covered by the *Code of Practice on the Management of Radioactive Wastes from the Mining and Milling of Radioactive Ores* (1982), or the *Code of Practice for the Disposal of Radioactive Waste by the User* (1985)

17 Munslow-Davies, Transcript of Evidence, p. 312-313

2.19 The Code is consistent with International Atomic Energy Agency publications *Principles of Radioactive Waste Management* and *Establishing a National System for Radioactive Waste Management.*[18] It deals with site selection criteria, waste characteristics, design of the facility and operational requirements. It suggests an 'institutional control period' of at least 100 years, and facilities with a design life of 300 years to allow the more long lived materials to substantially decay before the site is likely to be disturbed.[19]

Comments on the National Codes

2.20 In general there is mixed opinion about the usefulness of the national codes. Some witnesses found them helpful; others thought they are hard to understand or need updating and enforcing.[20] The Committee mentions the following points only briefly, as we are mindful of the fact that the codes are now being revised.

Need for Plain English

2.21 A common concern was that the codes are hard to understand. Several witnesses commented that the Transport Code is not user-friendly.[21]

> The Transport code itself is a detailed and somewhat complex document for those not familiar with it, or without relevant technical skills.[22]

> I have also been advised by colleagues who have had exposure to the [Transport] Code that it is a complicated document, difficult to understand comprehensively.[23]

2.22 On the other hand, it was said that adherence to the Code in Western Australia has led to a good standard of transport with very few incidents.[24]

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18 Australian Radiation Laboratory, Submission No. 21, p. 2

19 Munslow-Davies, Transcript of Evidence, p. 304

20 Siewert, Transcript of Evidence, p. 317; Townsville General Hospital, Submission No. 62, p. 2; Women's and Children's Hospital , Submission No. 63, p. 1

21 Rosen, Transcript of Evidence, p. 770; Collins, Transcript of Evidence, p. 770; Royal Alexandra Hospital for Children, Submission No. 5, p. 2

22 Codd M (1995) *Review of the Arrangements for the Recent Transportation of Radioactive Waste*, Report to the Minister for Industry, Science and Technology, July 1995, p. 3

23 Royal Alexandra Hospital for Children, Submission No. 5, p. 2

24 University of Western Australia, Submission No. 22, p. 3

2.23 The Committee was told that the User Code was 'not particularly helpful' in that the upper limit of radioactivity which may be disposed of by the user is not given in precise words but rather by referring to other documents.[25] On the other hand, the Committee was told that:

> It certainly would not be easy to understand for someone without the appropriate training, but it is not designed for someone who does not have that training.[26]

2.24 Many users write their own 'Plain English' summaries of the national codes. These extract from a wide-ranging code, for easy reference, items of particular relevance:

> I know of one hospital's Radiation Safety Officer who has gone to considerable trouble to attempt to produce an accurate summary [of the Transport Code] for easy use.[27]

Compliance and Enforcement

2.25 Some witnesses felt that the codes are inadequately enforced. Compliance with national codes depends on their incorporation in State/Territory law or administrative decisions, the attitudes of users, and the resources available to monitor compliance. Compliance relates more to the administrative arrangements than to the Code itself. However, there is an obvious interaction between the 'user-friendliness' of a code and the ease of compliance. This comment expresses the interaction:

> the [Transport] Code requirements are often not followed simply because of the unavailability of appropriate transport containers, or the lack of understanding of the Code, or both.[28]

Need for Update to New International Standards

2.26 Some submissions mentioned that the codes need to be updated generally, particularly in view of revised basic standards for radiation protection published by the International Commission on Radiological Protection (ICRP) in publication 'ICRP 60', 1991. ICRP 60 recommends more stringent standards of radiation protection than in the past, based on recent research on Japanese atomic bomb victims.

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25 University of New South Wales, Submission No. 75, p. 2

26 Wong, Transcript of Evidence, p. 744

27 Hanlon, Submission No. 5, p. 2

28 Westmead Hospital and Community Health Service, Submission No. 65, p. 4

2.27 In June 1995 the NHMRC and the National Occupational Health and Safety Commission jointly released revised Australian basic standards for radiation exposure, based on ICRP 60.[29] The NHMRC codes are now being revised accordingly.[30] The Committee also believes that further revisions of national codes may be needed after the publication of the Radioactive Waste Safety Standards program (RADWASS) guideline statements.

Problems of Large Hospitals

2.28 A particular problem of the User Code, according to some submissions, is that the standards are framed in such a way that larger hospitals which treat a higher volume of patients are disadvantaged because of the higher volumes of waste:

> the NHMRC [User Code] talks about a maximum absolute amount [of radioactive waste] which can be discharged into the sewer per week, based on the radionuclide, whereas various regulations in states and other countries talk about the maximum concentration of radionuclide. So the higher volume flow of effluent from your institution, the higher the amount that you can actually discharge.[31]

2.29 The Committee was told that the absolute weekly limit allows smaller hospitals to discharge larger amounts of radioactive waste per patient, and effectively restricts the number of patients that can be treated in larger hospitals.[32] Therefore this type of treatment may be concentrated in the few hospitals which have delay tank facilities, and this will increase the demand on existing facilities.[33]

2.30 By contrast, the New Zealand *Code of Safe Practice for the Use of Unsealed Radioactive Materials in Medical Diagnosis, Therapy and Research* sets limits based on concentration rather than the total quantity of radioactivity in a discharge. The Australian and New Zealand Society of Nuclear Medicine believes that this approach encourages all users, regardless of size, to improve

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29 National Health and Medical Research Council & National Occupational Health and Safety Commission, (1995) *Recommendations for Limiting Exposure to Ionising Radiation and National Standard for Limiting Occupational Exposure to Ionising Radiation*

30 The Transport Code is also being revised to be consistent with ICRP 60 recommendations and with the International Atomic Energy Agency's Basic Safety Standards; Nuclear Safety Bureau, Submission No. 31, p. 3

31 Collins, Transcript of Evidence, p. 753

32 Australian & New Zealand Society of Nuclear Medicine, Submission No. 68, p. 2

33 Hanlon, Transcript of Evidence, p. 754

their waste management techniques.[34] The National Health and Medical Research Council is currently looking into this issue.[35]

International Treaties, Agreements and Codes of Practice

2.31 Australia is party to a number of international treaties and other agreements relevant to management of radioactive waste. The Department of Foreign Affairs and Trade co-ordinates Australia's position, consulting with other bodies (Commonwealth, State and non-government) on the scientific aspects of radiation policy.

2.32 The Declaration on Development and the Environment (Rio de Janeiro, 1992), to which Australia is a signatory, is a primary source for international objectives in environmental protection. Various principles in the Declaration have a bearing on radioactive waste management, especially those relating to the need for public participation in decision making, the principle of polluter pays and the importance of the precautionary approach to possible environmental degradation.

Treaties

2.33 The most relevant treaties (not including treaties more relevant to nuclear weapons control) are:

- the *Convention on the Prevention of Marine Pollution by Dumping of Waste and Other Matter*, which prohibits the dumping of radioactive matter at sea;
- the *Convention for the Protection of the Natural Resources and Environment of the South Pacific Region*, which prohibits dumping or disposal of radioactive material in international waters of the region;
- the *South Pacific Nuclear Free Zone Treaty*, which prohibits the dumping of radioactive material at sea; and
- the *Convention on Early Notification of a Nuclear Accident*, which requires parties to notify affected states in the event of an accident involving, or likely to involve, an international release of radioactive material.
- the *Convention on Nuclear Safety,* which relates to civil nuclear power plants (expected to come into force by the end of 1996).

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34 Australian & New Zealand Society of Nuclear Medicine, Submission No. 68, p. 2

35 Collins, Transcript of Evidence, p. 753

2.34 Other treaties under negotiation with potential relevance:

- the *Convention on the Safety of Radioactive Waste Management*, (considered below);
- the *Convention to Ban the Importation into Forum Island Countries of Hazardous and Radioactive Waste and to control the Transboundary Movement of Hazardous Waste within the South Pacific Region*, under which Australia would be obliged to ban the export of radioactive waste to all Pacific Island developing countries which are members of the South Pacific Forum.

Arrangements of Less Than Treaty Status

2.35 Australia is a member of the International Atomic Energy Agency (IAEA), which has a major role in developing international standards and codes of practice.

> Over the years, Australian technical experts have played important parts in the development of international approaches to the regulation of peaceful nuclear activity and cooperation, from the viewpoint of nonproliferation and safeguards, safety and radiation protection or the viewpoint of the physical protection of peaceful nuclear activity.[36]

2.36 Current Australian codes and standards have regard to a number of international codes. These include the *International Basic Safety Standards for Protection Against Ionising Radiation and for the Safety of Radiation Sources*, based on the work of the International Commission on Radiological Protection and last issued in 1991; and the IAEA Safety Series.

2.37 Two non-binding Codes of Practice are:

- IAEA *Code of Practice for the Transboundary Movement of Radioactive Waste,* which provides a framework for an international notification regime;
- joint IAEA/ International Maritime Organisation/ UN Environment Program *Code for the Safe Carriage of Irradiated Nuclear Fuel, Plutonium and High Level Radioactive Wastes in Flasks on Board Ships*.

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36 Luck, Transcript of Evidence, p. 661

2.38 The proposed transfer of spent fuel rods from Lucas Heights to the United States and to Dounreay in Scotland for reprocessing are being carried out under the provisions of bilateral Australia/UK and Australia/USA agreements on the peaceful uses of nuclear energy and the Australia/IAEA agreements on safeguards connected with the non-proliferation of nuclear weapons.

The IAEA Radioactive Waste Safety Standards (RADWASS) Program

2.39 The RADWASS program commenced in 1991 and is scheduled for completion in 1996. The outcome will be a set of publications dealing with every aspect of radioactive waste management. These documents are intended to reflect existing international consensus and to provide users with a comprehensive set of internationally agreed standards which they may use in forming local standards. Experts from the Australian Nuclear Science and Technology Organisation are participating in the development of these publications.[37]

2.40 The Committee supports the principles of the RADWASS program, which are that:

- waste should be managed so as to ensure an acceptable level of protection for human health.
- waste should be managed so as to ensure an acceptable level of protection for the environment.
- possible effects on health and the environment beyond national borders should be taken into account.
- predicted effects on the health of future generations should not be greater than those considered acceptable today.
- management should not impose undue burdens on future generations.
- waste should be managed within a clear legal framework that includes independent regulatory functions.
- creation of radioactive waste should be kept to the minimum practicable.
- interdependencies among the steps in the creation and management of radioactive waste should be taken into account.
- the safety of facilities should be assured during their lifetime.[38]

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37 Australian Nuclear Science & Technology Organisation, Submission No. 32, p. 29

38 International Atomic Energy Agency (1994) *Safety Fundamentals - the Principles of Radioactive Waste Management - Safety Series No. 111-F*, pp. 4-11

2.41 It was suggested that future reviews of Australian codes should be based at least as much on Australian experience as on overseas documents.[39] The RADWASS documents acknowledge that the suggested standards are only for guidance, and each authority must work out the regime which best suits it having regard to local circumstances.

Convention on the Safety of Radioactive Waste Management (Radwaste Convention)

2.42 Negotiations began in 1995 under the auspices of the IAEA, and it is hoped that the convention will be open for signature by the end of 1996. The Convention is expected to cover all aspects of the topic other than those covered by the *Convention on Nuclear Safety*, which relates to nuclear power stations.

2.43 It is expected that the Convention will oblige parties to introduce appropriate domestic legislation to enforce agreed standards as laid down in IAEA and RADWASS documents. This would require the establishment of a legislative regime which separates regulatory and operational functions; includes provisions for licensing and independent inspection of waste storage and disposal facilities to determine compliance with regulatory standards; and provides a framework for information and early notification to states at risk of transboundary contamination.[40] The Convention is expected to recommend standards for domestic radioactive waste management, disposal regimes and obligations on contracting parties for safety issues such as safety analyses, design and construction of facilities, quality assurance and safety reviews. The Convention foreshadows that accountability would be addressed through reporting and peer review arrangements, as occurs with the *Convention on Nuclear Safety*.[41]

2.44 The Convention is envisaged as incentive-based, to provide for the sharing of knowledge and experience[42] and to reflect the evolutionary nature of radioactive waste practices. The Convention should be flexible and take into account developments in international practice so that international standards keep pace with technological improvements.

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39 Fleischmann, Submission No. 9, p. 7

40 Smith, Transcript of Evidence, p. 663

41 The Nuclear Safety Convention was signed by Australia in 1994. It is hoped to come into force by end 1996.

42 Department of Foreign Affairs and Trade, Supplementary Submission No. 26a, p. 2

> We believe that is what is achievable is a treaty we characterise as an incentive treaty which does not contain strong prescriptions and sanctions against non-compliance but which sets high standards and standards which we think can be achievable and which will be signed on to by the members of the international community, and they will than be obliged to implement those things in the domestic legislation ... in Australia's case, we have already the kinds of regulations and arrangements in place which this convention would probably require us to have.[43]

2.45 It is proposed that the Convention will form part of an integrated network of international codes, standards, conventions and treaties aimed at ensuring the best possible international arrangements for maintaining high levels of safety for all forms of nuclear activity.

State/Territory Radiation Control Legislation

2.46 Under the Constitution, control of radioactive materials generally lies with States and Territories. All States and Territories have laws explicitly controlling radioactive materials, which are listed in APPENDIX 5. Most have rewritten their original laws and all have made amendments from time to time. As a result the laws, though similar in tenor, have many differences of detail. Some differences may be minor, others may be significantly inconvenient, such as to interstate trade. Some differences occur as the chance result of separate evolution, others reflect differences in administrative arrangements between the States.

2.47 Examples of variations in State law follow:

- the division of instruction and detail between Acts and Regulations varies widely. Terminology may differ.
- Definitions and thresholds vary. For example, the threshold definition of 'radioactive material' (representing a level of radiation below which the material is not of official concern) varies. Some Acts refer to specific activity (becquerels per gram), others to the total activity of an object (becquerels) and the actual numbers vary. Other Acts refer to maximum permissible doses[44] and these also vary.

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43 Luck, Transcript of Evidence, p. 668

44 The 'total activity' method creates a situation in which one large object is subject to control but when cut into two smaller objects is not.

- Some Acts which set maximum permissible doses also contain the concept of minimising doses where possible.[45]

- Legislative anomalies may result because of differences in the reach of the law, in terms of the activities and types of persons that are controlled.

- In addition to licensing conditions, some States impose a separate general duty on those in charge of radioactive materials to ensure that people on the premises are not exposed to more than a maximum dose.

- The decision maker on licensing varies - from a statutory officer or departmental officer (Chief Medical Officer, Northern Territory; Chief General Manager, Victorian Department of Health) to a statutory authority (Environment Protection Authority of NSW), to a Minister (Queensland) or a special council appointed by a Minister.

- The amount of explicit direction which is given to decision makers in licensing decisions varies. Some decisions must merely 'take into account' maximum doses or consider whether applicants are fit and proper persons. There are other schemes where the decision maker must be satisfied that an application complies with dose limits or other detailed conditions set out in the law. The form of advisory councils vary, some with power of veto, some without.[46]

- Where transport or waste disposal are controlled in parts of Acts separate from basic 'manufacture, use or sell' provisions, the decision makers on transport or waste disposal may be different, or the decision maker's discretion level may be different.[47]

- The way in which the law is linked to national codes, or includes equivalent details in full, varies.

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45 For example, Queensland *Radioactive Substances Regulation 1961,* section 21; South Australian *Radiation Protection and Control Act 1982*, section 23.

46 This comment is not meant to imply that decision-makers with wide statutory discretion make less rigorous decisions. All administrations use detailed guidelines (whether their own policies or national codes) to guide license conditions. It is a matter of opinion and convenience how much detailed matter should be in Acts, how much in regulations, and how much in administrative guidelines.

47 For example, New South Wales and Australian Capital Territory. In New South Wales the Environment Protection Authority (EPA) controls licenses to use while the *Director-General* of the EPA gives consent to disposal, with wide discretion.

- There are differences in provisions for licensing and training of the users of radioactive sources.

2.48 In spite of these differences the State/Territory laws have similar results in practice. The Committee believes that most of the differences are the result of separate evolution and different administrative schemes, rather than different policies.

2.49 Many witnesses at the inquiry expressed a desire for greater national co-ordination, and the Committee believes that this is achievable.[48] Most State/Territory radiation control laws are now under review, and this may be an appropriate time to attempt greater co-ordination.

The Role of ANSTO in Dealing with Radioactive Waste

2.50 The Australian Nuclear Science and Technology Organisation (ANSTO) is a Commonwealth statutory authority. ANSTO is Australia's national centre for research and development in nuclear science and technology. Its activities include operating nuclear facilities, scientific research, producing radioactive materials and other irradiation services for medical use on a commercial basis, providing advice to Government, and assisting industry to develop new or improved products and processes. ANSTO supplies about 85 per cent of the demand for radioisotopes and radiopharmaceuticals in Australia.[49]

2.51 ANSTO's functions most relevant to this Inquiry are -

> to condition, manage and store radioactive materials and radioactive waste, arising from:
>
> (i) the Organisation's activities (including the production of radioactive materials for other persons); or
>
> (ii) the activities of companies in which the Organisation holds a controlling interest (including the production of radioactive materials for other persons); or
>
> (iii) the use by other persons of radioactive materials produced by the Organisation or such companies; or

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48 See also Swindon T (1995) 'On achieving a uniform approach to radiation control in Australia', *Radiation Protection in Australia*, 13 (2):55-60.

49 Australian Nuclear Science & Technology Organisation, Supplementary Submission No. 32b, p. 3

(iv) the activities of other persons who are specified in the regulations.[50]

ANSTO's Power to Deal with Radioactive Materials Owned by Others

2.52 The functions just quoted were added to the ANSTO Act in 1992. The last item, section 5(1)(ba)(iv) relating to radioactive materials produced by persons other than ANSTO, had the effect of neutralising a decision of the New South Wales Land and Environment Court forbidding ANSTO from storing radioactive materials owned by CSIRO.[51] This function is a significant one, since material produced by persons other than ANSTO is an important part of the national inventory of radioactive materials and waste.

2.53 The addition of section 5(1)(ba)(iv) has opened the way to controversial situations, such as the 1994 proposal to move Australian Defence Industries waste from St Marys to ANSTO's Lucas Heights property for treatment. This aroused objection from bodies such as Sutherland Shire Council, which feared that this might create a precedent for the development of a national radioactive waste repository at Lucas Heights, even though the ANSTO Act specifically prohibits this.[52]

2.54 On the other hand, the Department of Industry, Science and Technology argued that ANSTO's power to deal with radioactive materials produced by others should be facilitated by removing the limitation to persons 'specified in the regulations.' The Department argues that a regulation naming a party for the purpose of section 5(1)(ba)(iv) takes time to gazette, but without it ANSTO might not legally be able to help with emergencies (even those involving other Commonwealth authorities). The Department referred to several emergencies involving ANSTO-related radioactive materials since the ANSTO Act was amended, and pointed out the possibility that similar incidents could occur involving non-ANSTO-related materials.[53]

2.55 The Committee agrees that the need to make a regulation under section 5(1)(ba)(iv) is cumbersome. It could be replaced by a suitable scheme of

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50 *Australian Nuclear Science and Technology Organisation Act 1987*, section 5(1)(ba)

51 ANSTO had accepted for storage about 2000 cubic metres of slightly contaminated soil from CSIRO's Fishermens Bend site. The Court, on application by Sutherland Shire Council, held that this was outside ANSTO's legal functions. *Environmental Law Reporter*, 27 March 1992, p. 33

52 *Australian Nuclear Science and Technology Organisation Act 1987*, subsection 5(1A). See also Senate Legal and Constitutional Legislation Committee, *The Drafting of the ANSTO Regulations (No. 259 of 1994)*, November 1994.

53 Department of Industry, Science and Technology, Submission No. 74, p. 2

external licensing and monitoring of ANSTO's 'conditioning, managing and storing' activities by an independent body - a function that could be carried by the proposed Australian Institute of Radiation Protection (AIRP).

2.56 In the case of non-emergency work, such as conditioning and storing waste on a commercial basis, the time lag involved in getting external approval is not an issue and, in the Committee's view, it is desirable to retain external scrutiny in light of public sensitivities about storage of material at Lucas Heights.

2.57 Should an emergency arise, the Committee notes that non-ANSTO waste tends to have lower levels of radioactivity; State laws and licenses require detailed contingency planning for emergencies; ANSTO can give advice to anyone at any time, even without a regulation under section 5(1)(ba)(iv); and some private contractors can carry out emergency work. There is a question as to whether ANSTO needs to be physically involved in emergency work.

2.58 A further concern is that, while the argument for removing the requirement for a regulation based on the need to respond quickly to emergencies may have merit, it would also reduce control of everyday commercial activities, since the current law does not distinguish between the two. A regime of control by an independent AIRP could provide different levels of control for everyday and emergency activities.

2.59 The Committee notes that ANSTO's Strategy Review Recommendations take account of developing opportunities arising from the expansion of the nuclear power industry in Asia.[54] Sutherland Shire Council expressed concern that:

> The absence of effective nuclear industry regulation in Australia leaves the public susceptible to Commonwealth attempts to generate revenue and derive political gains through processing and/or disposing of Asian radioactive waste in Australia.[55]

2.60 The Committee does not believe that an expansion of ANSTO's activities should allow importing of radioactive waste into Australia for treatment or conditioning. To encourage community confidence in the Commonwealth's intentions, any change to the law should exclude this type of possibility. The Committee believes that if in future ANSTO's consideration of such a proposal

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54 Australian Nuclear Science & Technology Organisation (1994) *Strategy Review Recommendations* Final Report, 9 December 1994, p. 57

55 Sutherland Shire Council, Submission No. 20, p. 30

should be subjected to Parliamentary scrutiny, as required under the present ANSTO Act.

ANSTO's Immunity from State Law

2.61 The *Australian Nuclear Science and Technology Act 1987* explicitly exempts ANSTO from State laws on land use, environment protection, radioactive materials and dangerous goods, and licensing of business and employment (section 7A). This provision was also added after the 1992 New South Wales Land and Environment Court case.

2.62 ANSTO told the Committee that it complies with all Commonwealth requirements and conforms to New South Wales norms.[56] Nevertheless, groups such as Greenpeace and the Sutherland Shire Council have been critical of the immunity provision, which provides that ANSTO is not subject to control or supervision by the NSW Environmental Protection Authority.[57] Since there is no equivalent Commonwealth law, in practice ANSTO regulates much of its activities itself.[58]

2.63 ANSTO points out that:

> The policy of successive Commonwealth Governments is that such instrumentalities (ie ANSTO) are to operate consistently with all State laws where there is no existing, parallel, Commonwealth law and where those laws do not directly conflict with the existing ANSTO Act....[59]

2.64 Disputes surrounding Commonwealth bodies' immunity from State laws are not unique to ANSTO, and they raise broader issues which have not been canvassed by the Committee in this Inquiry.[60] It could be argued that if a Commonwealth body complies with State standards as a matter of policy, then

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56 Jostsons, Transcript of Evidence, p. 57

57 Pearson, Transcript of Evidence, p. 462; Sutherland Shire Council, Submission No. 20, p. 13

58 ANSTO is subject to direction by the Nuclear Safety Bureau, a separate Commonwealth statutory authority, but only in respect of the operation of its nuclear reactor. There is also an issue in whether the Nuclear Safety Bureau is sufficiently at an arm's length from ANSTO to ensure effective regulation. The Commonwealth's *Environment Protection (Impact of Proposals) Act 1974* is relevant but (in the context of this discussion of *external* controls), has the weakness that it is only triggered if a proposal is environmentally significant *in the opinion of the authority proposing it.*

59 Australian Nuclear Science & Technology Organisation, Submission No. 32, p. 17

60 See Senate Standing Committee on Legal and Constitutional Affairs, *The Doctrine of the Shield of the Crown*, Canberra, December 1992

it should have no reason to object to complying in law as well, since the difference will not affect its operations.

2.65 In the case of ANSTO the position is complicated by the obvious national security aspect of Australia's nuclear research capability, which underpins the argument for immunity from State laws:

> As Australia's centre for nuclear science and technology expertise, ANSTO undertakes what is essentially a national role in the effective development and implementation of the Commonwealth's nuclear safeguards, uranium export, non-proliferation and nuclear arms control policies. These are not matters which can be subject to the approval of individual local councils or State governments.[61]

2.66 The Committee accepts this argument, but with a caution. In a liberal democracy, while national security remains paramount, it must also compete with other interests. National security might require ANSTO to be able to operate without hindrance by State or local regulations; on the other hand, residents of Sutherland Shire claim a right to know, through independent audits, what radioactive waste is being created on ANSTO's property or emitted from it. The Committee believes that Sutherland Shire residents' concern is reasonable in principle regardless of how good ANSTO's environmental record is at the moment. Both ANSTO and the Sutherland Shire residents have legitimate interests.

2.67 Part of the problem is that ANSTO combines research and advice functions which may involve the national interest, as well as commercial activities in which, arguably, it deserves no advantage over private enterprise.[62]

2.68 The Committee accepts the 'national interest' argument but does not consider it satisfactory that ANSTO's waste or commercial operations are exempt from controls that apply to its private sector competitors. The Committee believes that this is not an area where self-regulation is appropriate.

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61 The Hon. Ross Free, former Minister for Science and Technology, second reading speech on *Australian Nuclear Science and Technology Organisation Amendment Bill 1992*, House of Representatives *Hansard* 4 May 1992, p. 2320

62 ANSTO earns about a third of its income from commercial activities and supplies about 85 per cent of Australia's demand for radioisotopes and radiopharmaceuticals. Australian Nuclear Science & Technology Organisation, Supplementary Submission No. 32b, p. 3; Research Reactor Review, *Future Reaction - Report of the Research Reactor Review*, August 1993, p. xviii

2.69 Separation of ANSTO's commercial activities, which might be made subject to State law, from its 'national interest' activities (which arguably should remain the province of the Commonwealth), is not considered practical. The creation of a Commonwealth regulatory body independent of ANSTO and the implementation of Commonwealth legislation equivalent to existing State laws would play an important role in enhancing public trust in ANSTO. These are issues which should be addressed in deciding the structure and powers of the planned Australian Institute of Radiation Protection.

The 'Regulatory Gap'

2.70 The Australian Radiation Laboratory emphasised that there are regulations and penalties in the States which are not present at the Commonwealth level.[63] This 'regulatory gap' was a common concern raised submissions to the Inquiry.

2.71 Some Commonwealth agencies allow State authorities to license their radioactive materials.[64] On the other hand, the Committee was told that there have been long standing difficulties in the application of the Western Australian *Radiation Safety Act 1975-81* on Commonwealth sites even though Western Australians are employed at those sites.[65]

2.72 Several pieces of Commonwealth legislation go a little way to filling the gap, but the results are 'ad hoc'.

Environment Protection (Nuclear Codes) Act 1978

2.73 Regulations under this Act may provide that a State law equivalent to a code promulgated under this Act will apply to Commonwealth places (section 11). However, no such regulations have ever been made under this provision.

Australian Nuclear Science and Technology Organisation Act 1987

2.74 The Act establishes a Safety Review Committee to oversee the safety of ANSTO's activities (section 26). The Committee may advise the Minister or ANSTO but has no powers of enforcement. Its members are appointed by the Minister, and the majority must not be employees of ANSTO.

63 Burns, Transcript of Evidence, p. 113

64 Hartley, Submission No. 24, p. 3

65 Hutchinson, Transcript of Evidence, p. 378

2.75 The Act establishes the Nuclear Safety Bureau, reporting to the Minister for Health and Family Services, to monitor the safety of ANSTO's nuclear reactor (section 37). The Bureau can impose conditions on the operation of ANSTO's reactor and provides technical advice to the Commonwealth on other nuclear matters. There are no restrictions on staffing for the Bureau comparable with those that apply to the Safety Review Committee to ensure that the Bureau is kept at arm's length from ANSTO. It should also be noted that a large proportion of ANSTO's waste comes from production of radiopharmaceuticals, which is not subject to the Bureau's control.[66]

The Environment Protection (Impact of Proposals) Act 1974

2.76 This Act aims to ensure that environmental matters are considered in Commonwealth decision making. A Commonwealth minister or authority proposing an action which, in his/its opinion, might affect the environment 'to a significant extent', must 'designate' the proposal, and bring it within the scope of the Act.

2.77 The Minister for the Environment may then direct the designated proponent to prepare a Public Environment Report (PER) or, in more significant cases, a more comprehensive Environmental Impact Statement (EIS). The Minister for the Environment may then make comments or recommendations, which the action Minister/authority must then take into account.

2.78 Significantly, a proposed 'action' includes administrative decisions or recommendations. Thus, though the Act does not directly affect the rights or duties of anyone other than Commonwealth ministers and authorities, it may affect other people indirectly. For example, the recommendations of an EIS may influence a Commonwealth's authority's decision on a private company's license application.

2.79 This scheme raises two issues. First, whether a proposal is sufficiently significant to justify triggering the Act's procedures is left to the discretion of the Minister responsible for the proposal, not the Minister for the Environment. Similarly at the next level, even if the procedures are triggered, there may be dispute over what level of environmental assessment is warranted. For example, the Minister for the Environment decided that neither an EIS nor a PER was required for movement of Fishermens Bend soil from Lucas Heights to Woomera nor the relocation of the Australian Defence Industries radioactive

66 Allen, Transcript of Evidence, p. 108

waste from St Marys to Woomera in 1994 and 1995 respectively.[67] On the other hand, a PER was prepared on the proposal to ship spent fuel rods from Lucas Heights to the United States and the United Kingdom for reprocessing.[68]

2.80 Secondly, even if a proposal is 'designated' under the Act and an EIS prepared, the Minister for the Environment has no power of veto. Neither authorities or ministers directly responsible are bound by the recommendations of the Minister for the Environment: they must merely 'take them into account'.[69]

2.81 The Committee notes that these issues, which go far beyond the issue of radioactive waste may be addressed during the current review of the Act.

Commonwealth Places (Applications of Laws) Act 1970

2.82 This Act provides that, in principle, State laws apply to Commonwealth places. However there are significant exceptions (subsections 4(2-3)) which involve complex Constitutional legal issues. The result is the application of this Act in a particular case may be uncertain.[70]

The Proposed Australian Institute of Radiation Protection

2.83 International standards require that use of radioactive materials should be controlled by an independent regulatory body with legal powers of enforcement.

> Essential parts of the national infrastructure are: legislation and regulations; a regulatory authority empowered to authorise and inspect regulated activities and to enforce the legislation and regulations; sufficient resources; and adequate numbers of trained personnel.[71]
>
> Separation of the regulatory function, including enforcement, from the operating function is required ... This separation will permit independent review and overseeing of radioactive waste

67 Commonwealth Environment Protection Agency, Supplementary Submission No. 46a, p. 1

68 The Public Environment Report was advertised for public comment in November 1995 and the Minister for the Environment provided his consequent advice to the Minister for Industry, Science and Technology by letter dated 22 December 1995.

69 *Environment Protection (Impact of Proposals) Act 1974,* section 8

70 See Senate Standing Committee on Legal and Constitutional Affairs, *The Doctrine of the Shield of the Crown*, December 1992.

71 International Atomic Energy Agency (1994) *International Basic Safety Standards for Protection Against Radiation,* IAEA, Vienna, p. 7

> management activities. The legal framework should specify the way in which separation of the functions is achieved.[72]

In Australia, at the Commonwealth level, these standards have not yet been met.

2.84 The Commonwealth Government proposes to create an Australian Institute of Radiation Protection (AIRP) by combining the Nuclear Safety Bureau[73] and the Australian Radiation Laboratory.[74] This proposal would also abolish the Australian Ionising Radiation Advisory Council and absorb its functions in the AIRP. The AIRP will have the additional function of regulating and licensing Commonwealth activities and places involving radiation:

> The Commonwealth will have the power to impose penalties in the case of breaches of operating licenses issued by the AIRP, except that where it finds an occupational radiation health infringement, the Institute will be required to advise Comcare on the bringing of proceedings under the *Occupational Health and Safety (Commonwealth Employment) Act 1991*.[75]

An Independent Regulator

2.85 The Committee strongly supports the proposal for an independent regulator of Commonwealth bodies' radiation activities, with functions of regulating, licensing, monitoring and imposing penalties for breaches of licenses. An independent regulator is required by international standards, and would go some way towards meeting the concerns of many witnesses at this inquiry.

2.86 However, some concerns were raised in the inquiry over whether, under the scheme now proposed, the AIRP will be a truly independent regulator. There are three main concerns.

2.87 First, it is unclear whether it is proposed that the AIRP will itself have substantive 'operating functions' as well as regulatory functions. The Australian Radiation Laboratory's present structure allows it to charge for

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72 International Atomic Energy Agency (1994) *Safety Fundamentals - the Principles of Radioactive Waste Management - Safety Series No. 111-F*, p. 9

73 The Nuclear Safety Bureau is a statutory authority which oversees the safety of ANSTO's reactor.

74 The Australian Radiation Laboratory is part of the Department of Health and Family Services, with functions of research and advice.

75 Australian Radiation Laboratory, Supplementary Submission No. 21b, p. 1

services;[76] in its advice role it might be seen as being in competition with ANSTO, particularly if giving advice became a commercial activity. Sutherland Shire Council commented:

> [The Australian Radiation Laboratory] have had commercial interaction with the nuclear industry by way of selling safety processes, intellectual capabilities and so on ... some of the long lived waste that we are talking about here probably passed through the ownership of ARL ... You cannot expect public confidence to occur unless there is a *de novo* independent process set up.[77]

2.88 The Committee shares this concern about the possible conflict of interest if the Australian Radiation Laboratory, as now constituted, simply becomes 'part of' the AIRP. The principle of separation of the regulator from the industry requires that the regulator should be *only* a regulator. The functions of AIRP should reflect this.

Recommendation 1

The Committee recommends that in order to conform with international standards on separating the regulatory body from the regulated industry, the Australian Institute of Radiation Protection as proposed regulator should have no substantive operational functions or commercial activities in nuclear science.

2.89 Secondly, there was a concern that locating the AIRP in the Health and Family Services portfolio raises a possible conflict of interest, in that this Department also has an obvious interest in the use of radiopharmaceuticals. It is conceivable that radiation safety controls might come into conflict with the aim of keeping radiopharmaceuticals cheap and accessible. It was suggested that the proposed AIRP should be in the Environment portfolio.[78]

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76 *Australian Radiation Laboratory Order*, Commonwealth Gazette 7 October 1987, p. 1360

77 Smith, Transcript of Evidence, p. 577

78 Sutherland Shire Council, Submission No. 20, p. 27

2.90 The previous Government proposed that the AIRP would be part of the Health and Family Services portfolio to ensure legal separation from ANSTO, which is in the Industry, Science and Tourism portfolio.[79] There is an argument that 'public health' as a concept covers the field of radiation control more aptly than 'environmental protection'. The storage of radioactive materials is an obvious public health issue requiring monitoring although, providing the store is securely sealed, it may be argued whether it is an 'environmental' issue properly defined. Most State and Territory radiation safety regulators sit in Health portfolios. On the other hand ANSTO, a Commonwealth statutory authority, produces 85 per cent of Australia's radiopharmaceuticals, so there is real potential for conflict of interest within the Health portfolio - a conflict that does not arise at State level. This issue needs to be further considered.

Recommendation 2

The Committee recommends that the Minister responsible for the proposed Australian Institute of Radiation Protection be required to act to ensure that the administrative arrangements avoid conflicts of interest.

2.91 Thirdly, there was concern over how truly independent a regulatory body will be in what is a small specialised field where the staff of the regulator may often be moving to or from the 'regulatee'. Sutherland Shire Council claimed:

> There is no nuclear physicist or chemist in Australia who has not been, at one stage, either an employee of ANSTO or dependent on ANSTO's largesse ... The concern we would have is that there would be a revolving door for people who join the regulatory agency, leave it and have only one source of employment, directly or indirectly - the industry they have regulated.[80]

79 Ibid, p. 1

80 Robertson, Transcript of Evidence, p. 574,576

2.92 Sutherland Shire Council pointed to what it called a historic lack of independence between ANSTO and the Nuclear Safety Bureau.[81] On this issue the 1993 Research Reactor Review commented:

> Perceptions of potential conflicts of interest of staff of the NSB, arising from secondment ex-ANSTO and the somewhat limited career structure for specialist staff, are well based.[82]

2.93 It is feared that the role of ANSTO in funding research would also be a significant lever - particularly because of the trend towards commercialisation of university research in recent years:

> ... there are a significant minority of scientists who, because of the recent steps towards commercialisation of basic research in tertiary institutions, feel - whatever the truth of the matter is - that if they assisted someone who was seen to be an opponent of the industry that would prejudice them in their future life.[83]

2.94 The risk of regulators becoming too close to the industry they are regulating is, of course, not unique to nuclear science. However in the present case the concern does have some extra force in that the regulator and the regulated industry will both be parts of the Commonwealth government - contrasting with the more usual situation of a government body regulating the private sector. Given this, and given that nuclear science is a small specialised field, the Committee cannot suggest any easy solution to the problem. But it is essential to acknowledge the risk and to structure the AIRP to pre-empt that risk as far as possible. Sutherland Shire Council suggested:

> There are mechanisms for coping with this problem by banning for a certain number of years employment in the industry you have been regulating and they work reasonably well in other countries.[84]

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81 Sutherland Shire Council, Submission No. 20, p. 26

82 Research Reactor Review (1993) *Future Reaction - Report of the Research Reactor Review*, August 1993, p. 230

83 Robertson, Transcript of Evidence, p. 576-7

84 Ibid, p. 576

Recommendation 3

The Committee recommends that the Government should structure the proposed Australian Institute of Radiation Protection to maintain an arm's length relationship with the industry as far as possible having regard to international best practice, and the industry be required to provide the information the regulator needs to perform its functions.

Community Participation

2.95 Principle 10 of the Declaration on Environment and Development 1992 (known as the Rio Declaration) states that:

> Environmental issues are best handled with the participation of all concerned citizens at the relevant level. At the national level, each individual shall have appropriate access to information concerning the environment that is held by public authorities, including information on hazardous materials and activities in their communities, and the opportunity to participate in decision-making processes. States shall facilitate and encourage public awareness and participation by making information widely available. Effective access to judicial and administrative proceedings, including redress and remedy shall be provided.

2.96 This raises three questions:

- How is the community involved in framing proposed new systems?
- How is the community involved, by way of appropriate representation and access to information, in administering new systems on an on-going basis?
- Who has the right to take action in court to restrain a breach of the law?

2.97 On the development of the AIRP proposal, there has been no proposal advertised for public comment, although State authorities have been consulted:

> We called together representatives from each state health authority and affected Commonwealth departments to have a sort of show and tell at the Australian Radiation Laboratory, where we outlined what the proposal was and what the nature of the combined organisation would be and how its national committee - like our radiation health committee - would assist and so on.[85]

A State representative characterised this as 'being kept informed of progress'.[86]

2.98 In relation to ongoing community representation on the AIRP, the Committee was told that the AIRP Board and working committees will include 'suitable scientific and public interest representations'.[87] It was argued there should also be representation from communities near the existing ANSTO site, any future research reactor site or national repository site, the Australian conservation movement and consumer organisations.[88]

2.99 The Committee believes that appropriate representation *and* public access to relevant information are necessary. The public's right of access to information should be affirmed in principle, although, of course, national security considerations might raise the need for some exceptions in practice.

Recommendation 4

The Committee recommends that the proposed Australian Institute of Radiation Protection structure should include appropriate community representation.

2.100 The third question raised above was, 'who has the right to take action in court to restrain a breach of the law?' The facility for interested persons to take court action against administrative decisions by government is a matter of civil

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85 Lokan, Transcript of Evidence, p. 109

86 Colgan, Transcript of Evidence, p. 415

87 Australian Radiation Laboratory, Supplementary Submission No. 21b, p. 1

88 Rankin, Transcript of Evidence, p. 539; Queensland Greens, Submission No. 15, p. 5; Sutherland Shire Council, Submission No. 20, p. 23

may help maintain the diligence of administrative decision makers, which is the basis for comments such as:

> there is no third party and no community right to enforce and supervise the regulatory process proposed at a federal level... There will be no right on the part of the community to go to the courts for an independent, unbiased, third-party review of regulatory decisions.[89]

2.101 This is particularly relevant to environmental matters (by contrast with matters involving private rights) because in environmental matters it is common that there is *no* individual with a close enough private 'interest', according to traditional legal definitions, to have the right to take action.

2.102 In general, the scope of those whom courts regard as having a close enough interest to have the right to take action on environmental matters has broadened over the years. Some Acts of Parliament also make explicit provision to the effect that 'any person may take action to restrain a breach of the Act'.[90] The Committee supports this principle. In the case of the proposed AIRP this approach is warranted not least to foster trust in the new scheme and to allay the concerns as to whether in practice the AIRP can be truly independent.

Recommendation 5

The Committee recommends that the proposed Australian Institute of Radiation Protection legislation should include a provision to the effect that 'any person may take action in court to restrain a breach of this Act'.

89 Rankin, Transcript of Evidence, p. 544

90 For example, the New South Wales *Environmental Planning and Assessment Act 1979,* section 123

A National Approach

2.103 The above discussion of the structure of the AIRP, its powers and independence, leaves open the question of *what* regulations it will be administering. The Committee considers that the details should reflect a consistent, nationally agreed scheme, devised by the Commonwealth and the States/Territories as equal partners.

2.104 Present State laws, though different in detail, have similar outcomes, and most of their differences probably reflect historical accidents rather than significant differences of opinion. Many witnesses at the Inquiry expressed a desire for greater national co-ordination, and this should be achievable.

2.105 The hospitals asked for:

> a national uniform approach to storing, handling and moving radioactive waste so that we all work by the same set of rules and there are no conflicts between various arms.[91]

2.106 Another examples of anomalies that can arise is:

> Because the activity of Americium [241] [in smoke detectors] is less that 40 Kbq [kilobecquerels] this quantity is exempt from the licensing provision of the [New South Wales] *Radiation Control Act* [1990]. However, wholesalers who sell smoke detectors are licensed by the NSW EPA [Environment Protection Authority].... [but] it is quite possible for detectors to be imported by wholesalers in other states and then sold to retailers which the EPA does not control.[92]

2.107 If nationally consistent regulations could be introduced simultaneously, it would prevent behaviour exploiting commercial advantage in states with different standards. The revision of the national codes in the light of ICRP 60 recommendations provides an excellent opportunity to implement nationally consistent regulations.

2.108 The previous section, discussing the structure of the AIRP, has assumed it will be a *Commonwealth* body - that is, a body set up under Commonwealth law, which will include State and community representation in a form yet to be finalised but subject to the Commonwealth's decision. The Committee accepts this scheme for the *regulatory* body because of the 'national security'

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91 Collins, Transcript of Evidence, p. 752

92 New South Wales Environment Protection Authority, Submission No. 45, p. 3-4

argument. ANSTO (for example) has functions that the Commonwealth could not allow to be put under the control of State governments or local councils. Accordingly the AIRP, in its role as regulator licensing particular activities of bodies such as ANSTO and Defence, must be a Commonwealth body.

2.109 The function of co-ordinating national standards in regulations - including the regulations which the AIRP will administer - is a rather different one, and it is here that a full degree of State and community participation is necessary. It was suggested that:

> Amalgamation of Commonwealth bodies into a single organisation is not likely to serve the needs of the states significantly better than is the case at present. The States need to play a significant role in policy formulation, direction and priority setting.[93]

2.110 This 'significant role' is primarily a matter of genuine consultation and co-operation at the administrative level - the Committee does not recommend detailed mechanisms here. It is not essential for all jurisdictions to have identical administrative details. Different administrative frameworks may prevent this. However, the outcomes of regulation should be compatible. The Committee believes that co-operative actions in setting national standards must be seen as completely distinct from the AIRP's unilateral role as a Commonwealth decision-maker on individual Commonwealth cases. Commonwealth regulations should conform to the nationally agreed scheme.

2.111 If the Commonwealth wishes to take leadership role in co-ordinating a national scheme, its initiatives must be timely. In this regard the Committee notes that revised international basic standards for radiation exposure published in 1991 (ICRP 60) were incorporated into the New South Wales *Radiation Control Regulation* in 1993,[94] but not reflected in new national standards until 1995.[95] The Committee is concerned at the time it has taken to produce new national standards, since delays may encourage individual States to 'go it alone', making it more difficult to achieve a nationally agreed system.

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93 Hartley B (1993) 'A National Institute of Radiation Protection and Nuclear Safety' *Radiation Protection in Australia*, 11 (1):3-7, p. 3

94 Smart, Transcript of Evidence, p. 772

95 National Health and Medical Research Council, *Recommendations for Limiting Exposure to Ionising Radiation (1995) and National Standard for Limiting Occupational Exposure to Ionising Radiation*

Recommendation 6

The Committee recommends that the Government review current procedures for developing national guidelines to ensure that they are prepared in a more timely manner.

Recommendation 7

The Committee recommends that the Commonwealth together with the States and Territories should act to expedite revision of national codes and development of a nationally agreed regulatory scheme.

Recommendation 8

The Committee recommends that Commonwealth regulation of Commonwealth bodies under the proposed Australian Institute of Radiation Protection legislation should conform to a nationally agreed scheme.

Compliance and Enforcement of Regulations

2.112 Some witnesses felt that the level of compliance and enforcement of radiation safety regulations is less than satisfactory. For example:

> the incentives for compliance are too few, and the penalties for non-compliance too rarely applied. With financial and

> productivity-related pressures steadily increasing, there is the risk that work practices will become less stringent.[96]

2.113 According to Townsville General Hospital:

> ... the wording and application of *the Queensland Radioactive Substances Act (1958* & 1978) to be ambiguous in parts, unclear in others and at times irrelevant. The administration of the act is largely left to the user, which may not be a bad thing if the act itself was not so ambiguous. There seems to be a genuine lack of commitment or understanding of the act by those officers whose primary function is to enforce and advise on this act. A lack of communication from these officers to the practitioners in the field is clearly present. In addition, it would appear that a surfeit of red tape and administrative requirements is severely hampering [t]he effectiveness of the application of this act.[97]

2.114 The threat to efficient compliance if the law is too complicated or has no Plain English guidelines was mentioned in paragraph 2.25 in connection with the national codes.

2.115 As well as the need for adequate resources for monitoring and enforcement in known situations, there is a potential problem with radiation sources of which the authorities were not aware:

> There are a lot of sealed, long-lived sources around which somebody can buy, and that is it. They vanish, and they could end up anywhere.[98]

2.116 In Western Australia an industrial radiation source was sold to a scrap metal dealer in Singapore after a mine had been decommissioned.[99] One waste contractor in New South Wales employs science graduates with radiation training as truck drivers because:

> many institutions actually submit waste for disposal which exceeds the threshold level and is therefore technically radioactive.[100]

2.117 Some States now have a system of registering all radiation sources.[101] The New South Wales Environment Protection Authority registers all fixed

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96 Royal Alexandra Hospital for Children, Submission No. 5, p. 3

97 Townsville General Hospital, Submission No. 62, p. 2

98 Collins, Transcript of Evidence, p. 763

99 Wong, Transcript of Evidence, p. 746-747

100 Ibid, p. 743

radiation gauges, which are inspected every two years.[102] Of particular concern to the Committee are comments made by the Queensland Department of Health:

> in the public interest, we have to be able to deal with illegal possessions. We have, as I say, a radiation surveillance program, but it is not as large as we would like ... Of course, establishing those informal links through other regulatory authorities, suppliers and all of that enables you to become aware of the situation ... we do hear about things that are going on in the industry ... It is unusual for something to slip through the whole system totally undetected, but it is not impossible.[103]

2.118 In New South Wales there are problems with the legal coverage in that radiation sources must be registered, but once considered waste, no longer have to be registered.[104] This is an example of the type of anomaly with which a nationally agreed scheme of regulation might deal.

2.119 A related matter is control of imports to Australia. Under the *Customs Act 1901* importation of radioactive materials requires a license; licenses are issued by the Australian Radiation Laboratory as delegate of the Australian Customs Service, and after consultation with State authorities. There was a concern that some materials, though legally declared to Customs, might not be recognised as radioactive by Customs officers; and once off the wharf they might disappear from the view of the State authorities who license possession and use.

> There are mechanisms by virtue of customs prohibited imports. While that does catch most of them, the fact is that things turn up from time to time that do not seem to have been caught by that net...[105]

2.120 For example, the Queensland Criminal Justice Commission discovered some stored X-Ray equipment in a disused Gold Coast shopping centre which had been imported from the United States. A Faxitron Radiographic Inspection System was confiscated by the Queensland Health Department because the owner did not have a license. Initially a TI-204 Thickness Gauge Probe was

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101 Collins, Transcript of Evidence, p. 763

102 Samuel, Transcript of Evidence, p. 389

103 Wallace, Transcript of Evidence, p. 719-720

104 Towson, Transcript of Evidence, p. 763

105 Wallace, Transcript of Evidence, p. 720

also seized but was later returned as it did not constitute a breach of the relevant State Act.

2.121 There is a need for better procedures in Customs to recognise radioactive materials, and for better co-ordination between Customs and State authorities so that materials are detected and once recognised, remain in view of State authorities.

Recommendation 9

The Committee recommends that the Australian Customs Service should consult with the Australian Radiation Laboratory and the State and Territory radiation authorities to develop better procedures for recognising radioactive imports and for co-ordinating licensing procedures.

Conclusions

2.122 The underlying theme of this chapter is consultation and co-ordination between Commonwealth and States/Territories - on national codes; on compatible regulations; on licenses to import and licenses to use. A nationally agreed scheme of regulation applying to Commonwealth bodies in the same way as it applies to other people would help allay public concerns about the 'regulatory gap' and would enhance confidence in the independence of the proposed Australian Institute of Radiation Protection.

2.123 Although, for national security reasons, the Commonwealth cannot be expected to put its radiation activities directly under the control of State authorities, it is important that they should be under the control of an independent Commonwealth body administering regulations that conform to an agreed national scheme. The regulator and the 'industry' will both be Commonwealth bodies. There will therefore need to be special care in designing the regulatory scheme so that the regulator is genuinely independent, and is seen to be independent, having regard to international best practice.

2.124 The Commonwealth regulator's unilateral role in making administrative decisions on the activities of Commonwealth bodies must be seen as completely distinct from the Commonwealth's co-operative role in achieving a nationally agreed regulatory scheme. In this the Commonwealth and the States must be equal partners. Now is an appropriate time to move towards a nationally agreed scheme because of the need to review standards in the light of the new international standards of ICRP 60 and the RADWASS program. If the Commonwealth wishes to take a role as facilitator in co-ordinating a national scheme, its initiatives must be timely, to pre-empt the situation in which one State decides to 'go it alone' while waiting for national standards to emerge.

CHAPTER 3

EXISTING QUANTITIES AND FUTURE CREATION OF RADIOACTIVE WASTE

3.1 In Australia radioactive waste generated through medical, industrial and research uses of radioactive sources is a relatively small amount compared with that produced in mining and milling operations. Australia does not have a nuclear power industry or nuclear weapons, which generate substantial amounts of waste in some other countries.

3.2 Australia's only nuclear reactor, HIFAR, produces radioactive neutrons for investigative purposes in science, medicine and industry. HIFAR currently produces about 85 per cent of the radioisotopes and radiopharmaceuticals used in Australia.[1] Radioisotopes can also be produced in cyclotrons and there are currently two operating in Australia. Radioisotopes are used to diagnose and treat illnesses such as cancer, and to sterilise medical products and instruments.

3.3 Isotopes are also used in industry to check structures for cracks, to gauge the thickness of materials, for checking oil and gas pipelines, for insect and pollutant control and for smoke detectors. The long term management of the radioactive waste from these types of activities needs to be addressed.

Sources of Radioactive Waste

Australian Nuclear Science and Technology Organisation

3.4 The production of radiochemicals and radiopharmaceuticals accounts by volume for more than 90 per cent of all liquid radioactive waste and more than 70 per cent of all solid radioactive waste produced at the ANSTO site.[2]

3.5 Currently there are 4200 drums of low level solid waste in storage at ANSTO's Lucas Heights property.[3] The total accumulated volume of liquid intermediate waste is six cubic metres with an annual accumulation rate of 300 litres.[4] There are also 200 cubic metres of intermediate level solid waste

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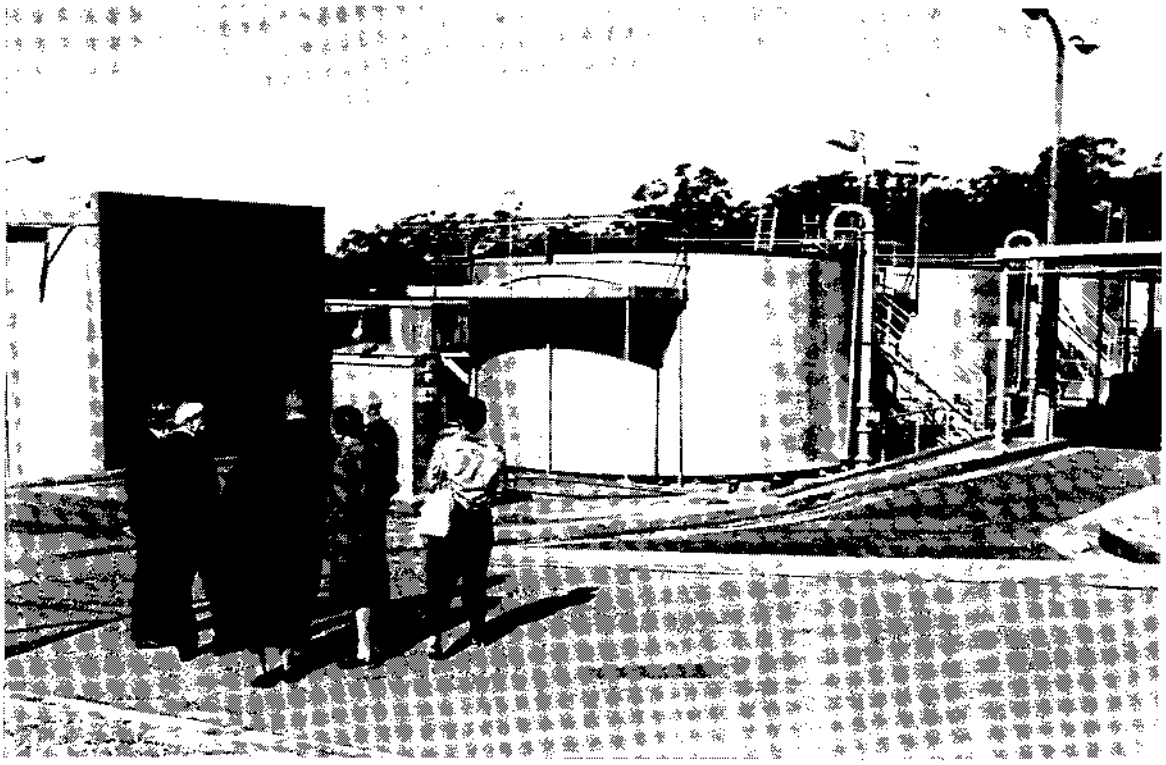
1 Australian Nuclear Science & Technology Organisation, Supplementary Submission No. 32b, p. 3

2 Jostsons, Transcript of Evidence, p. 57

3 Australian Nuclear Science & Technology Organisation, Submission No. 32, p.3-4

4 Ibid, p. 5

increasing by about seven cubic metres per year, and in May 1991 there were 1661 spent fuel elements in storage, increasing by about 36 rods per year.[5]



The Committee inspecting the low level liquid waste treatment plant at Lucas heights (Photograph provided by ANSTO)

3.6 The Committee was told that:

> Ironically, the biggest Governmental producer of radioactive waste in Australia - ANSTO - has recently switched its HIFAR reactor to a Technecium-99m (T-99m) production method that has actually increased the amount of radioactive waste created. This was done because the "dirtier" method was cheaper, as ANSTO conceded to Greenpeace in 1993.[6]

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5 Australian Nuclear Science & Technology Organisation, Submission No. 32, p. 5,7

6 Greenpeace, Submission No. 48, p. 3

3.7 Greenpeace considers the research reactor spent fuel rods to be high level radioactive waste although ANSTO disputes this.[7] ANSTO argues that research reactor spent fuel rods are not 'waste' because they can be reprocessed. ANSTO points out that they differ from fuel rods used in power reactors and are not high level radioactive material.[8] The Committee considers this debate to be academic in relation to this Inquiry and that correct management of these fuel rods is the issue. ANSTO points out that:

> The presence of aluminium influences the eventual conditioning of the spent fuel and the high level of uranium enrichment in research reactor fuel poses particular safeguards and criticality problems for the disposal of such fuel.[9]

Other Commonwealth Bodies

3.8 CSIRO produces radioactive waste through biological experiments and other experiments such as the beneficiation of ore experiments and sealed sources from analysis and measurements.[10] The CSIRO waste from Fishermens Bend at Woomera is slightly contaminated soil which is stored in 9726 drums of 207 litre capacity.[11]

3.9 The annual amounts of radioactive waste generated by the Department of Defence are minor amounts of radioactive waste, mostly comprise equipment containing radioluminescent material or tritium gas and waste from the research activities of the Defence Science and Technology Organisation.[12] Sources from Amersham International in the United Kingdom can be returned to the company.[13]

3.10 The Australian Defence Industries material from St Marys now stored at Woomera, is approximately half low level material and about half intermediate level waste.[14] This material originated from sources within the Commonwealth and State and Territory governments, universities, hospitals and from medical

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7 Pearson, Transcript of Evidence, p. 453; Australian Nuclear Science & Technology Organisation, Submission No. 32, p. 6

8 Australian Nuclear Science & Technology Organisation, Submission No. 32, p. 6

9 Ibid, p. 6

10 CSIRO, Submission No. 25, p. 3

11 Blewitt, Transcript of Evidence, p. 85; Blewitt, Correspondence, 26 July 1995, p. 1

12 Department of Defence, Submission No. 33, p. 1

13 Ibid, p. 1

14 Curtis, Transcript of Evidence, p. 116

practitioners. The Department of Defence accepted responsibility because of the wide range of sources.[15] About half of this waste, in terms of radioactivity, is cobalt^{60}.

Medical Sources

3.11 The four types of radioactive waste generated in significant quantities in medicine are unused radiopharmaceuticals; used sealed sources; contaminated equipment or other materials such as syringes and bed-linen; and bodily excretions of patients following diagnostic or therapeutic procedures.[16] The first three categories produce approximately 30 per cent of the waste while the fourth category produces the remaining 70 per cent.[17]

3.12 Radioactive isotopes used for diagnostic purposes usually have short half lives and the quantities are small. The short lived waste is disposed of in the normal waste stream after storing for a short period to allow it to decay. It was suggested that all isotopes should be stored without any disposal to sewer, but this has not occurred.[18] Patients' excrement is dealt with as short lived waste.

3.13 Sources with higher activity used for therapeutic purposes are generally not suitable for immediate disposal.[19] These sources are surplus to hospital needs but require longer term storage. For example, St Vincent's Hospital Sydney Ltd has a number of caesium^{137} tube sources from an obsolete technique.[20]

3.14 Teaching hospitals, in particular, generate radioactive waste which is difficult to deal with because it is in toxic or flammable liquids.[21] The Committee was told that many hospitals have conducted waste audits in order to reduce the volumes of radioactive waste being generated and to look at issues such as the management of radioactive putrescent materials.

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15 Curtis, Transcript of Evidence, p. 119

16 Australian & New Zealand Society of Nuclear Medicine, Submission No. 68, p. 1

17 Ibid, p. 1

18 Hanlon, Transcript of Evidence, p. 421

19 Australian Radiation Laboratory, Submission No. 21, p. 1

20 St Vincent's Hospital Sydney Ltd, Submission No. 59, p. 2

21 Collins, Transcript of Evidence, pp. 751-752

Industrial Sources

3.15 A number of companies are currently storing radioactive materials pending a decision on a national repository site. Penrice Soda Products Pty Ltd store obsolete sealed radioactive sources on site as the cost of disposal overseas is considered prohibitive.[22] Coca Cola Amatil has a radiation gauge which was taken out of service in 1986.[23] BHP have eighty radioactive sources, mainly cobalt^{60} or caesium^{137}, and would be interested in disposing of twelve in a national repository.[24] Other industrial sources include compasses used by geologists which contain tritium,[25] and radioactive sources used to detect water levels in bore holes.[26] Roads authorities also use radioactive sources routinely for the quality control in manufacturing road beds.[27]

3.16 About 400 000 tonnes per year of radioactive waste is produced from six mineral processing operations in Western Australia, and this material is stock piled on site awaiting further treatment at a processing plant.[28] The cost of transporting mineral sand tailings to a national repository is generally considered by the industry to be prohibitive unless it is in close proximity to the mine site.[29] Some members of the Committee believe that proper waste disposal should be included as part of the cost of production and if this makes the proposal economically unviable then it should not proceed.

Future Generation of Radioactive Waste

3.17 In 1986 there were estimated to be a national total of 960 cubic metres of radioactive waste in Australia requiring storage or disposal, with an annual increase of 50 cubic metres.[30] Since then some States have significantly reduced the volume of the waste held. However there are a number of special cases where particularly large volumes of waste might be produced in the foreseeable future. These include the decommissioning of ANSTO's HIFAR

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22 Penrice Soda Products Pty Ltd, Submission No. 55, pp. 1-2

23 Coca Cola Amatil (SA) Ltd, Submission No. 56, p.1

24 BHP Steel, Submission No. 58, p. 1

25 Peebles, Transcript of Evidence, p. 836

26 Paix, Transcript of Evidence, p. 226

27 Ibid, p. 226

28 Hewson, Transcript of Evidence, p. 235-236

29 Rawson, Transcript of Evidence, p. 42

30 Department of Primary Industries and Energy, Submission No. 28, p. 4

reactor and future reactors, an increase in the amount of waste produced by replacing the existing research reactor with one of greater capacity, residue from reprocessing spent fuel rods, the proposed Rhone Poulenc rare earth project in Western Australia and other similar proposals, and the large numbers of smoke detectors entering the market.

3.18 The Fishermens Bend contaminated soil currently in storage at Woomera and Maralinga former atomic bomb test site still need to be dealt with. CSIRO is currently considering the possible clean up a number of sites where some radioactive material may have been buried. These sites include O'Hallorans Hill in Adelaide and sites in Queensland at Longpocket and Sandford.[31] The Department of Defence has retrieved some radioactive materials previously buried at Salisbury in South Australia.[32] These materials, once recovered, may be considered as additional quantities of radioactive waste to be managed.

3.19 The Committee believes that these large quantities must be considered in developing a national strategy to deal with radioactive wastes.

Australian Nuclear Science and Technology Organisation

3.20 Future waste generated from ANSTO can be separated into five major categories: waste produced during operation of the reactor and production of radiopharmaceuticals; residue from the reprocessing of the fuel rods and any fuel rods not returned to the country of origin; waste from decommissioning the existing and future reactors; emissions to air and sewer; and possible remediation of the Little Forest Burial Ground.

3.21 About 90 per cent of Australia's annual generation of radioactive waste other than that from mining and milling are created at Lucas Heights.[33] Compacted low level waste increases about 30-40 cubic metres, intermediate level solid waste about two cubic metres and intermediate level liquid waste about 0.3 cubic metres per year.[34]

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31 Smiles, Transcript of Evidence, p. 91; Harley, Transcript of Evidence, p. 91

32 Department of Defence, Supplementary Submission No. 33a, p. 1

33 Davoren, Transcript of Evidence, p. 35

34 Rolland, Transcript of Evidence, p. 74

1. Waste from the Research Reactor Operations

3.22 The amount of radioactive waste produced at ANSTO is directly proportional to the demand for medical isotopes.[35] Greenpeace is concerned that a new research reactor could allow an increase in production of radiopharmaceuticals resulting in a three to four fold increase in waste created at that site.[36]

2. Reprocessing of Spent Fuel Rods

3.23 ANSTO intends to return the spent fuel rods from the HIFAR reactor to the United Kingdom and the United States. The residue from reprocessing spent fuel rods in the United Kingdom will be returned to Australia for storage: an estimated 340 cubic metres (670 concrete filled 500 litre drums) of intermediate level waste.[37]

3.24 The return of the spent fuel rods to the United States will not require that Australia take back the waste from reprocessing. Some consider that this waste is Australia's responsibility and Greenpeace has opposed this option and the Research Reactor Review stated that:

> exporting an Australian problem is morally dubious.[38]

3. Decommissioning of Reactors

3.25 The 1993 Research Reactor Review recommended that a decision on a new neutron source should be made in five years but the issue of waste management should be settled before then.[39] It is estimated that the decommissioning of the existing HIFAR reactor will generate five cubic metres of intermediate level waste and 500 cubic metres of low level waste initially.[40] After the 20 years cooling off period there would be a further few hundred tonnes of radioactive structural materials which would be mostly low level

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35 Bull, Transcript of Evidence, p. 72

36 Greenpeace, Submission No. 48, p. 5

37 Nuclear Safety Bureau, Submission No. 31, p. 2

38 Research Reactor Review *Future Reaction, Report of the Research Reactor Review*, August 1993, pp. 209, 212

39 Ibid, p. 216

40 Nuclear Safety Bureau, Submission No. 31, p. 2

waste.[41] The issue of dealing with the decommissioning of future reactors should also be considered prior to the approval of a replacement reactor.

3.26 The shutdown of the Moata reactor prior to decommissioning has left 177 irradiated fuel plates in storage.[42] The decommissioning phase will also generate waste which will need to be managed.

4. Emissions to Air and Sewers

3.27 ANSTO currently produces considerable amounts of iodine[131] and tritium, which concerns the Sutherland community.[43] ANSTO told the Committee that it would be looking at replacement reactors which would reduce environmental emissions significantly.[44]

5. Remediation of the Little Forest Burial Ground

3.28 Approximately 1700 cubic metres of low level waste, and possibly some intermediate and high level waste, was buried at the Little Forest Burial Ground between 1960 and 1968.[45] To date there has been:

> no detectable immediate health risk, however the site is contaminated and toxic, and a more detailed investigation has been recommended on the extent of movement of radioactive contaminants from the trenches and potential exposure pathways for near by residents.[46]

3.29 The Sutherland Shire Environment Centre told the Committee that plutonium had migrated to the surface in the Little Forest Burial Ground.[47] The Federal and State governments have decided to monitor the site and deal with any contaminants seeping from the site, although there are currently no long term plans to remediate the site.[48]

3.30 The Commonwealth Government is cleaning up other contaminated sites. These include Maralinga, Salisbury and O'Hallorans Hill in South Australia,

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41 Ibid, p. 2

42 Nuclear Safety Bureau, Submission No. 31, p. 2

43 Pearson, Transcript of Evidence, p. 453; Sutherland Shire Council, Submission No. 20, p. 8

44 Bull, Transcript of Evidence, p. 71

45 Sutherland Shire Council, Submission No. 20, p. 12-13

46 Ibid, p. 13

47 Ward, Transcript of Evidence, p. 594

48 Sutherland Shire Council, Submission No. 20, p. 13

Fishermens Bend in Victoria and Long Pocket and Sandford in Queensland. In the future the Commonwealth Government, may also have to remediate the Little Forest Burial Ground site. Any strategy plan for the management of radioactive waste in Australia must be able to accommodate this material if necessary.

Rhone Poulenc Rare Earth Project

3.31 The Rhone Poulenc rare earth processing project proposal in Western Australia will create 6 000 tonnes per year of radioactive waste containing up to 12 per cent thorium.[49] The thorium isotopes include thorium^{232} and thorium^{228} which have half lives of about 10 billion years and 1.9 years respectively.[50] The volume of radioactive material, indicates that the integrated health effects from exposure over time could be significant if the material is not managed appropriately.

3.32 The Rhone Poulenc proposal has been given an environmental assessment level of Environmental Review and Management Program, which is the highest level required in Western Australia under the *Environmental Protection Act 1994* (as amended).[51] As a foreign company Rhone Poulenc also requires approval by the Commonwealth Government's Foreign Investment Review Board. The potential for significant environmental effects resulted in a designation under the Commonwealth *Environment Protection (Impact of Proposals) Act 1974.*[52] The Commonwealth Environment Protection Agency is assessing the proposal in cooperation with the Western Australian Government.[53]

Smoke Detectors

3.33 As smoke detectors become routinely installed in domestic premises the question of their disposal becomes more pressing because of the sheer numbers involved. Smoke detectors contain americium^{241}; the limit of radioactivity is

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49 Hewson, Transcript of Evidence, p. 237

50 Ibid, p. 259

51 Schuster, Transcript of Evidence, p. 253

52 Commonwealth Environment Protection Agency, Supplementary Submission No. 46a, p. 2

53 Ibid, p. 2

now one microcurie[54], but in the past smoke detectors have contained much higher levels. Americium has a half life in excess of 400 years.[55]

3.34 The electronic component of smoke detectors lasts approximately ten years after which the smoke detector becomes unusable. The Committee was told that:

> Nowhere in the instructions of fire detectors or on the fire departments literature does it advise people about the safe disposal of smoke detectors and the difficulties associated with the incorrect disposal.[56]

3.35 The NSW Environment Protection Authority (EPA) is concerned at the large number of detectors entering the household rubbish system:

> the sheer numbers of these detectors presently entering the system is of concern and the public are becoming increasingly concerned about hazardous wastes entering the garbage stream.[57]

3.36 Last year approximately one million ionising smoke detectors were imported into New South Wales.[58] As the mandatory inclusion of smoke detectors in domestic premises becomes standard throughout Australia the number of ionising smoke detectors discarded annually in municipal rubbish tips will increase further.

3.37 The Radiation Health Committee of the NHMRC is looking at the potential problem resulting from the large volumes of smoke detectors which may occur.[59] The NSW EPA has proposed that a system be established for the recovery of domestic smoke detectors to return this material to the manufacturer.[60]

Other Future Waste Generation

3.38 The factors affecting future waste generation include changes in technologies, the commencement of new projects such as the Rhone Poulenc

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54 Hutchinson, Transcript of Evidence, p. 385

55 Samuel, Transcript of Evidence, p. 390

56 Queensland Greens, Submission No. 15, p. 3

57 NSW Environment Protection Authority, Submission No. 45, p. 3

58 Samuel, Transcript of Evidence, p. 390

59 Wallace, Transcript of Evidence, p. 724

60 Samuel, Transcript of Evidence, p 406

rare earth project, changes in future uranium contracts and the availability of disposal options. It was suggested that it would be impossible to predict future technological changes. For example, there would be more than 1000 soil moisture density gauges in Australia now whereas there were very few 15 years ago.[61]

3.39 It was pointed out that future uranium contracts may require the return of the waste products to Australia, and ways of dealing with this waste must be considered now in the design and capacity of a national facility.[62] It was argued that Australia should not provide uranium to the rest of the world without taking responsibility for the waste disposal.[63]

3.40 The Committee is concerned that the current international trend requiring the producer to take back the waste may require that Australia take back uranium waste if it wishes to continue uranium exports in the future. It is therefore essential that this be taken into account in the consideration of a national repository or storage facility.

Radioactive Waste Held in States and Territories

3.41 All States and Territories have some radioactive waste which they would prefer to send to a national facility. However the Northern Territory, Queensland, Victoria and Western Australia have now built new facilities which are capable of storing the waste for the immediate future.

3.42 The Queensland Government has established a purpose built facility at Esk which currently holds 219 devices containing radioactive sources. However, there are over 2000 radioactive sources in use in Queensland.[64]

3.43 The Victorian Government has recently built a new temporary storage facility, and has reduced the amount of material held by returning 80 curies of tritium exit signs to the United States and the United Kingdom and 4 curies of beta/gamma emitters to the original suppliers.[65]

3.44 The Western Australian Health Department has temporary storage facilities in Perth and in November 1992 dedicated a site at Mt Walton East for

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61 Wallace, Transcript of Evidence, p. 723

62 Dickinson, Transcript of Evidence, p. 200

63 Dickinson, Submission No. 1, p. 1; Women Opposing Uranium Mining, Submission No. 39, p. 6

64 Queensland Government, Submission No. 30, p. 1

65 Victorian Government, Submission No. 37, p. 3

shallow burial of suitable material. This site can also accommodate large quantities of waste from mineral processing.

3.45 In New South Wales there are approximately 100 cubic metres of radioactive waste stored in two repositories at Lidcombe, but this can be consolidated to approximately 30 cubic metres.[66] New South Wales accumulates approximately three cubic metres of unconsolidated waste and approximately one cubic metre of consolidated waste per year, some of which has an extremely long half life.[67]

3.46 From early 1978, the New South Wales Government attempted to move about 3000 tonnes of radioactive soil containing thorium and radium residues from Hunters Hill in Sydney to decontaminate six house blocks. Efforts to relocate the waste to a remote rural site at Manara (NSW) and South Australia were unsuccessful and this matter has not been resolved.

A National Inventory of Radioactive Waste

3.47 An inventory of radioactive waste was prepared by the Commonwealth-State Consultative Committee on radioactive waste which reported in February 1986. The Committee was told that although there has been some accumulation of waste since that time, the inventory is still a 'pretty accurate record'.[68] On the other hand, evidence presented to the Committee indicates that there have been significant changes to the national inventory since it was produced in 1986.

3.48 The Committee is concerned at the accuracy of the current inventory. One university has stored radioactive materials which it has not identified and others may have similar problems.[69] Other waste is improperly labelled and some containers were described as rusty and in poor condition, and resources would need to be committed to identify the waste before disposal.[70] There is a difficulty in defining waste in terms of volume: for example, the two cubic metres of waste collected in Western Australia over a period of 30 years became 44 cubic metres when it was conditioned and packaged for burial.[71]

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66 Samuel, Transcript of Evidence, p. 390

67 Ibid, p. 390

68 Rawson, Transcript of Evidence, p. 27

69 Hochman, Transcript of Evidence, p. 214

70 Paix, Transcript of Evidence, p. 216

71 Peebles, Transcript of Evidence, p. 843

The total volume of radioactive waste in Australia is given as about 3000 cubic metres, of which 2000 has extremely low activity.[72]

3.49 The Committee notes that many State and Territory governments and institutions have made considerable progress since 1986 in identifying and reducing their radioactive waste holdings. There has also been some progress in the registration of radioactive materials. In Victoria all sealed sources are now registered and all unsealed sources are listed on a license.[73] The Committee was told that this year unsealed sources of radioactive materials used in laboratories in New South Wales will need to be registered and:

> that will bring an awful lot of things out of the woodwork.[74]

3.50 The Department of Foreign Affairs and Trade told the Committee that it would like contracting parties to the RADWASS Convention to be required to report on radioactive waste volumes.[75] The Committee believes that Australia should urgently prepare an up to date national inventory reflecting the changes mentioned in this report and other changes since 1986. The Committee does not believe that the plans for a national facility should proceed on the basis of the 1986 inventory.

3.51 Further the Committee believes that an up to date national inventory would promote a national approach to finding markets and recycling or reuse opportunities.

Recommendation 10

The Committee recommends that an up to date inventory of all existing and potential radioactive waste be prepared and that this be maintained to detect any changes to the current accumulation rates.

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72 Rawson, Transcript of Evidence, p. 32

73 Victorian Government, Submission No. 37, p. 4

74 Collins, Transcript of Evidence, p. 772

75 Smith, Transcript of Evidence, p. 663

CHAPTER 4

AVOIDANCE AND MINIMISATION

Introduction

4.1 A commitment to waste avoidance and minimisation principles is essential in the development of waste management strategies, as these attack the cause of the problem rather than dealing with the results through storage or disposal.[1] The hierarchy of waste management - reduction, reuse, recycling and treatment before disposal - should be applied to radioactive waste in the same way that it applies to other types of waste. Greenpeace told the Committee that:

> after nearly 90 years of creating radioactive waste, Australia still does not have an acceptable strategy for dealing with it ... Ultimately, however, any radioactive waste policy must be based on a simple, unavoidable truth: there is no known environmentally acceptable way of permanently disposing of radioactive waste. With current knowledge and technology the only thing we can achieve is long term storage. Given this, waste avoidance and minimisation must be an integral part of any waste management strategy.[2]

4.2 While some conservation groups may argue for zero production, and therefore zero waste, given the importance of the use of radioactive isotopes in medicine and industry and Australia's work in the field of international research, this is not a realistic short term option.

Justifying the Use of Radioactive Materials

4.3 The Committee was told that the International Commission on Radiological Protection's principles of justification, optimisation and minimisation, if rigorously applied, effectively reduce the creation of radioactive waste.[3]

> Everybody is a lot more careful about the future now, so research proposals have to come before a radiation safety committee which says, 'What are you going to do about your waste handling?' They

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1 Baker, Transcript of Evidence, p. 137

2 Greenpeace, Submission No. 48, p. 1

3 Hanlon, Submission No. 5, p. 1

> will have to really think twice if they are using a long-lived isotope.[4]

4.4 It was argued, however, that:

> Because many of the reagents used have hazardous characteristics other than those pertaining to the radioactivity, more 'radioactive' waste is probably generated than is strictly necessary. However it is probably unwise and unpopular and possibly unsafe to too strongly encourage minimisation of radioactive waste.[5]

4.5 Radiation safety officers cooperate with users of radioactive materials in hospitals and universities to assist them in avoiding excess waste creation. The University of Western Australia described their procedure:

> They have to tell us ... what isotopes they are going to use, how much of it, where they are going to do it, what sorts of monitors they have on hand to monitor the work they are doing and what sort of waste they are going to produce.[6]

4.6 Some regulatory authorities require organisations or individuals intending to use radioactive sources to provide information on the purpose and duration of use and indicate storage or disposal options. Registration procedures can be used to provide advice to users on appropriate recycling, reuse and reduction options, as well as the best possible disposal options if no alternatives are available. The Committee considers it important that such procedures are implemented for all users of radioactive material.

4.7 The Committee is also concerned that the difficulties encountered in storing or disposing of radioactive waste could mean that valuable research could be jeopardised:

> The difficulties of the disposal of long lived active putrescent waste sometimes prevent certain types of research work being undertaken ... To some extent then, not only in our university but elsewhere, people tailor their research programs because of this problem of disposal.[7]

4.8 The Committee believes that a balance must be struck between minimisation strategies and the restrictions this may place on important

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4 Towson, Transcript of Evidence, pp. 768-9

5 Royal Alexandra Hospital for Children, Submission No. 5, p. 7

6 Munslow-Davies, Transcript of Evidence, p. 299

7 Rosen, Transcript of Evidence, p. 751

research. One example is the use of sodium[22] and chlorine[36] in research into the enterotoxigenic *Escherichia coli* at the Royal Alexandra Hospital for Children which has the potential to save children's lives.[8] The justification process must weigh the benefits of the research against the difficulties and disadvantages of managing the waste created.

4.9 This caution should be taken in the light of comments that:

> It seems to be a popular conception of the public that all things nuclear are somehow justified by nuclear medicine ... Medical waste is only a very tiny minority of waste which is generated.[9]

4.10 The Committee believes that more can be done to avoid or minimise the amount of waste being produced in some areas. The Committee believes that in cases where long lived radioactive waste will be produced that a full justification process should be undertaken at the hospital or research institution and by the proposed Australian Institute of Radiation Protection if the radioactive waste is to be stored in a national facility.

Strategies for Avoiding the Use of Radioactive Materials

4.11 The Committee believes that organisations using radioactive materials should be encouraged to find alternative procedures where practicable. Particular attention should be paid to radioactive materials such as plutonium, which is radiotoxic if inhaled and long lived.[10] The Queensland Greens claimed that:

> We actually subsidise the creation of radioactive waste as there are hidden subsidies for the use of radioactive materials in industry, science and medicine. If the full costs were paid by users then cheaper and safer alternatives would be developed ... Full cost recovery would mean that charges would reflect the full cost of production of radioactive isotopes, the costs incurred by governments in regulating the nuclear industry and the full costs of the disposal of radioactive waste and site clean-up.
>
> At present the production of radioisotopes is heavily subsidised with ANSTO ... supplying its isotopes from its Lucas Heights reactor at prices cheaper than at cost ... If isotopes were to be sold to industry only at a realistic price, the attitude of industry and its willingness to make use of these techniques might be very

8 Hanlon, Transcript of Evidence, p. 417

9 Lowe, Transcript of Evidence, p. 319

10 Pearson, Transcript of Evidence, p. 456

> different. The consumers of radioactive isotopes ... do not have to pay the real cost of operating and servicing a reactor nor its eventual decommissioning perhaps 100 years down the track.[11]

4.12 The use of radioactive materials in Australia in medicine, both in diagnosis and therapy, is steadily expanding as the incidence of cancer increases. In many cases, alternative methods are not available. However, in pathology, radioactive iodine[125] is being replaced by non-radioactive assays thus reducing the use of radioactivity in this area.[12] Replacement isotopes are being used as better ones become available, such as the replacement of radium with iridium.[13]

4.13 Some industries have also been able to switch to cost-effective non-radioactive technologies such as the use of microwave units instead of radiation gauges by companies working in remote areas.[14]

4.14 Other avenues of avoidance may become apparent in the future and government funded research could be directed towards this. The Committee was told that:

> knowledge is changing over time and technology is changing over time. It is quite easy to look back now ... and to say that they used far more than perhaps they should have. Perhaps in 25 years time, people will look back at what we are doing and say that we have been using more than we should have too.[15]

> There are a number of types of work, particular molecular biology and genetics ... which use radioisotopes, based on techniques that have been well established in those fields for some time. Perhaps these people, if given the incentive to look at non-isotopic methods of detection, may change to that.[16]

4.15 The Committee believes that consideration should be given to increased funding for research into alternative technologies using non-radioactive materials, with the long-term goal of reducing the amount of radioactive waste created.

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11 Queensland Greens, Submission No. 15, p. 2

12 Smart, Transcript of Evidence, p. 766

13 Towson, Transcript of Evidence, p. 526

14 Northern Territory Government, Submission No. 14, p. 11

15 Hochman, Transcript of Evidence, p. 216

16 Hanlon, Transcript of Evidence, p. 770

4.16 Smoke detectors are an example where other technologies are available but those containing radiation sources are being used because they are cheaper. It was suggested that the use of a more expensive type of smoke detector which uses a photo-electric device, instead of a radioactive source, could overcome to some extent the problem of the disposal of large numbers of these radioactive sources into the general waste stream in the future.

4.17 However, it was argued that photo-electric smoke detectors are not suitable in most domestic or occupational situations because they do not respond as well to the early emissions from a fire.[17] On the other hand the Fire Protection Industry Association of Australia told the Committee that:

> Photoelectric type smoke detectors offer several advantages over the more common ionisation type smoke detectors. Photoelectric smoke detectors, in addition to containing no radioactive material, are more sensitive and reliable than ionisation type smoke detectors ... It is believed that a combination of market pressures and technology improvements will reduce the price of photoelectric type smoke detectors. This, coupled with the superior performance of photoelectric type smoke detectors may lead to the eventual withdraw[al] of domestic ionisation type smoke alarms from the market.[18]

4.18 It was suggested that the differences of opinion were due to 'horses for courses', with each type of detector having the advantage in a particular type of fire.[19]

4.19 The Committee believes that this is an important issue that governments should consider. If photo-electric smoke detectors are superior in these respects, economic incentives may be appropriate to encourage the increased use of these rather than the ionising radiation types. This is a complex issue because an increased cost to cover the storage or disposal of the radioactive materials after the useful life of the smoke detectors may discourage the installation of these in homes thus potentially risking lives.

4.20 Another potential reduction in the amount of radioactive waste might come from mining rare earths from less radioactive sources than those presently proposed.[20] The Committee was told that the clay from the Pinjarra site has 9 to 15 times more radioactive thorium dioxide than the world

17 Wallace, Transcript of Evidence, p. 724

18 Fire Protection Industry Association of Australia, Submission No. 76, p. 13

19 Orr, Transcript of Evidence, p. 794-795

20 Siewert, Transcript of Evidence, p. 334

average.[21] Other rare earth ores, containing little or no radioactivity, are available in China and Mt Weld-Meenaar, Western Australia. The Rhone Poulenc plant at La Rochelle is already using the non-radioactive bastnaesite from China to avoid the problems associated with storing radioactive waste.[22]

Strategies for Reducing the Volume of Radioactive Waste

4.21 In many cases the volume of solid radioactive wastes can be reduced by compaction, especially materials such as paper, plastics, protective clothing, laboratory glassware and other material contaminated during research or medical activities. ANSTO compacts much of its low-level solid radioactive waste achieving a volumetric reduction of six- to eight-fold.[23] Compaction is routinely carried out overseas at storage sites and repositories such as the Centre de l'Aube repository in France.[24]

4.22 The Committee received evidence that there is a need for such strategies to be more widespread:

> Possible only one hospital has compaction facilities. Much of the laboratory waste is in the form of bulky items such as paper products, and the resultant bags of waste have a large volume, much of which is air. Compaction is a well-recognised tool for handling any waste. US institutions virtually all use compaction as a means of volume reduction, yet it is hardly used at all in Australian hospitals at least, probably because of the cost of the equipment and the need for space to operate it.[25]

4.23 Mr Wong also commented on this difficulty:

> One management strategy that could help reduce the national stockpile in a physical sense is shredding this material so that it can occupy less space ... you would need to be able to account for all the emissions from that mechanical process ... that process has to be done with quite specific safeguards.[26]

4.24 The New South Wales Environment Protection Authority believes that by removing non-radioactive material and consolidating what is left, the

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21 Statewide Network of Action Groups *et al.*, Submission No. 50, p. 2

22 Ibid, p. 7

23 Australian Nuclear Science & Technology Organisation, Submission No 32, pp. 3-4

24 ANDRA, Explanatory video on the Radioactive Waste Facility at Centre de l'Aube, France, 1995

25 Westmead Hospital and Community Services, Submission No 65, p. 4

26 Wong, Transcript of Evidence, pp. 741-742

amount of radioactive waste held by the NSW government could be reduced from 100 to 30 cubic metres.[27] The Committee would like to see greater use of compaction in institutions using radioactive material, and provision should be made for this in the design of new buildings.

4.25 Radioactive waste is often of mixed categories and/or activity, and sorting this waste could facilitate volume reduction by enabling shorter lived radioactive materials to be disposed of after the radioactivity has decayed. On the other hand, if this requires greater handling of the material, it may increase the exposure of workers to radiation:

> Although, in principle, further segregation and volume reduction of existing wastes is possible, the gains must be carefully assessed against the resources required and the additional radiation exposures to operational staff.[28]

4.26 The 'concentrate and contain' strategy for reducing volume, either by chemical methods or by evaporation, can be used in proposals such as the Rhone Poulenc rare earths project, where wastewater would be sent to evaporation ponds.[29] Another example is sending discarded smoke detectors to a central facility where the radioactive source could be removed, thus reducing the volume of waste.[30] The 'concentrate and contain' strategy will, however, produce a secondary waste stream which has a higher specific activity than the original.[31]

4.27 In some countries incineration of low-level solid radioactive waste is also used as a means of volume reduction, and the resultant radioactive ash and gases are stored until it is safe to dispose of them into the environment. This is not widely used in Australia and statutory emission standards and ash contents need to be considered.

Strategies to Minimise the Quantity of Radioactive Waste Created

4.28 A number of witnesses expressed the view that radioactive waste should be stored at the site of production.[32] The Committee was told that only when

27 Colgan, Transcript of Evidence, p. 390

28 Australian Nuclear Science & Technology Organisation, Submission No. 32, p. 22

29 Rhone Poulenc, *Rare Earth Project, Pinjarra, Western Australia, Environment Review and Management Programme*, September 1995, p. 3-10

30 Wallace, Transcript of Evidence, p. 725

31 University of Western Australia, Submission No 22, Attachment 1, p. 60

32 Lannstrom, Transcript of Evidence, p. 190; Pearson, Transcript of Evidence, p. 464; Botten, Transcript of Evidence, p. 171; Nuclear Issues Action Group, Submission No. 42, p. 3

people are required to deal with the waste they produce will they implement practices to minimise the amount of radioactive waste created.

4.29 ANSTO has established a working party to review and monitor their waste management strategy and practices on a continual basis.[33] ANSTO told the Committee that it's approach is one of:

> minimising its current waste generation both *at source* (by adopting processes which minimise the creation of waste) and in subsequent waste treatment (to avoid or minimise the creation of secondary waste streams).[34]

4.30 The Committee is concerned that this is not always the case. Mr Pearson pointed out that:

> Ironically, the biggest Governmental producer of radioactive waste in Australia - ANSTO - has recently switched its HIFAR reactor to a Technecium-99m (T-99m) production method that has actually increased the amount of radioactive waste created. This was done because the "dirtier" method was cheaper, as ANSTO conceded to Greenpeace in 1993.[35]

4.31 The Committee believes that the proposed Institute of Radiation Protection should consider as a matter of urgency any departures by ANSTO from its stated position in relation to waste minimisation and ensure that appropriate remedies be implemented as soon as possible.

4.32 The Committee was told that regular waste audits being carried out in New South Wales hospitals have been able to reduce the amounts of radioactive wastes requiring storage or disposal.[36] Greenpeace recommended a government audit of all industries which produce radioactive waste, with the aim of identifying ways in which they could avoid or minimise waste production.[37] The Committee believes that a nationally coordinated approach to auditing would avoid duplication.

4.33 A potential area of future radioactive waste minimisation is the use of cyclotrons instead of reactors in the production of medical radioisotopes. Greenpeace estimated that if cyclotrons were used to produce these isotopes

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33 Jostsons, Transcript of Evidence, p. 58

34 Australian Nuclear Science & Technology Organisation, Submission No. 32, p. 21

35 Greenpeace, Submission No. 48, p. 3

36 Smart, Transcript of Evidence, p. 766

37 Greenpeace, Submission No. 48, p. 2

then approximately one per cent of the radioactive waste would be created compared with that produced if a reactor was used.[38]

4.34 Cyclotrons can not currently solve all problems. Technetium^{99m}, which is produced using molybdenum as a source, represents 80 to 90 per cent of radiopharmaceuticals used in nuclear medicine.[39]

Mr Nigel Wood explaining the production of technetium-99 generators used for medical purposes. On the trolley are two assembled generators (Photograph provided by ANSTO)

4.35 ANSTO maintains that a huge step forward in cyclotron technology would be required before it could be routinely applied in nuclear medicine, because at the moment it is not possible to generate a quantity of molybdenum^{100} sufficient for Australia's needs.[40]

4.36 The Research Reactor Review also found that more research was needed on the feasibility of cyclotron production of technetium^{99m}.[41] It was suggested

38 Greenpeace, Submission No. 48, p. 4

39 Egan, Transcript of Evidence, p. 783

40 Australian Nuclear Science & Technology Organisation, Submission No. 32c, p. 4; Jostsons, Transcript of Evidence, p. 69

41 Research Reactor Review (1993) *Future Reactions, Research Reactor Review Report*, August 1993, Recommendation 5.4, p. 49

that prior to the approval of a new research reactor, it would make good economic sense to look at technologies producing short lived radioisotopes, and to import others from overseas if necessary.[42] It may be, as the Research Reactor Review found, that cyclotron-produced and reactor-produced radioisotopes are complementary and that a reactor based source will continue to be essential in Australia.[43]

4.37 Dr Egan, of the Positron Emission Tomography Centre, said that:

> just after the Reactor Review Committee's report was published [August 1993] it was clear to us that in the interim five-year period that the reactor report committee identified, there needed to be a concerted effort to try and establish the feasibility or not of other production techniques for technetium.[44]

4.38 Professor Lagunas-Solar, who is creating technetium^{99m} in experimental situations,[45] conceded that further studies are needed on questions of radionuclidic purity and dosimetry.[46] The Committee was told that since 1993, Professor Lagunas-Solar has advanced his research and Dr Egan is confident that some of these claims, such as those relating to radioisotopic purity, have now been substantiated.[47]

> I think that ... a medium energy cyclotron can produce a significant amount of technetium ... the answers to questions about production yields and purity and so on ... would be fairly well resolved in the next two years.[48]

4.39 If cyclotron technology becomes a viable option, adequate and regular distribution to individual hospitals may require a number of regional cyclotrons to be set up. It is possible that such cyclotrons would be smaller, and therefore less expensive, than the 30MeV cyclotron in Sydney, which in 1992 cost $25 million. The cyclotron used at the PET Centre at the Austin Hospital is 10MeV. The cost of replacing the HIFAR reactor was estimated to be no less

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42 Smith, Transcript of Evidence, p. 570

43 Research Reactor Review (1993) *Future Reactions, Report of the Research Reactor Review*, August 1993, p. 88

44 Egan, Transcript of Evidence, pp. 778-779

45 Pearson, Transcript of Evidence, p. 458

46 Lagunas-Solar, M, *Production of TC^{99m} and MO^{99} for Nuclear Medicine Applications via Accelerators as an Option to Reactor Methods*, Paper presented at the 18th Annual Conference of the Australian Radiation Protection Society, Sydney, October 1993

47 Egan, Transcript of Evidence, p. 781

48 Ibid, p. 783,786

than $250 million in 1992. Running costs of cyclotrons are also much less than reactors.

4.40 The Cyclotron and PET Centre at the Austin Repatriation Medical Centre, Melbourne and the Crocker Nuclear Laboratory at the University of California, Davis, USA, are collaborating to determine the feasibility of this new accelerator-based production method for Australian nuclear medicine. This will provide essential information for the final decision of the Australian Reactor Review Committee, due in 1998.[49]

4.41 In 1992 Greenpeace requested that the Federal government provide $1 million, over three years, to finance Australian participation in a cyclotron feasibility study, but this request was rejected by the former Federal Government.[50] Speaking about the project, Dr Egan said:

> We needed to establish factually some of these questions that were being raised and, based on those facts, we could then develop a model, a facility that would be sufficient to produce what was needed in Australia and then we would know what the ultimate cost benefit would be of such an investment. It has become a bit clearer in the interim two years but it is still not fully decided, by any stretch, as to exactly what type of cyclotron facility one would need to have to achieve this production for Australia's requirements.[51]

4.42 Dr Egan's plea was echoed by the Sutherland Shire Council:

> they [ANSTO] do not seem to be keen to put any intellectual investment into alternatives to reactors for medical radioisotope production ... we made a good case that economically it would make reasonably good sense to look at accelerator technology for production of expensive short-lived radioisotopes for medicine and import some short-lived ones from overseas if necessary without a reactor technology. It would be a major reduction in the waste and probably come out ahead economically.[52]

4.43 Dr Egan confirmed the continued relevance of a grant for collaboration with Professor Lagunas-Solar in his research.[53] An amount of approximately $500 000 is required over three years to determine whether any of the identified

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49 Egan, Submission No. 77, p. 1

50 Pearson, Transcript of Evidence, p. 458

51 Egan, Transcript of Evidence, pp. 785

52 Smith, Transcript of Evidence, pp. 569-570

53 Egan, Transcript of Evidence, p. 781; Egan, Submission No. 77, p. 1

radioactive impurities in cyclotron produced technetium^{99m} may preclude its use in clinical nuclear medicine.[54] Under the proposal, the University of California would undertake the production of technetium^{99}. The Australian team would then study the characteristics of that for clinical imaging and diagnostic scanning purposes.[55]

4.44 The Committee considers that Dr Egan's submission comprises a modest request for research funding, the results of which may provide a useful basis for decision-making associated with the replacement of Australia's research reactor. The Committee believes that the Government should look at all options for the future production of radioisotopes in Australia before deciding on the possible replacement of the existing reactor.

Strategies for Return and Reuse of Radioactive Materials

4.45 A significant way of reducing radioactive waste is to recycle or reuse the source. It was suggested that prior to the purchase of a radioactive source, the user should determine whether the supplier of the radioactive source is prepared to have it returned at the end of the equipment's useful life.[56] The Victorian Government has been able to reduce its inventory of radioactive materials by 84 curies, by returning various items to the country of origin.[57]

4.46 The Committee was told that many radioactive sources have very long half lives which makes it feasible for them to be reused. In many cases the useful life of the equipment is much shorter than the time necessary for the radioactivity of the source to decay.[58]

4.47 Although recycling is a very attractive option it is not always viable.[59] The Committee was told that the problem with recycling is often one of logistics:

> That is, checking the source to ensure that [it] is still in a useable condition, storing it pending reissue and finding a new application for it.[60]

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54 Egan, Submission No. 77, p. 4-5

55 Egan, Transcript of Evidence, p. 779

56 Samuel, Transcript of Evidence, p. 389

57 Victorian Government, Submission No. 37, p. 3

58 Fleischmann, Transcript of Evidence, p. 478

59 Ibid, p. 478

60 Fleischmann, Submission No. 9, p. 4

4.48 Most radioactive waste from hospitals is not suitable for recycling, although the packaging materials are already reused.[61] Shorter lived materials such as cobalt[57] and iridium[192] are replaced on a 6 or 12 month basis, the company removes the old source when delivering a replacement.[62] When a source is operational for 15 or so years then the company may not still be in existence.[63]

4.49 CSIRO confirmed this difficulty:

> In the past suppliers [in Australia and overseas] have often suggested that this material could be returned. With the exception of 5 americium[241] and 2 caesium[137] sources returned to Amersham UK in 1992, these assertions generally have proved unfounded.[64]

4.50 The Victorian Government has returned approximately 80 curies of tritium EXIT signs to suppliers in the United Kingdom and the United States.[65] New South Wales has 300 to 400 tritium exit signs which can be sent overseas at a disposal cost of £30 per item. This represents a significant reduction in the volume of waste but at a substantial cost.[66]

4.51 An important aspect that must be considered in returning material to companies overseas is whether approval can be gained from the government authority in the receiving country.[67] The willingness of governments to accept back radioactive material which they have exported is not necessarily predictable:

> A company may have all the intention of taking material back on signed agreements but a government could change its policy, there could be a change of government and they could say: 'That's it; we're not taking any more of that material back'.[68]

4.52 If a national inventory was prepared for Australian radioactive waste it would facilitate the shipment of large quantities of these materials overseas for reuse being negotiated at a lower unit cost.

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61 Westmead Hospital and Community Health Service, Submission No. 65, p. 4

62 Smart, Transcript of Evidence, p. 759

63 Ibid, p. 759

64 CSIRO, Submission No. 25, p. 4

65 Victorian Government, Submission No. 37, p. 3

66 Colgan, Transcript of Evidence, p. 414

67 Samuel, Transcript of Evidence, p. 414

68 Wallace, Transcript of Evidence, p. 723

> At the moment the only disposal available is via people who know how to do the export paperwork and can get agreement from somebody like the Radio Chemical Center at Amersham. They charge a terrific amount to take off your hands embarrassing radioactive sources. I think it is a serious economic problem.[69]

4.53 While sending radioactive waste back to the manufacturer may foster an 'out of sight out of mind' attitude, the costs of sending radioactive sources overseas may be an incentive to waste minimisation.

4.54 There may be possibilities for local reuse. The Committee was given an interesting example of a university purchasing a cobalt[60] source from a hospital for $1000. The university was later told that it could have been given the source free because the cost of transporting it back to Lucas Heights was so high.[70]

4.55 For some sources processing for reuse is likely to be more expensive than making new sources and storing old ones.[71] An industrial user told the Committee that the cost of having some old sealed sources taken away would be in the order of $4000 - $5000 per source.[72]

4.56 The Committee was given a number of other examples concerning the difficulty of correctly disposing of sources that are no longer needed, including a radiotherapy source of 1000 curies no longer used by a Newcastle hospital[73], a cobalt[60] therapy source and a strontium[90] ophthalmic applicator.[74] The cost of returning these to Britain would be considerably more than the original cost of their supply.

4.57 These logistic and economic difficulties are a significant disincentive to return and reuse. The Committee was told that it is easier to dispose of a source than to find another owner.[75] However, some old caesium sources which are no longer considered practical to use in Australia are shipped to developing

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69 Paix, Transcript of Evidence, p. 225

70 Hochman, Transcript of Evidence, p. 223

71 Collins, Transcript of Evidence, p. 759

72 Penrice Soda Products, Submission No. 55, p. 2

73 Elbourne, Submission No. 53, p. 1

74 Paix, Transcript of Evidence, p. 224

75 Fleischmann, Transcript of Evidence, p. 480

countries under private aid programs, on the basis that an old source is better than no source at all.[76]

4.58 The NSW Environment Protection Authority believes that there is significant potential to recycle the radioactive sources in smoke detectors.[77] Australian Standards require that detectors be marked so that they can be returned to supplier or health authorities.[78] Mr Wong commented to the Committee:

> The real cost of recycling to a commercially acceptable product, in most cases and probably in this case, would exceed the cost of buying a new americium product.[79]

4.59 It was argued that the disposal of smoke detectors to landfill was acceptable because the radioactive source is insoluble and the associated risk is therefore considered low.[80] The Committee considers that because of the increasing numbers of discarded smoke detectors, a way of recycling them needs to be found. The Committee was told by Mr Carter:

> I see no radiological problem in disposing of them to municipal tips. That does not mean that if there were an easy way of getting them into a good repository they should not go into the tips.[81]

4.60 The Committee suggests that more work should be put into researching the latest developments in the design of smoke detectors with the aim of selecting one which allows the radioactive source to be recycled into a new detector. In present designs the radioactive material is difficult to remove from the detectors so a degree of redesign is needed.[82]

4.61 The possibility of using other radioactive materials with shorter half lives may be another way of approaching the problem. Currently there is a mismatch in that the life of the radioactive source far exceeds the life of the smoke detectors:

> we would see something like an americium smoke detector as a real mismatch. You have got a job you want to do, which is to

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76 Collins, Transcript of Evidence, p. 773

77 NSW Environment Protection Authority, Submission No. 45, p. 3

78 Coate, Transcript of Evidence, p. 789

79 Wong, Transcript of Evidence, p. 743

80 Samuel, Transcript of Evidence, p. 390

81 Carter, Transcript of Evidence, p. 824

82 Samuel, Transcript of Evidence, p. 407

> monitor a particular room for, at most, 20 or 30 years before somebody wants to re-wire it or re-paint it or something, and into that you put a source with a 400-year half-life. In a physiological study, like a nuclear medicine one, you try and match the half-life to the purpose, as a general principle.[83]

4.62 There is a well-established system in place for the return of commercial smoke detectors, and the Committee believes that there should be provision for the return of domestic smoke detectors.

> Certainly, in the commercial environment, any organisation that imports detectors has to enter into an agreement to return any spent detectors to the original manufacturer or supplier.[84]

4.63 If central collection of the smoke detectors is envisaged, each local tip could designate a special place or accept detectors in the recycling section of domestic garbage bins, to be sorted out at the recycling depot. In this way, the problem of the safe disposal of batteries included in the detectors could also be addressed. The Committee was told that Brisbane City Council has a collection service for all forms of hazardous waste, including smoke detectors, available on request at no cost to the consumer.[85]

4.64 One approach suggested overcoming difficulties for people living in rural areas by amending legislation so that domestic smoke alarms could be returned by ordinary mail. The industry spokesperson suggested that if necessary, special packaging for this purpose could be designed and sold through Australia Post.[86]

4.65 The Committee believes that relevant overseas practices should also be examined. The European Commission is planning a series of studies as part of its approach to achieving harmonisation at European Union level of radioactive waste management practices. One of these studies focuses on waste minimisation for goods, such as smoke detectors and calibration mechanisms which rely on small radioactive sources but do not have regulatory controls after manufacture.[87] The results of this study should be taken into account in any future revision of policy aimed at managing the disposal of smoke detectors.

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83 Towson, Transcript of Evidence, p. 526

84 Coate, Transcript of Evidence, pp. 789

85 Lewis, Transcript of Evidence, p. 634

86 Fire Protection Industry Association of Australia, Submission No. 76, p. 10

87 Commission to Study Harmonised Nuclear Waste Practice, *European Report*, Brussels, September 1995

4.66 If it is decided that the smoke alarms must be returned to the supplier, industry and government need to ensure that appropriate avenues exist so such a policy is practicable.[88] Further, the Committee would like to see government and industry discuss this matter and develop a united position to avoid confusion which may undermine public confidence. A program of community education should be established on the return and reuse of smoke detectors.

Incentives for Avoiding and Minimising the Creation of Radioactive Waste

4.67 The Committee believes that there are three approaches to providing the necessary incentives for waste minimisation:

- the waste should remain on site and the user bear the cost of storing it appropriately;
- the costs of storage in a central facility should be met by the creator of the waste; and
- the cost of buying the radioactive source should include a levy to cover the cost of disposal or storage. This should encourage the prospective user to purchase the minimum amounts.

On-site management and storage

4.68 The Friends of the Earth argue that:

> On site storage of radioactive waste at the site of origin will lead to waste minimisation. In this way, the onus of responsibility and costs falls on the producer, providing the motivation for producers to minimise the amount of waste created.[89]

4.69 The Friends of the Earth also told the Committee that in the United States, where there is no national or regional repository and utilities are held responsible for the waste, users are implementing waste minimisation practices to which they might not otherwise have resorted.[90]

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88 Fire Protection Industry Association of Australia, Submission No. 76, p. 10

89 Baker, Transcript of Evidence, p. 137

90 Hallam, Transcript of Evidence, p. 441, citing Oyen L (1993) *Low level Radioactive Waste Disposal and Nuclear Plant Storage Designs in the United States;* Paper presented at the Institution of Engineers Australia and Australia Nuclear Association 9th Pacific Basin Nuclear Conference, Sydney, 1-6 May 1993

4.70 In New South Wales prior to 1993 radioactive waste was accepted by the Health Department at no cost. However, today the Environment Protection Authority's policy is in line with that used for the management of hazardous waste, making waste generators responsible for its management, including on-site storage.

4.71 An analogy was drawn to illustrate the disadvantage of having a national facility:

> a local shire suddenly announcing that they were not going to have any rubbish collection any more and householders were suddenly made responsible for all their own domestic rubbish. We would see consumer patterns change instantly ... The fact that you can put it in your big green garbage bin and send it somewhere else means that we will continue to go to the supermarket and buy packaging and so on, whereas if I had to bury that in my own backyard I would be a lot more cautious.[91]

4.72 It was argued that the availability of a national facility would not change the need for its cost to be included in each justification procedure.

> It just means that there will be a solution and also there will be a cost associated with it. In other words, they will have to build the cost or removal of the waste into their research application.[92]

4.73 Different problems are associated with the storage of short-lived and long-lived wastes. On-site storage may be an appropriate strategy for waste which will rapidly decay, but not for waste which will last thousands of years, is highly radiotoxic, high level radioactive waste or where public health issues may arise. The Committee received many pleas for the removal of small amounts of intermediate level, long lived radioactive wastes from premises at which it had been stored for up to thirty years.

4.74 A general policy of on-site storage may not be appropriate where public safety needs to be ensured, especially when these wastes are generated from obsolete procedures which have been replaced with better technologies. Another concern for the Committee is the potential loss of institutional control as a result of hospital and medical practice closures. The Committee considers, however, that the on-site management of short lived, low level waste should continue to be the generator's responsibility.

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91 Lowe, Transcript of Evidence, p. 322

92 Smart, Transcript of Evidence, p. 769

User Pays Principle for Radioactive Waste Storage

4.75 A user-pays for storage would seem an obvious way to encourage waste minimisation. A difficulty arises in determining how much and who should be charged for medical wastes. Secondly, some waste generated years ago, is held by those who were in no way responsible for its creation.

4.76 Other factors such as the possible need for compensation to the community hosting the facility[93] and variations in activities and half lives of different wastes may make it hard to calculate a pricing regime for indefinite storage. If the charges are too high there is an incentive for radioactive waste owners to avoid the charge by disposing of waste incorrectly. High costs might lead to hoarding waste on-site as long as possible to avoid payment, as has happened in hospitals and research laboratories of California.[94]

4.77 Further, most of the radioactive waste in Australia which is likely to be sent to a national facility is generated by Commonwealth bodies, hospitals and universities, which are funded by the taxpayer who will pay for waste management anyway.

4.78 The Committee believes that there are limitations to the applicability of a user-pays system as a means of encouraging avoidance and minimisation of radioactive waste, except in the case of industrial waste.

4.79 It was suggested to the Committee that a charge might provide an incentive to use methods not involving radioactive materials.

> There are a number of types of work, particularly molecular biology and genetics, being done at the Children's Hospital which use radioisotopes, based on techniques that have been well established in those fields for some time. Perhaps these people, if given the incentive to look at non-isotopic methods of detection, may change to that. Building the costs into the research project may, in fact, give them that incentive.[95]

4.80 Ms Peebles also pointed out that the user-pays principle was working from the negative end in attacking the results not the cause. She said:

> It would be much better if they develop their research and work to minimise it in the first place. As a lot of the institutions are part of

93 Hartley, Transcript of Evidence, p. 358

94 Mcmenamin B (1994) 'Don't Drink the Water', *Forbes* 153 (March 1994): 92-93, p. 92

95 Hanlon, Transcript of Evidence, p. 770

> the public purse, then, in the end, it is us paying for it, and that is not acceptable.[96]

4.81 Several witnesses before the Committee maintained, however, that if manufacturers who create radioactive materials are charged for the waste disposal, they would presumably keep its creation to a minimum.

4.82 If the manufacturer passed on the cost of disposal to the consumers then attitudes to the use of radioactive materials may change. The Committee was told that:

> If isotopes were to be sold to industry only at a realistic price, the attitude of industry and its willingness to make use of these techniques might be very different. The consumers of radioactive isotopes, usually industries like ICI, BHP, Comalco or Pacific Power, do not have to pay the real cost of operating and servicing a reactor nor its eventual decommissioning perhaps 100 years down the track.[97]

4.83 ANSTO is the only manufacturer of radioactive sources in Australia. The Committee was told that in the case of ANSTO, the concept of user pays is meaningless because the user is not paying the full cost of operating or decommissioning the reactor.[98] Its prices must compete with those of imported sources, such as those produced by Amersham International in Britain. Government intervention would be necessary to keep prices of the imported products at an artificially high level, in order to discourage purchase.

4.84 It was also pointed out to the Committee that the use of the Mt Walton East facility for disposal is very expensive and that this encourages waste minimisation and recycling and treatment wherever possible.[99]

4.85 ANSTO maintains that the high costs of transport to a national facility provides a strong economic incentive for waste minimisation, as shown in France, the United Kingdom, Spain and Sweden, where the volumes of waste being received at low level repositories are below projected volumes (typically,

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96 Peebles, Transcript of Evidence, p. 838

97 The Queensland Greens, Submission No. 15, p. 2

98 Sutherland Shire Environment Centre, Submission No. 7, p. 9

99 Davies, Transcript of Evidence, p. 267

by about 25 per cent).[100] The reduction is attributed to the effects of waste minimisation.[101]

4.86 The user-pays principle is complicated where central storage or disposal is the preferred option. The process of charging for the collection and storage or disposal including whether to charge an up front sum or an annual registration fee, has to be considered. Another choice would be the possible exemption for certain materials.

4.87 The Committee believes that consideration must be given to a number of special cases in determining pricing structures for waste which might be considered is a national repository is established:

- hospitals, universities, CSIRO, ANSTO and Defence and other tax payer supported facilities;
- research which provides net community benefits;
- companies which have already implemented changes to non-radioactive technology and retain only sources of historic origin;
- mining activities which generate large amounts of waste; and
- waste produced in the future, particularly where alternative technologies are available.

4.88 The Radiation Protection Office in Western Australia does not have an up-front charge for waste disposal at the University. It is a centrally funded facility and running costs include handling waste from different departments. Hospitals are charged on a cost recovery basis for the use of the service.[102]

4.89 The Committee was told that hospitals are already paying to have pathological waste removed, which usually includes radioactive waste. An additional charge made to remove radioactive waste to a central repository, may provide an incentive to hold waste for decay rather than remove it. Hospitals would prefer regular removal of radioactive waste, with only a minimum inventory being held.[103]

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100 Australian Nuclear Science & Technology Organisation, Supplementary Submission No. 32b, p. 6

101 Ibid, p. 6

102 Munslow-Davies, Transcript of Evidence, p. 300

103 Westmead Hospital and Community Services, Submission No. 65, p.3

4.90 On the other hand, some charge to hospitals was thought to provide an incentive for minimisation.

> If there was a charge involved that was realistic, there would be a great incentive and the charge would have to be cost recoverable. It would have to be realistic and it would have to include all the components of the waste minimisation and handling. I think that would provide an incentive, particularly if it was passed back down to the bottom of the chain.[104]

4.91 One problem when referring to medical treatment is deciding whether the hospital or the patient is the bottom of the chain. The Committee considered the possibility of including radiopharmaceutical treatment in the Medicare schedule, to draw attention to the cost associated with radioactive waste generated by nuclear medicine procedures.

4.92 The Committee is concerned that a project being undertaken at the Royal Alexandra Hospital for Children, on the enterotoxigenic organism, similar to that which recently caused serious food poisoning in South Australia, would not have proceeded if the researcher had to raise the funds for the radioactive waste disposal. Under a user pays system, when society benefits from a project such as this, should the hospital pay the cost? What should be the contribution by the community that benefits from the use of radioactive materials?

4.93 One of the problems with a user-pays system is how to reasonably account for long term costs of managing waste when such enormous lengths of time are involved.[105] For proposals such as the Rhone Poulenc rare earth plant, the costs of the disposal operation are easy to quantify over the twenty year project.[106] Appropriate financial mechanisms, however, would be required to calculate the cost of monitoring and managing that material for the institutional control period of 200 years.[107]

4.94 There are a number of industries which have made the transition to using non-radioactive materials but may still store radioactive sources from obsolete technologies. The Committee believes that the user-pays penalty should be applied to companies who continue to produce radioactive waste, but a special case may need to be considered for those companies who have done the right thing. A lenient approach may encourage other companies to follow suit.

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104 Collins, Transcript of Evidence, p. 771

105 Lowe, Transcript of Evidence, p. 320

106 Schuster, Transcript of Evidence, p. 265

107 Ibid, p. 265

4.95 Dr Fenton suggested to the Committee that:

> a fee for service or user pays policy should not be introduced for recovering the cost of storing radioactive materials acquired by their current owners prior to the year in which the national repository becomes operational - that is the cost must be borne by the Australian community.[108]

4.96 A suitable pricing regime will need to be determined and decisions on which waste will be exempt from a user pays system will need to be considered if the Government decides to proceed with a national facility.

4.97 The Committee believes, however, that the extent to which organisations would be prepared to send material to a national storage site or repository would depend on the fees charged, compared with the cost to that organisation of continued self-storage. If companies have built a storage facility or have a room available to store radioactive material, they can continue to produce and store that material until that room or facility is full. Therefore, the user-pays system may not be very effective in encouraging minimisation strategies in the short term.

4.98 It was pointed out that any charging regime would have to be accompanied by sanctions.

> There has to be provision for regulations and fines for people who do not comply.[109]

4.99 Any user-pays system should be uniform throughout Australia. Until a national approach to radioactive waste storage is determined, a pricing structure is impossible to establish:

> The reality is that the users who want to obtain the benefits of these things should ultimately be paying for the disposal of these things. So yes, there should be charges and we will charge for taking material on to the Esk facility. We are yet to develop a charge regime. There are complicated reasons why we have not, and one of them is related to the national shallow ground facility.[110]

4.100 The national facility concept requires that the Commonwealth Government, as the main generator of radioactive waste, and therefore the

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108 Fenton, Transcript of Evidence, p. 731

109 Wallace , Transcript of Evidence, p. 718

110 Wallace, Transcript of Evidence, p. 718

taxpayer, would bear the cost. The Friends of the Earth believe that it is inevitable that any national facility will be at taxpayers' expense.[111]

4.101 The Committee was told that economies of scale would be achievable in having one central site which would service all Australia.[112] However a number of States have recently established their own facilities which will be adequate for a number of decades and they will not need to pay the cost of sending material to a national repository in the immediate future.

An Up Front Levy for Storage and Disposal Costs

4.102 It was suggested to the Committee that a levy could be placed in a fund and used for storage or disposal of radioactive wastes. An up-front cost at the time of purchase would provide an incentive to minimise the use and also remove the problem mentioned above, that a charge at the time of disposal might encourage illegal disposal.[113] Dr Hartley believes that economic factors in relation to the disposal of radioactive waste dictate the degree of waste minimisation.[114]

4.103 If the up front cost of disposal of the radioactive source is paid and the manufacturer or retailer subsequently goes out of business, then the upfront disposal payment would be lost.[115] An option of an upfront fee in the form of a levy payable to government would address this concern.

Conclusions

4.104 The Committee considers that waste minimisation strategies should be established during the justification phase of any project. In some situations, this is a fairer way of achieving what economic incentives may not necessarily accomplish and which may in fact mitigate against the undertaking of valuable research projects.

4.105 The Committee believes that in any proposal to restrict the use of radioactive material, consideration needs to be given to the benefits which may outweigh the risk. It is important that the costs and benefits be assessed in the broadest possible context, including the potential effects of radioactive waste

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111 Hallam, Transcript of Evidence, p. 448

112 Ibid, pp. 422-423

113 Hartley, Submission No. 24, p. 7

114 Ibid, p. 7

115 Griffiths, Transcript of Evidence, p. 767

on future generations. Factors such as the number of lives saved by smoke detectors and research into fatal medical conditions should be considered. In these cases the emphasis may need to be on finding reuse and recycling options for the waste produced and developing alternative technologies.

4.106 The Commonwealth Government should promote research into alternative technologies in both industry and medicine which will lead to the avoidance or reduction of radioactive waste.

4.107 A problem inhibiting effective management of radioactive waste has been the on going promise of a national repository to deal with the low level waste. When States are required to manage their own wastes then there may be an attempt to achieve waste minimisation through legislation.[116]

> Promoting a repository creates an atmosphere where producers are not encouraged to minimise or avoid waste creation or to take responsibility for the waste regardless of the rhetoric ... Failure to discourage the creation of radioactive wastes is not in keeping with the most modern concepts of industrial practice.[117]

116 Peebles, Transcript of Evidence, p. 838

117 Women Opposing Uranium Mining, Submission No. 39, p. 6

CHAPTER 5

TRANSPORTATION

5.1 The risks involved during transportation of radioactive waste are of major concern to the public, and the alleged leakage of radioactive material from a drum during the transport of contaminated soil from Lucas Heights to Woomera prompted the establishment of this Inquiry. There is community concern that it is during transport that the 'human factor' makes accidents most likely.[1] There is a tradeoff between the risks of storing radioactive waste in populous areas, and the risks involved in moving it to more remote locations.

Current Transport Regulations

5.2 Regulations at the Commonwealth level relevant to the transport of radioactive waste vary depending on the mode of transportation. The Civil Aviation Authority has responsibility for air transport, the Australian Maritime Safety Agency for sea transport and the Department of Transport for land transport at the Commonwealth level.

5.3 However, the responsibility for the implementation of the national Transport Code is at the State/Territory level.[2] The legislation for the proposed Australian Institute of Radiation Protection will incorporate the national Transport Code. This will provide the Commonwealth with a means of regulating Commonwealth bodies' transport arrangements and will overcome the current lack of regulatory control in this area.[3]

5.4 The *Code of Practice for the Safe Transport of Radioactive Substances* is based on the International Atomic Energy *Agency's Regulations for the Safe Transport of Radioactive Material 1988* and the National Health and Medical Research Councils standards. It is currently being revised.

5.5 The National Road Transport Commission is reforming land transport regulation generally. The model for the National Road Transport Commission Act is based on a Commonwealth-State arrangement in which a ministerial

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1 Women Opposing Uranium Mining, Submission No. 39, p. 5

2 Makeham, Transcript of Evidence, p. 683

3 Johnston, Transcript of Evidence, p. 692

council will vote on proposed regulations to be implemented by State legislation.[4] It was pointed out that:

> The commission legislation is capable of handling radioactive materials, but, at the end of the day, most land transport, except perhaps for Commonwealth materials, would be regulated by state legislation in any event.[5]

Mr Nigel Wood (Manager of Technical Operations, Australian Radioisotopes) explaining to the Committee the types of IAEA approved packages which are used to transport medical radioisotopes from ANSTO to hospitals (Photograph provided by ANSTO)

4 Makeham, Transcript of Evidence, p. 689

5 Ibid, p. 689

The Committee inspecting two containers used for transporting waste between the Australian Radioisotopes Laboratories to the on-site waste management facilities. The fibre-board drum on the left contains slightly contaminated solid trash. The metal cask contains very low activity liquid waste. Both types of waste are a consequence of radioisotope production for medical applications (Photograph provided by ANSTO).

Incidents Involving Transport of Radioactive Materials

5.6 When radioactive soil was dug up from CSIRO's Fishermens Bend property in Victoria for transport to Lucas Heights some of it had a high moisture content. Subsequently, during transportation of this material from Lucas Heights to Woomera, the soil settled to the bottom of the drums and the water rose to the top. Each drum was sealed with the lid and then banded, but when two drums rubbed against each other during transportation, one of the seals was disturbed and water was able to leak out during transit through Port Augusta.[6] In the incident there was in effect no leakage of radioactive material:

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6 Burns, Transcript of Evidence, p. 100

> The measure was 0.15 microsieverts per hour compared with the background radiation level in South Australia which varies from about 0.07 microsieverts per hour to more than 0.2 microsieverts per hour.[7]

The incident was, however, widely reported and caused considerable community concern.

5.7 A second incident to receive media attention during the transportation of contaminated soil from Lucas Heights to Woomera was a reported leakage from a drum during transit through the suburbs of Sydney. This incident turned out to be rain water which had been caught on the top of the drum which was dislodged with the movement of the vehicle.

5.8 The Committee was also told that there were two incidents in which medical radioisotope containers were run over at airports, though in both cases there was no leakage. In these incidents the packaging withstood the impact of two tonne trucks, as it was designed to do.[8]

Transport Risks

5.9 In considering the risk involved in transporting radioactive material important factors are: the minimum amount of handling required; frequency; and nature of the transport. The Committee was told that there have been no significant incidents in the transportation of radioactive materials in the last 30 years and the Department of Transport considers that the distance transported is not a primary issue, provided there are appropriate safeguards written into the Transport Code.[9] If radioactive materials are of a higher level, the distance involved becomes a more important factor to be considered.[10]

5.10 Notwithstanding the absence of major incidents, a commercial industrial gauge company which moves radioactive sources in gauges for use at mine sites around Australia has had difficulty in getting transport companies to take this cargo. It was suggested to the Committee that this was a perceived rather than an actual hazard.[11]

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7 Codd M (1995) *Review of Arrangements for the Recent Transportation of Radioactive Waste*, July 1995, p. 16

8 Munslow-Davies, Transcript of Evidence, p. 309

9 Makeham, Transcript of Evidence, p. 687

10 Ibid, p. 688

11 Munslow-Davies, Transcript of Evidence, p. 309-310

5.11 Senator Cook (former Minister for Industry, Science and Technology) designated the shipment of spent fuel rods from Lucas Heights to the United Kingdom under the *Environment Protection (Impact of Proposals) Act 1974* to ensure that transportation arrangements are open to public scrutiny.[12] The spent fuel rods are be transported by road in Australia and the United Kingdom. ANSTO has prepared a risk assessment study and concluded that:

> the road transport phase of the shipment, in both Australia and the United Kingdom, will have no environmental or health consequences for workers or the public, taking into account both normal incident-free operations and a range of possible accident scenarios encompassing accident severities up to and beyond the maximum credible accident.[13]

5.12 The first load of 110 fuel rods was moved through Sydney suburbs about midnight on the 18 April 1996 to be loaded on the merchant vessel Condock bound for Dounreay in Scotland. Despite the presence of a police convoy and a fire brigade unit, Greenpeace were concerned that there were still some unresolved safety issues.

5.13 In developing the proposal for the Mt Walton waste repository, Western Australia, considerable attention was given to the question of whether waste should be moved by road or rail. The environmental approval of the Mt Walton site allows for small quantities of material to be moved by road but the question should be reconsidered for larger quantities.[14]

5.14 Although there is a general assumption that rail travel is safer, the Committee was told that in Western Australia the rail system has a high accident record.[15] Last year a train was derailed on the Queensland Sunshine Coast hinterland, though the radioactive waste containers did not split open.[16]

5.15 Air transport should not be discounted, considering Australia's excellent air safety record and the long distances over which material may have to be

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12 Senator Peter Cook (former Minister for Industry, Science and Technology) and Senator Bob Collins (former Minister for Primary Industries and Energy) *'Spent Nuclear Fuel to Leave Australia'* Joint Media Release, 27 October 1995, p. 1

13 Australian Nuclear Science & Technology Organisation (1995) *Public Environment Report, Transport of HIFAR Spent Fuel from Lucas Heights Research Establishment to the United Kingdom for Reprocessing,* October 1995, p. 30

14 Davies, Transcript of Evidence, p. 270

15 Peebles, Transcript of Evidence, p. 838

16 Mahoney, Transcript of Evidence, p. 628

transported. The volume and level of radioactivity of the waste need to be considered because of the additional precautions required to ensure that the packaging could withstand a plane crash.

Suggestions

5.16 The Western Australian Chamber of Mines and Energy attributes the lack of transport incidents in the mineral sands industry to the use of long term contracts with a particular haulier whose drivers are trained on the occupational hazards involved.[17]

5.17 During the Inquiry it was suggested that local authorities should be advised and contingency plans established for each area.[18] For example, when concentrated uranium ore (yellow cake) from Roxby Downs transits Port Augusta, police control the traffic on the bridge through the main thoroughfare. It was also suggested that more training is needed for fire services and State Emergency Services, whose members are not always fully trained and equipped to handle radioactive spillages en route.[19] The concern is that training in these services is limited to cleaning up the material, and inadequate attention may be given effects on the health of emergency workers.

5.18 Suggestions included:

- a team of trained and well-equipped people could accompany the radioactive material so that an accident could be dealt with immediately;[20]
- waste disposal companies which have safety and spill equipment and training response and escort vehicles for other classes of dangerous goods, could also deal with radioactive substances;[21]
- a police, army or suitable guard escort should accompany the transportation of radioactive waste;[22] and
- radioactive waste transport vehicles should travel in convoys, as drivers would be better able to maintain a safe area whereas single units do not have that capacity.

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17 Schache, Transcript of Evidence, p. 284

18 District Council of Paringa, Submission No. 6, p. 1

19 Pitt, Transcript of Evidence, p. 163

20 Ibid, p. 167

21 Wong, Transcript of Evidence, p. 743

22 District Council of Paringa, Submission No. 6, p. 1; Pitt, Transcript of Evidence, p. 163

5.19 Rhone Poulenc proposes to include a Global Positioning System satellite tracking system for vehicles transporting radioactive waste from its proposed Pinjarra rare earth processing plant to the Mt Walton repository. This will enable the identification of and communication with vehicles in the case of an accident.[23]

5.20 It is inevitable that from time to time radioactive waste will need to pass through areas which are environmentally sensitive or farming areas which have international markets in food, wine or ecotourism. Australia enjoys a reputation of being a clean food producing nation: Ms Lannstrom stressed that accidents in areas such as the Murray Darling River basin, the third largest river system in the world, could severely damage our international reputation and have vast economic consequences.[24] It was suggested that alternative routes around environmentally sensitive areas or cities could be used to transport this waste.[25] For example, the consignment of radioactive waste to the Esk storage facility, Queensland, took a longer route to by-pass the wall over the Wivenhoe Dam.[26]

Recommendation 11

The Committee recommends that the transportation of significant amounts of radioactive materials should require an assessment of the most appropriate transport mode.

5.21 Community consultation processes should be considered during the review of the transport guidelines and legislation.[27] It was suggested that an independent consultant should consider the details of any proposed movement of Commonwealth owned radioactive waste.[28] The Committee believes,

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23 Newton, Transcript of Evidence, p. 701

24 Lannstrom, Transcript of Evidence, p. 190

25 Botten, Transcript of Evidence, p. 174-175

26 Mahoney, Transcript of Evidence, p. 627

27 City of Port Augusta, Submission No. 4, p. 4

28 Ibid, p. 4

however, that for most transport operations, authorities' concerns could be adequately dealt with by sufficient consultation with state and local governments.

Recommendation 12

The Committee recommends that State governments and local councils en route should be fully notified of the route and contents of radioactive waste consignments and should be given sufficient practical knowledge to be able to devise and implement contingency plans.

Conclusions

5.22 Where it is necessary to transport significant quantities of radioactive waste the full range of options should be considered including rail, sea and air transport provided the necessary safety precautions are taken in each case.

5.23 In weighing up a 'one central repository' scheme versus a 'several local repositories' scheme the desire to move waste away from populous areas must be weighed against the risks of transport. It was suggested that:

> there is a very significant risk in transporting large volumes of high level waste to a repository.[29]

5.24 It was suggested that it may be preferable to have several regional or local interim storage sites where waste could be retained until it has decayed to levels more acceptable for longer distance transport. This may present a lower risk than trying to move larger volumes of high or intermediate level radioactive waste.[30]

5.25 On balance the Committee does not believe that this approach is the most appropriate. Much of the higher level waste has a longer half life and this

29 Hanlon, Transcript of Evidence, p. 430

30 Ibid, p. 430

approach would increase the amount of handling. There are also the issues of security at a number of sites, and additional distances involved in moving the material to an interim regional storage facility and then moving it to a more permanent site. The Department of Transport also believes that distance is not a major concern, provided that the correct precautions are taken.[31]

5.26 The *Code of Practice for the Safe Transport of Radioactive Substances* is currently being revised and many concerns in relation to its readability and regulatory limits must be addressed in that process.

31 Makeham, Transcript of Evidence, p. 687

CHAPTER 6

STORAGE AND DISPOSAL OF RADIOACTIVE WASTE

6.1 The issues of storage and disposal are quite separate. The major difference is that stored materials remain accessible whereas disposal assumes there is no intention of retrieving the radioactive waste. The principal considerations for storage facilities are containment, monitoring and security. Siting and design are the most critical factors for disposal facilities.[1] With both storage or disposal arrangements the primary concern is avoiding potential health effects on future, as well as current, generations.

6.2 The multilayer approach employs a series of physical and chemical barriers to provide protection from radioactive materials until the decay process reduces radioactivity to near background levels.

> The multibarrier approach sets standards for the safe disposal of radioactive wastes which go far beyond those now applied to the disposal of other toxic and hazardous waste.[2]

Short Term Storage

6.3 Although the quantities of radioactive waste in Australia requiring storage are not large, it was apparent to the Committee that there is a need to review the national inventory of material which might require storage in a national facility.

Commonwealth Storage Facilities

Australian Nuclear Science and Technology Organisation

6.4 One of the most pressing needs for the Commonwealth is to develop an appropriate management plan for dealing with ANSTO's radioactive waste held at Lucas Heights, including that resulting from the decommissioning of the research reactors.

6.5 A total of 1 140 cubic metres of radioactive waste stored on site at Lucas Heights, has been produced over a 40 year period of operation.[3] ANSTO told

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1 Smith, Transcript of Evidence, p. 663

2 Uranium Institute (1992) 'The management of radioactive waste' *The Mining Review* (August 1992): 8-15, p. 10

the Committee that it can store the low level waste at the site in the existing buildings for a couple of years before there is a need to construct new buildings.[4] The Committee was told that there are no physical limits on the storage of radioactive waste at Lucas Heights and technically there is no practical urgency to send the material to a national repository. However ANSTO is aware that the local community may feel differently.[5]

The Committee inspecting the low level solid radioactive waste store at Lucas Heights. (Photograph provided by ANSTO)

6.6 Greenpeace argued that above ground storage facilities on site are preferable to below ground burial facilities elsewhere, particularly for the radioactive waste produced by ANSTO:

> ANSTO is considered competent to operate a nuclear reactor at Lucas Heights which discharges radioactive gases over residential areas and effluent into the local river. According to the

3 Rolland, Transcript of Evidence, p. 63

4 Rolland, Transcript of Evidence, p. 70

5 Jostsons, Transcript of Evidence, p. 72

> Government they are able to do this without harm to the local residents, and may get permission to build a replacement reactor three times as large. How, then, can the Government maintain that an above ground store for low- and short-lived intermediate level radioactive waste at Lucas heights is unacceptable on safety grounds? ... Why putting radioactive wastes in a trench at a remote location is safer than storing it at a dedicated nuclear facility has never been properly explained by DPIE. Greenpeace still maintains that it is designed to put an embarrassing political problem for ANSTO "out of sight and out of mind".[6]

The building containing the spent fuel dry storage facility and the solid intermediate level waste storage facilities (Photograph provided by ANSTO)

6.7 Greenpeace argued that the main criticisms of above ground storage are the loss of knowledge of what is being stored on site, changing land uses of storage sites, companies going out of business and the risk of abandonment.[7]

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6 Greenpeace, Submission No. 48, p. 10

7 Ibid, p. 10

Greenpeace pointed out that none of these should apply to the ANSTO facility which produces 90 per cent of the radioactive waste that would go to a national facility.[8] ANSTO also told the Committee that:

> there is sufficient space at ANSTO site for storage of solid [radioactive] waste well into the 21st Century ...[9]

6.8 Sutherland Shire Council, however, told the Committee that the Safety Review Committee reported three years ago that on-site storage facilities at ANSTO were almost at exhaustion point and above ground ponds were being used to store the spent fuel rods.[10]

The Committee inspecting the irradiation pond, the principal wet storage facility for HIFAR spent fuel. The pond is also used as an irradiation research facility. (Photograph provided by ANSTO)

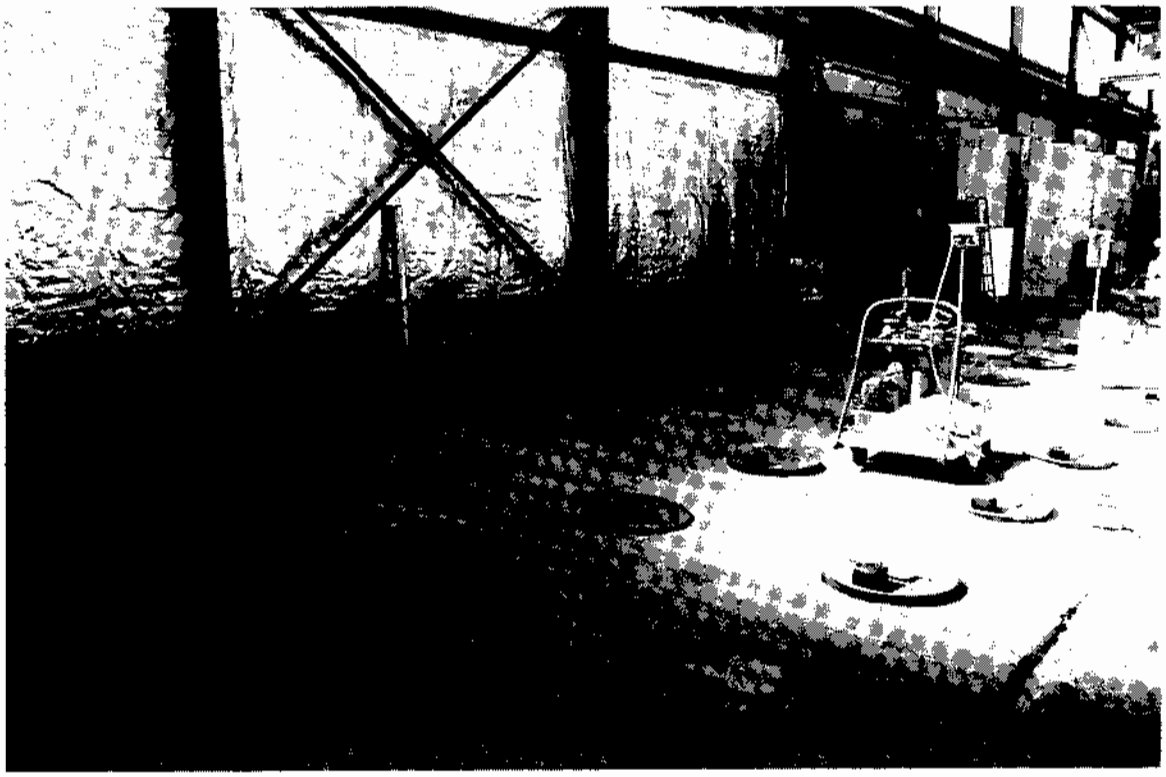
8 Greenpeace, Submission No. 48, p. 10

9 Ibid, p. 10

10 Carter, Transcript of Evidence, p. 582-583

6.9 The Committee was told that the site was inappropriate because it is located in the middle of one of the fastest growing urban communities in Sydney; it is on land situated on the water table for major waterways which feed into the Georges and Woronora Rivers; and is situated on Hawkesbury sandstone which is fissured and unstable.[11]

6.10 The *Future Reaction* Review in 1993 considered that the present interim storage at Lucas Heights is in conformity with world's best practice and is the safest and most practicable short term arrangement.[12] The Sutherland Shire Council stressed that this statement refers to world's best practice for a short term facility; and that it is not in accordance with world's best practice for a long term storage facility.[13]



The HIFAR spent fuel storage facility with dry storage for 1100 elements contained in stainless-steel-lined holes drilled into rock. The radiation shield plugs also seal the tops of these stainless-steel tubes in which the elements are stored in a dry nitrogen atmosphere. The trolley contains monitoring instrumentation (Photograph provided by ANSTO).

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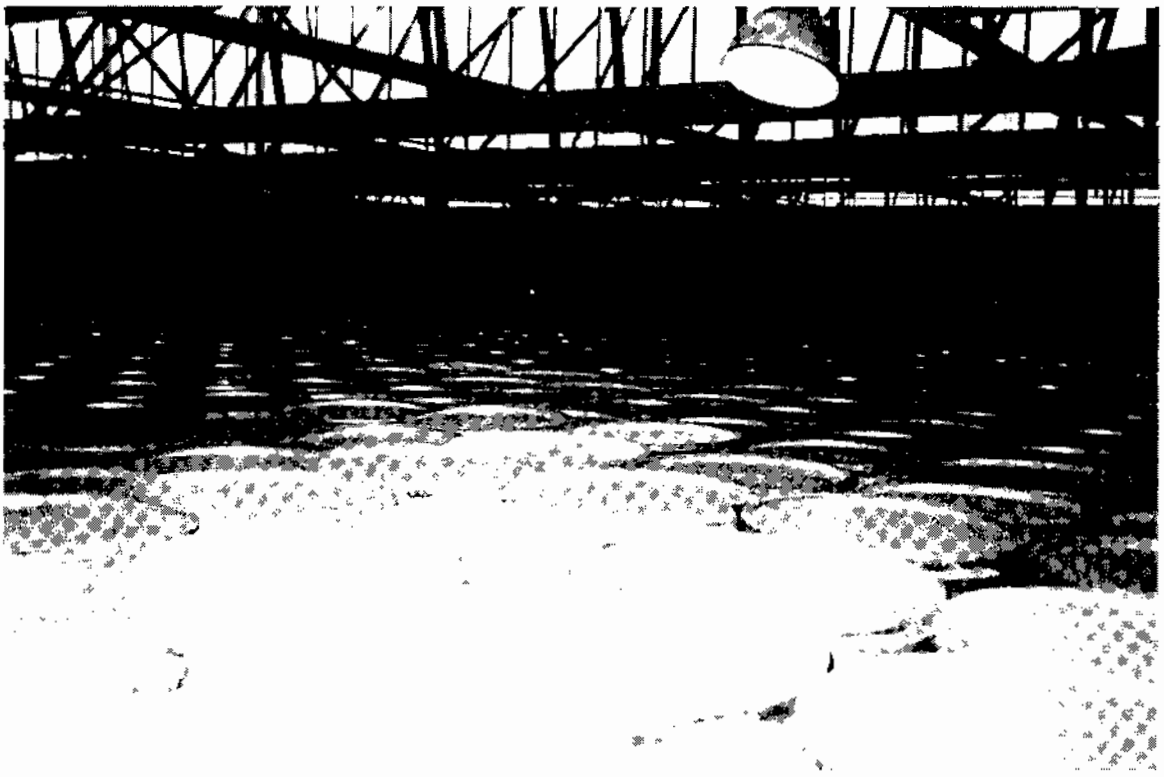
11 Robertson, Transcript of Evidence, p. 570; Rankin, Transcript of Evidence, p. 539

12 Research Reactor Review (1993) *Future Reaction: Report of the Research Reactor Review*, Commonwealth of Australia, August 1993, p. 216

13 Robertson, Transcript of Evidence, p. 563

Woomera

6.11 Most of the Fishermens Bend soil has very low radioactivity levels[14] and is currently stored in drums in a disused aircraft hanger at Woomera.



The Fishermens Bend contaminated soil stored at Woomera

6.12 The Australian Defence Industries material from St Marys is about half low level material and about half intermediate level material[15] and is now stored in the bunker at Woomera. The above ground bunker has a concrete wall three metres high on three sides with a raised earth mound on one side. The dose rates outside the bunker are less than one microsievert per hour. This level complies with the South Australian State regulations which require that areas accessible to the public do not exceed 25 microsieverts per hour.[16]

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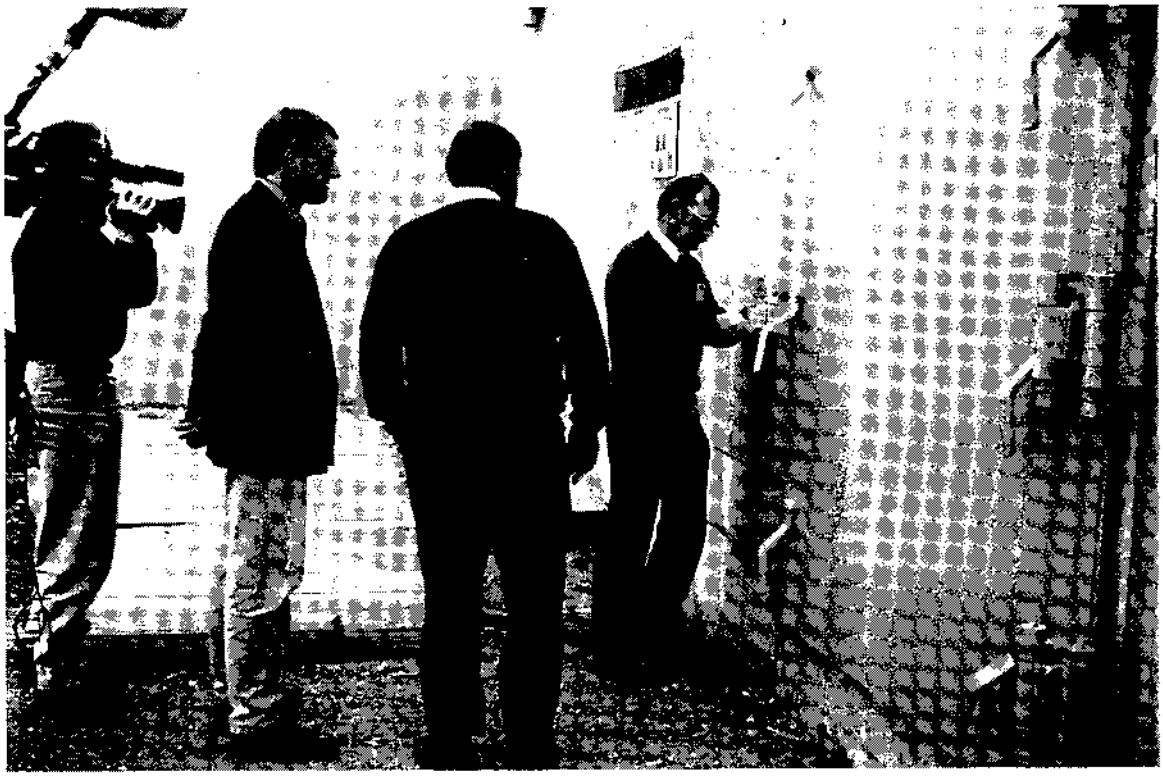
14 Burns, Transcript of Evidence, p. 105

15 Curtis, Transcript of Evidence, p. 116

16 Ibid, p. 127

6.13 An additional roof has been added to prevent rain water leakage and two chimney ducts were installed to prevent the build up of radon gas within the bunker.[17] The Committee notes that no radon monitoring equipment has been installed comparable to that in the Queensland's Esk facility. The Committee feels that the absence of monitoring equipment has left the Commonwealth open to future compensation claims, as evidence as to the low level or absence of radon gas in the facility cannot be provided. This will need to be considered, particularly if additional radioactive material is to be stored in the bunker.



The Committee Chairman inspecting the bunker at Woomera

6.14 It is expected that the radioactive waste presently at Woomera will remain there until the national facility is established.

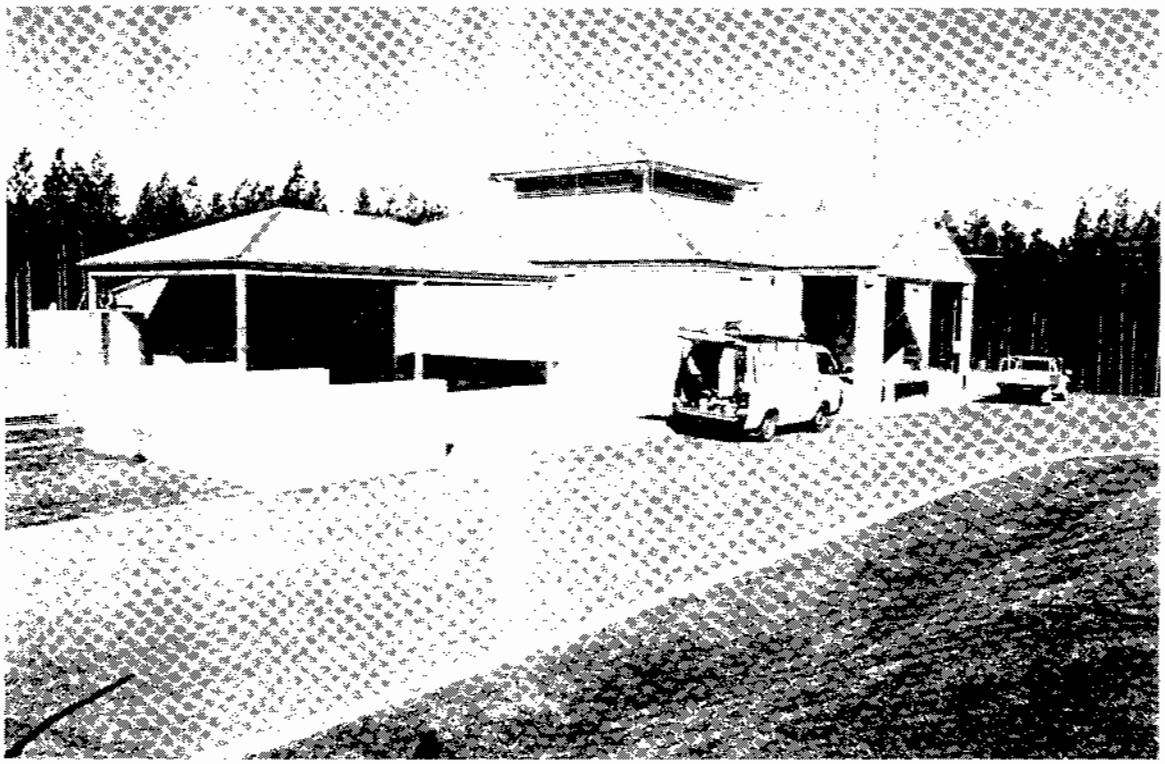
6.15 Other Commonwealth radioactive wastes are stored on site at a number of locations throughout Australia such as Department of Defence and CSIRO premises.

17 Curtis, Transcript of Evidence, pp. 119-20

State Storage Facilities

Esk Storage Facility

6.16 The above ground, purpose built concrete storage facility at Esk in Queensland enables the integrity of the structure to be monitored and any problems to be easily detected.



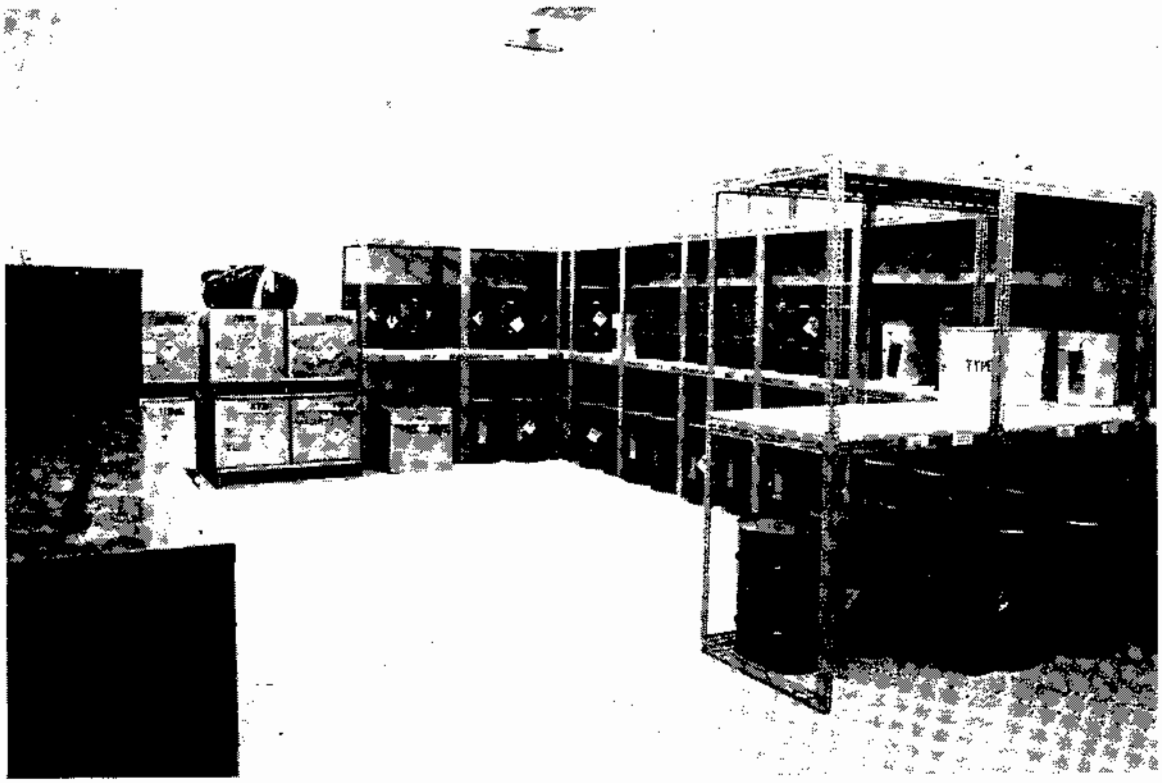
The Esk facility (Photograph provided by the Queensland Department of Health)

6.17 It has electronic surveillance. It is not far away from fire services and police. There is a full operational audit every month.[18] The Australian Radiation Laboratory commented that:

> The State of Queensland should be congratulated on its efforts, in view of the considerable opposition to the project and for leading

18 Kleinschmidt, Transcript of Evidence, p. 722

the country by providing this facility which will no doubt become the benchmark for the rest of the country to follow.[19]



The radioactive Waste Stored in the Esk Storage Facility (Photograph provided by the Queensland Department of Health)

6.18 The Queensland Greens expressed concerns about the location of the facility in the Brisbane River catchment area, which supplies water for south east Queensland and is surrounded by small farm crops which are irrigated from underground bores.[20] The Queensland Greens were concerned that there was no ground water quality monitoring to detect any long term contamination. The site is also located over a fault line.[21]

6.19 Disposal options have not been considered as this facility was always considered to be for storage only.[22] There are still significant amounts of

19 Cited in Queensland Government, Submission No. 30, p. 1

20 Mahoney, Transcript of Evidence, pp. 619, 622

21 Ibid, pp. 621- 622

22 Wallace, Transcript of Evidence, p. 713

radium stored which are not suitable for shallow ground burial.[23] The Committee was told that the Esk community is concerned that this higher level material will remain at Esk until the Commonwealth provides a radioactive waste facility.[24]

Other State Facilities

6.20 The Victorian Government has a new purpose built storage facility and the Northern Territory proposes constructing one in the near future. [25] The New South Wales Government has two storage facilities at Lidcombe.

Individuals and organisations

6.21 In the past, hospitals have been able to send sealed sources to the relevant State or Territory authority. However, in some states this is no longer an option.[26] Most hospitals have some radioactive materials they wish to send to the proposed national facility. Examples given to the Committee include St George Hospital which has a number of small point sources[27], Royal Perth Hospital which has some radium and caesium sources[28], Royal Adelaide Hospital which has a large cobalt[60] therapy source.[29] A doctor in Adelaide has a strontium[90] ophthalmic applicator.[30]

6.22 The Royal Alexandra Hospital for Children does not believe that the storage of long term radioactive waste on site in hospitals is the most desirable option.[31] Westmead Hospital has limited facilities for handling radioactive waste and is only able to store materials on a temporary basis. The hospital believes that this is fairly typical of large medical institutions.[32] The Committee was told that:

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23 Wallace, Transcript of Evidence, p. 714

24 Mahoney, Transcript of Evidence, p. 640

25 Victorian Government, Submission No. 37, p. 3; Northern Territory Government, Submission No. 14, p. 7

26 The Alfred Healthcare Group, Submission No. 67, p. 1

27 St George Hospital, Submission No. 66, p. 3

28 Royal Perth Hospital, Submission No. 69, p. 1

29 Paix, Transcript of Evidence, p. 224

30 Ibid, p. 224

31 Hanlon, Transcript of Evidence, p. 750

32 Westmead Hospital and Community Health Services, Submission No. 65, p. 2

> security of storage can often be a problem, as can ventilation, water inflow, flammable liquid storage etc. To my knowledge very few hospitals and universities have adequate radioactive waste storage and disposal arrangements (which should also include facilities for waste compaction).[33]

6.23 There are still a lot of caesium and radium sources.[34] The Committee was told that caesium[137] sources such as decommissioned radiotherapy sources should never be kept in hospitals because they are too dangerous.[35] Caesium has a half life of 32 years.[36] In the Soviet Union a terrorist bomb was made from caesium[137] combined with an ordinary explosive charge.[37]

6.24 Oncology departments will continue to use caesium in the foreseeable future although much of this will be returned to the manufacturer.[38] A number of large caesium sources used in the treatment of gynaecological cancer will need to be stored in 3-4 years time.[39] Mr Griffiths that it was more appropriate that:

> a single set of guidelines and a single repository for waste would be more appropriate than having it spread around the countryside.[40]

6.25 The Alfred Healthcare Group also provided a scenario in which changing staff and conditions at hospitals may lead to unidentified sources being disposed of in an unsafe manner.[41] Some States now have a system for registering radioactive sources, although this approach was not without criticism:

> Registration of these sources is better than doing nothing, but it will not guarantee the safe custody of sources over a very long period of time. In the past, difficulties have arisen because early pract[it]ioners have retired or died, records were incomplete or non-existent; labels deteriorated or were obliterated; storage safes were relocated, buildings have been renovated, designated for

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33 Westmead Hospital and Community Health Services, Submission No. 65, p. 3

34 Collins, Transcript of Evidence, p. 759

35 Ibid, p. 774

36 Ibid, p. 758

37 Elbourne, Transcript of Evidence, p. 803

38 Collins, Transcript of Evidence, p. 768

39 Griffiths, Transcript of Evidence, p. 753

40 Ibid, p. 753

41 The Alfred Healthcare Group, Submission No. 67, p. 1

> other uses or demolished. Given the half life of radionuclides such as radium-226 (1600 years), it would be a brave hospital administrator indeed who foresees no problems over the ensuing centuries.[42]

6.26 There are also some problems in some universities. Mr Paix told the Committee that when he:

> arrived on the scene and became a radiation safety officer, I was faced with this waste - improperly labelled, some of it rusting away and in poor condition. All I could do with the facilities and time I had was to check it for gamma emissions and make sure that it could be stored safely without any impact on staff or the environment.[43]

6.27 Hospitals and universities established 100 years ago, many of which are located in densely populated areas, could not have foreseen the need to store the variety and quantities of radioactive wastes that exist today. Mr Fleischmann expressed his concern that organisations such as hospitals and scientific facilities are not set up to store their own waste indefinitely.[44]

6.28 This is a situation where radioactive waste may be stored locally and is 'in sight and in mind', but long term better facilities are required for these wastes.[45] The Committee notes that much of this material is derived from obsolete techniques. A balance is needed between the 'in sight in mind' concept and public safety in populated areas. The Committee considers that public safety provides a powerful argument for a central facility to store intermediate level radioactive waste.

One Site or a Number of Storage Sites

6.29 The Commonwealth Environment Protection Agency believes that a national repository for long term storage of radioactive materials would provide stronger environmental safeguards than the present system of multiple storage

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42 Towson, Submission No. 38, p. 2

43 Paix, Transcript of Evidence, p. 215

44 Fleischmann, Transcript of Evidence, p. 479

45 Lewis, Transcript of Evidence, p. 648

sites.[46] Others argue that organisations using radioactive material should be required to keep it in a safe and secure storage facilities on site.[47]

6.30 Conservation groups believe that a purpose built, fully enclosed, storeroom on the site of production is the preferred option.[48]

> on site, surface engineered, monitored storage is preferable to a single national repository. This is especially true if that repository makes use of a discredited disposal mode such as shallow-land burial. If this disposal mode is chosen for all LLW then, we argue, much of the waste in Australia may in fact be better contained in its existing sites and structures. This does of course, depend highly on the exact conditions in which the waste is currently stored.[49]

6.31 Mr Ian Taylor argued that this approach is not suitable for Western Australia:

> the ad hoc storage of these wastes and the ad hoc solution for Western Australia is not a reasonable or proper solution.[50]

6.32 The Committee's concern is that a number of witnesses commented on the inadequacy of some existing storage sites and the difficulties in having facilities upgraded due to tight budgetary constraints. The Committee was told that storage facilities in some states are inadequate.[51] The Committee believes that the existence of a central storage facility would provide an additional option on a user pays basis for those in this situation. Those having adequate storage facilities could be expected to retain the radioactive materials on site.

6.33 There are risks to staff and members of the public if waste is retained in inadequate facilities. Some intermediate level discrete sources are of particular concern. Many hospitals have adequate facilities for dealing with low level wastes but are concerned about keeping higher level waste in a public facility.

6.34 The Committee was told that there are probably more than one hundred radioactive waste storage sites at the moment.[52] The former Minister for

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46 Johnston, Transcript of Evidence, p. 691

47 Botten, Transcript of Evidence, p. 171

48 Pearson, Transcript of Evidence, p. 464; Nuclear Issues Action Group, Submission No. 42, p. 4

49 Friends of the Earth, Submission No. 47, p. 3

50 Taylor, Transcript of Evidence, p. 862

51 Hartley, Submission No. 24, p. 1

52 Hochman, Transcript of Evidence, p. 216

Primary Industries and Energy puts the figure at 50 sites.[53] The advantages of needing to maintain security at only one site must be balanced against the risks of transportation. When a number of locations are involved there is an increased danger of somebody accidentally stumbling across the material, the building burning down[54] or deliberate or accidental breaches of security.[55]

6.35 Security for a central facility as opposed to a number of local storage sites is an important issue. The safe storage of higher level radioactive waste in the public domain such as a public hospital would be much more difficult than security at a dedicated facility.[56]

> As it is virtually impossible to assure absolute security in a hospital, this remains a matter of constant concern.[57]

6.36 Another problem identified with having many on-site stores is the increased potential for abandonment and mishandling of that waste. The storage of long lived sealed sources which are used for therapy purposes in hospitals is of particular importance.[58] There have been some particularly nasty incidents in other countries where institutional control has been lost. Mr Fleischmann told the Committee that one of the worst radiation accidents involved a medical source.[59] The human consequences of lack of institutional control were evident in Goiana in Brazil.[60] Several people died, many were contaminated and hundreds of truckloads of contaminated waste had to be stored.[61]

6.37 The University of South Australia has 'good' security for a concrete room but is concerned that in the event of a major fire, a dispersal hazard could be created by the radioactive materials.[62]

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53 Collins B, (1994) former Minister for Primary Industries and Energy, *Phase Two of Radioactive Waste Repository Site Selection Study Released for Public Comment,* Media Release 18 July 1994, p. 1

54 Hochman, Transcript of Evidence, p. 217, 223

55 Paix, Transcript of Evidence, p. 224

56 Towson, Transcript of Evidence, p. 523

57 Royal Alexandra Hospital for Children, Submission No. 5, p. 5

58 Towson, Transcript of Evidence, p. 524

59 Ibid, p. 524

60 Davoren, Transcript of Evidence, p. 37

61 Elbourne, Submission No. 53, p. 2

62 University of South Australia, Submission No. 27, p. 1

6.38 The Westmead Hospital believes that in the absence of a national repository:

> the conflicting waste disposal guidelines of the NHMRC and the various states, it is virtually impossible to dispose of radioactive waste until it is of very low activity ... Most hospitals allocate a relatively small area of greatly varying levels of security and suitability for waste storage. In some cases these are a potential source of risk, from say, flooding and forced entry.[63]

6.39 One of the problems with having a number of storage facilities in cities is the likelihood of future redevelopment of sites in populated areas. For example, the Royal Alexandra Hospital for Children has recently moved from Camperdown. The redevelopment of the Australian Defence Industries site at St Marys required the removal of waste stored there.

6.40 One of the difficulties associated with covering radioactive waste with soil, particularly in a metropolitan area, is the construction of a multistorey building or installation of water pipes which requires digging to a greater depth than that required for a standard house. Mr Fleischmann does not believe it is a good practice to leave radioactive waste at any disused site or potential redevelopment site.[64]

6.41 The current practice in mineral processing operations is for tailings to be returned to the mine site and covered with at least five metres of non mineralised sand. The location is recorded to ensure that no inappropriate use may take place in the future.[65] In the case of Westralian Sands, the company maintains those sites on its own land.[66] The Committee is concerned that these pockets of high level radioactivity may present a risk in the future if the area is breached. The costs of transporting mineral sands tailings to a national repository, however, is generally considered prohibitive.[67]

6.42 The Committee was told that:

> the very clear preference of every government in Australia is that we have a central facility. Issues of efficiency are involved - the

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63 Westmead Hospital and Community Health Services, Submission No. 65, p. 2

64 Fleischmann, Transcript of Evidence, p. 495

65 Fee, Transcript of Evidence, p. 280; Dench, Transcript of Evidence, p. 278, 280; Schache, Transcript of Evidence, p. 277

66 Dench, Transcript of Evidence, p. 280

67 Rawson, Transcript of Evidence, p. 42

> costs of maintaining a whole lot of separate stores are quite large over the nation.[68]

6.43 The opposing argument is that the long term risks of concentrating all radioactive waste in one place are enormous and there is an additional increase in transporting that waste over long distances.[69] It was suggested that the disposal of this material at a convenient site in the middle of nowhere would not discourage the creation of further radioactive industries.[70]

6.44 The evidence to the Committee indicates that most radioactive waste producers can cope with the storage of the radioactive waste they generate annually, but it is waste of historic origin that causes the most concern. In the past a number of organisations have stored radioactive waste for others. The future management of any radioactive material from the closure of hospitals or private medical practices must be considered on a case by case basis.

6.45 A possible compromise would be to retain most on site waste with a capacity for the relevant authority to consider requests from individuals or organisations to store certain materials at a national facility. The Committee believes that this approach would enable assessment of situations which may constitute a potential public health risk, while not encouraging the increased production of radioactive materials simply because there is an easy storage solution.

Above Ground Storage Versus Underground Disposal

6.46 Evidence to the Committee suggests there was considerable opposition to the shallow burial of the radioactive waste even at the levels permitted under the *Code of Practice for the Near Surface Disposal of Radioactive Waste in Australia 1992.*

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68 Davoren, Transcript of Evidence, p. 32

69 Lowe, Transcript of Evidence, p. 319

70 Ibid, p. 319

Above Ground Storage

6.47 Storing radioactive waste above ground will enable the maximum number of management options to be available in the future.[71] Stored wastes remain accessible if new technologies for processing it, are developed.

6.48 Dr Fenton believes that a technology which will enable the destruction of heavy radioactive nuclei will eventually be developed.[72] He gave the example of the natural spallation process in which heavy nuclei are broken into smaller fragments as a result of collisions with interstellar gas atoms or in the top of the earth's atmosphere.[73] This process can be reproduced in overseas laboratories and it is possible that:

> fundamental research with colliding beams of accelerated nuclei, now being undertaken in the US and Europe, may lead to such spallation processes becoming a practical reality.[74]

6.49 Friends of the Earth pointed out that at l'Aube in France, the heavily engineered vaults designed to last for 10 000 years and to be out of reach of ground water, come very close to being above ground permanent storage.[75] The Committee was told that the French would be storing their high level waste until the year 2010.[76] They will then determine what they will do with it.

6.50 Australia produces about 50 cubic metres per year compared with France's one million cubic metres per year.[77] Some hold the view that storage should be temporary until the scientific community can determine safe disposal methods or recycling or reuse options. Western Australia built its first above ground storage facility in 1967. It is still useable and in quite good condition.[78] It follows therefore that a storage facility of the standard recently constructed at Esk in Queensland would be able to store Australia's radioactive waste until international research is able to develop technologies capable of dealing with the waste materials.

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71 Baker, Transcript of Evidence, p. 150

72 Fenton, Transcript of Evidence, p. 732

73 Ibid, p. 732

74 Fenton, Submission No. 18, p. 1

75 Hallam, Transcript of Evidence, p. 442

76 Munslow-Davies, Transcript of Evidence, p. 307

77 Ibid, p. 308

78 Ibid, p. 304-305

6.51 On the other hand, it was argued that an above ground storage facility would result in double handling of the waste; would require greater maintenance than shallow burial repository; and that buried waste is more secure, as earth moving equipment would be needed to recover it.[79]

6.52 Mr Fleischmann told the Committee that it is perceived that above ground storage facilities were automatically safer.[80] An illustration that this is not necessarily the case was that of a radiotherapy source stored in a building in Brazil. It was obtained and broken open by a scrap metal dealer. Half the city was severely contaminated and four people died.[81]

6.53 An important consideration is the suitability of shallow ground burial for only low and some intermediate level waste. Higher level wastes need to be in above ground storage.[82] There is an ongoing need to store radium and americium, which are not suitable for shallow ground burial, above ground.[83]

6.54 A further advantage of above ground storage is that if a national repository could accommodate higher level radioactive waste, existing low level waste could be concentrated, shredded or compacted to reduce its volume, provided adequate safeguards were used.[84]

6.55 The Committee supports the establishment of an above ground waste facility over the burial option because:

- higher level radioactive wastes could be accommodated which are currently being stored in less than optimum circumstances;
- radium and some other materials are not suitable for burial;
- it is not economically feasible to build a deep burial facility for Australia's current quantities of radioactive waste; and
- above ground storage allows the retrieval of the waste if new technologies are developed to use or process the waste, while burial, for practical purposes, makes waste irretrievable.

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79 NSW Environment Protection Authority; Supplementary Submission No. 45a, p.2

80 Fleischmann, Transcript of Evidence, p. 476

81 Ibid, p. 476-477

82 Colgan, Transcript of Evidence, p. 393-394

83 Wallace, Transcript of Evidence, p. 714

84 Wong, Transcript of Evidence, p. 742

6.56 Radioactive waste could be stored for the next 100 years and if no solution is found, it could then be buried, utilising experience and knowledge gained during that period. For example, at Oak Ridge National Laboratory Tennessee the disposal method for solid low level waste was radically changed from unlined shallow trenches in 1986 to concrete silos and lined auger holes and in 1994 to above ground tumulas.[85]

6.57 With burial there is a risk of contaminating the environment through leakage to ground water. It was pointed out that the engineering costs associated with ensuring that the burial facilities are not likely to leak, could be better spent on an above ground facility which will have the capacity to store all levels of radioactive waste, without the same risks.[86]

Below Ground Storage

6.58 One submission suggested the storage of low and intermediate radioactive waste below ground in coal mines. It was suggested that this is a technically feasible and cost effective solution. Advantages include the close proximity to the major source of radioactive waste, accessibility by road and rail and location in an area not heavily inhabited.[87] This method may be suitable for high level waste if the design was modified to deal with potential problems with high temperatures.[88]

6.59 Chambers could be made earthquake resistant and any size required; other technical requirements can be accommodated at increased cost.[89] The chambers would form a controlled environment through continuous monitoring and regular inspections of the materials.[90]

6.60 Germany and Sweden use different forms of deep geological storage for high, intermediate and low level waste and Sellafield in the United Kingdom uses this storage method for both intermediate and low level waste.[91]

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85 Kendrick C (1994) *Environmental Restoration and Management of Low-Level Radioactive and Mixed Waste at Oak Ridge National Laboratory*, Institute of Engineers Australia and Australian Nuclear Association, 9th Pacific Basin Nuclear Conference, Sydney, 1-6 May 1994, , p. 965

86 Fenton, Transcript of Evidence, p. 735

87 Bhattacharyya, Transcript of Evidence, p. 817

88 Ibid, p. 814

89 Bhattacharyya, Transcript of Evidence, p. 815; Fairclough, Transcript of Evidence, p. 820

90 Bhattacharyya, Transcript of Evidence, p. 813

91 Friends of the Earth, Submission No. 47, p. 4

6.61 The Committee believes that any proposal to place radioactive waste underground in the Illawarra region or any other populated area would generate considerable community concern.

Disposal Options

6.62 Radioactive material cannot be destroyed. Hence, the term 'disposal' in this context refers to the isolation of longer lived or higher level radioactive waste from the environment. There was concern within the community that:

> The notion that radioactive waste can be disposed of is dangerous and erroneous.[92]

6.63 Disposal in the context of radioactive waste means putting it somewhere where retrieval is not intended. A great deal of effort has gone into finding a suitable method of disposing of radioactive waste but this has not yet been achieved.

> It is almost certain that more effort and resources have been devoted to finding an acceptable and safe disposal route for radioactive wastes than for any other kind of waste.[93]

6.64 Near-surface disposal of low-level waste, usually in steel drums buried in shallow earth or concrete lined trenches, at depths of about thirty metres, has been practised internationally for over thirty years.

6.65 There is an international trend away from shallow ground burial due to problems with existing sites.[94] Many countries have had to remediate their earlier dangerous procedures, where material has migrated into the surrounding areas, either through inadequate packaging, poor engineering, or unsuitable location. Some early burial sites were just holes in the ground.[95]

6.66 The Committee was given some notable examples. At Maxey Flat in the United States, plutonium has migrated more than two miles off site in less than nine years, although estimates were that it would migrate half an inch in 24 000 years.[96] At Hanford in the United States, a high level facility leaked 500 000

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92 Women Opposing Uranium Mining, Submission No. 39, p. 6

93 Uranium Institute, (1992) 'The management of radioactive waste' *The Mining Review* (August 1992): 8-15, p. 11

94 Greenpeace, Submission No. 48, p. 5

95 Fleischmann, Transcript of Evidence, p. 486

96 Schrader-Frechette, Submission No. 2, p. 1-2

gallons of waste into the soil at Columbia River and the Pacific Ocean.[97] In Soviet Kasli, 22 square miles were made uninhabitable by high level radioactive waste that went critical three decades ago.[98]

> The US government has extrapolated, on the bases of past leaks at its nuclear waste facilities ... that future leaks should occur at the rate of two to three per year. Using US government-estimated exposure levels (580 person rem) at each radwaste site, each existing facility could cause approximately 12 cancers and 116 genetic deaths per century, and ultimately, tens of thousands of cancers per storage site.[99]

6.67 It was also pointed out that future generations can not be guaranteed that repositories would not be breached:

> through war, terrorism or drilling for minerals or that water and heat will not combine to create nuclear reactors in underground waste, as already has happened in the USSR.[100]

6.68 Dr Schrader-Frechette told the Committee

> Radioactive waste probably ought not be buried permanently. First because no geology will be stable in perpetuity and because the threats to health and safety of future generations are severe.[101]

6.69 Reinforced vaults or tumulas, with protective covering layers, are now the preferred solution. Since 1990, major engineered disposal facilities for low level and short lived intermediate level waste have been commissioned in France (Centre de l'Aube, above-ground vault,), Japan (Rokkashomura, below-ground vault), Spain (El Cabril) and Canada (Chalk River Laboratories).

6.70 A number of European countries including Germany are examining the disposal of combined low level and intermediate level wastes in specially excavated caverns or disused mines at depths of more than 50 metres. So far, no country has decided on a permanent repository for high level wastes, although it is the topic of much discussion. According to an OECD

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97 Schrader-Frechette, K, (1991) Discussion Papers, Ethical Dilemmas and Radioactive Waste; A Survey of the Issues, *Environmental Ethic* 13 (Winter 1991): 327-343, p. 328

98 Ibid, p. 328

99 Ibid, p. 328

100 Ibid, p. 331

101 Schrader-Frechette, Submission No. 2, p. 1

international workshop held in September 1994, disposal facilities for long-lived waste will not be operational before about 2010-2020.

Near Surface Disposal

6.71 Near surface disposal is the burial of radioactive waste, with or without engineered barriers, on or below the ground surface where the final protective covering is of the order of a few metres thick, or in caverns a few tens of metres below the surface. The Department of Primary Industries and Energy's discussion paper published in 1993 stated that:

> Disposal of radioactive waste in a near surface repository is preferable to above-ground storage as the substrate provides a natural barrier to radioactivity and there is less risk of vandalism or removal of radioactive material.[102]

This view was not supported by many of those participating in this Inquiry.

6.72 The *Code of Practice for the Near Surface Disposal of Radioactive Waste in Australia* (1992) deals with the general site characteristics, site selection criteria, waste characteristics, facility design and operational requirements. The code recommends conditions for disposing, by shallow burial, of waste[103] such that doses received by anyone in the vicinity should be no higher than those recommended by the National Health and Medical Research Council.

6.73 The Committee was told that shallow land burial is being used at Drigg in Cumbria, Hanford in the United States, Barnwell and Centre de l'Aube in France.[104] The Drigg facility is currently being upgraded with the construction of concrete lined cells which contain specially made steel containers.[105]

Mt Walton Intractable Waste Disposal Facility, Western Australia

6.74 The Mt Walton East Intractable Waste Disposal Facility was established in 1992 by the Western Australian Government for the disposal of hazardous

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102 Department of Primary Industries And Energy, (1993) *National Radioactive Waste Repository Site Selection Study* Phase 1 A Report on Public Comment, August 1993, Australian Government Publishing Service, Canberra, p. 8

103 other than waste covered by the *Code of Practice on the Management of Radioactive Wastes from the Mining and Milling of Radioactive Ores* (1982), or the *Code of Practice for the Disposal of Radioactive Waste by the User* (1985)

104 Davoren, Transcript of Evidence, p. 38

105 Davies, Transcript of Evidence, p. 258

and intractable wastes including monazite residue.[106] To date there have been two disposal operations of waste collected by the Health Department including an old phosphoric acid plant.[107]

6.75 At Mt Walton, waste is cased in cement and placed in drilled two metre diameter bore holes. A concrete slab weighing several tonnes is placed on top then there are five metres of clay and then another shaft of concrete inside which are two layers of drums. Each bore hole is fenced, the area of two hundred square metres is cleared and fenced and gates have radiation warning signs.[108] The Radiation Protection Office in Western Australia has accepted a 100 year institutional control period. Over the 300 years design lifetime, after which the concrete will crack and be incorporated into the surrounding soil, the concrete provides the mechanical containment and the alkaline environment will help stop the migration of cations of metallic radionuclides.[109]

6.76 The Committee was told that this creates several layers of security and there is really no prospect of anybody reasonably being able to extract waste from the repository.[110] The site is visited about once a month for statutory monitoring and reporting requirements.[111] A number of witnesses from the region commented on the lack of security in terms of a permanent presence on site.[112]

6.77 The radioactive waste deposited at Mt Walton includes discrete sources which are quite active. The Committee was told that the Mt Walton East facility met the ideal selection criteria published by the International Atomic Energy Agency except for the criterion relating to proximity to transport routes.[113]

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106 Newton, Transcript of Evidence, p. 711

107 Davies, Transcript of Evidence, p. 267; Hutchinson, Transcript of Evidence, p. 386; Schuster, Transcript of Evidence, p. 246

108 Schuster, Transcript of Evidence, p. 255

109 Munslow-Davies, Transcript of Evidence, p. 306

110 Davies, Transcript of Evidence, p. 257; Hartley, Transcript of Evidence, p. 353

111 Schuster, Transcript of Evidence, p. 256

112 Nilsson, Transcript of Evidence, p. 346; Wright, Transcript of Evidence, p. 869; Botica, Transcript of Evidence, p. 853; Peebles, Transcript of Evidence, p. 847; Conservation Council of Western Australia, Submission No. 44, p. 1

113 Hartley, Transcript of Evidence, p. 352

6.78 The Department of Environmental Protection considers Mt Walton East to be one of the most geologically stable areas in Australia.[114] On the other hand the Committee was told that a minor earthquake in January 1990 at Bullfinch, approximately 100 kilometres from Mt Walton, resulted in the cracking of a quite thick concrete slab.[115] Australia is moving slowly in a northerly direction and may eventually collide with South East Asia. However, Rhone Poulenc believe that this will not impact on the geological stability of the Yilgarn Block.[116]

6.79 Mt Walton East is considered a very arid region. However, it does rain heavily at times.[117] With global warming it is predicted that rainfall events may be heavier but less frequent.[118] The Country Women's Association of Western Australia is concerned that water from Mt Walton could flow into Lake Deborah East, Lake Seabrook and the Avon and Swan Rivers.[119] Rhone Poulenc told the Committee that even with the scenarios of global warming there is no prospect of the Mt Walton East site being flooded from the melting of polar ice caps.[120]

6.80 Ground water is a major factor in causing radioactive waste to migrate from the place of disposal.[121] The statutory monitoring process at Mt Walton requires the monitoring of ground water[122] although no ground water has been found on the site in the 50 wells drilled.[123] The Committee was told that even in the event of a substantial climate change, it is unlikely that a water table would ever form in the area because of the nature of the soils.[124] The site was purposely chosen away from surface drainage channels. Rhone Poulenc, however, told the Committee that:

> There are ancient drainage channels in the area and it is supposed that any free ground water would eventually find its way into them,

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114 Schuster, Transcript of Evidence, p. 251

115 Nilsson, Transcript of Evidence, p. 347

116 Rhone Poulenc Chimie (Australia) Pty Ltd, Submission No. 71, p. 11

117 Schuster, Transcript of Evidence, p. 251

118 Hartley, Transcript of Evidence, p. 706

119 Nilsson, Transcript of Evidence, p. 343

120 Rhone Poulenc Chimie (Australia) Pty Ltd, Submission No. 71, p. 11

121 Munslow-Davies, Transcript of Evidence, p. 305

122 Schuster, Transcript of Evidence, p. 262

123 Hartley, Transcript of Evidence, p. 353

124 Davies, Transport of Evidence, p. 262

> unless first lost through evaporation or transpiration. Evaporation and transpiration exceed precipitation by a factor of about ten.[125]

6.81 Rainfall at the site is trapped by the cap rock layer and does not penetrate below to the level where the waste is placed. A clay capping is added so that rain water cannot infiltrate to the waste.[126] The Committee questions the adequacy of the clay capping as a mechanism to provide long term impermeability considering the half lives of some of the radioactive material.

6.82 The Committee was also told that Mt Walton is not a remote location as it is only 35 kilometres north of Southern Cross; and the Western Australian Planning Commission predicts a forty per cent population increase in the Goldfields Region by the year 2026 to 76 000.[127]

Rhone Poulenc Rare Earth Project

6.83 Rhone Poulenc believe that in the case of an accident during transport the radioactive material problems could be contained and managed by normal emergency procedures.[128] The Radiation Health Section of the Health Department and Rhone Poulenc would train emergency crews.[129]

6.84 Waste from the Rhone Poulenc rare earth project may be suitable for disposal at the Mt Walton East site.[130] Rhone Poulenc will need to dilute the uranium and thorium waste by a factor of 1.4 to meet the Disposal Code requirements, and will cover the waste with layers of neutral material to reduce the radiation levels to the average activity for the disposal structure.[131]

6.85 The bulka bags used to transport the Rhone Poulenc radioactive waste, although industrial heavy duty polypropylene, are not intended to be a long term barrier. The clay structure surrounding it is designed to contain the material.[132] Mr Fleischmann told the Committee that:

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125 Rhone Poulenc Chimie (Australia) Pty Ltd, Submission No. 71, p. 6

126 Davies, Transcript of Evidence, p. 263

127 Nilsson, Transcript of Evidence, p. 342; Goldfields Against Serious Pollution, Submission No. 57, p. 4

128 Rhone Poulenc Chimie (Australia) Pty Ltd, Submission No. 71, p. 11

129 Ibid, p. 12

130 Schuster, Transcript of Evidence, p. 254

131 Rhone Poulenc Chimie (Australia) Pty Ltd, Submission No. 71, p. 5

132 Newton, Transcript of Evidence, p. 705

> using plastic drums to contain thorium hydroxide and putting them in a shallow burial site was that plastic would probably last a considerable amount of time and, if ultimately they did break up and the stuff leached out it would only generally tend to mix with the soil and ultimately break down. ... I could not imagine it representing a major hazard if it is in a remote location.[133]

6.86 It is proposed that this waste be placed in a pit in the granite covered by three metres of compacted clay and various other geotextile materials to prevent intrusion of water and roots into the waste.[134] If this waste is required to be placed in a strictly monitored secure engineered facility, the cost for Rhone Poulenc would be higher and thus the project would be less economically viable.[135]

6.87 The materials are very fine talc particle size (<1µm)[136] and Ms Peebles believes that issues relating to dusting were not covered adequately in the documentation.[137] Rhone Poulenc argued that on drying, the material forms a hard solid and does not dust.[138]

6.88 It was suggested that should the Rhone Poulenc proposal proceed, then the institutional control period of about one hundred years would not be adequate. Thorium has a half life of 14 billion years, uranium half life of 10 billion years and radium half life of 1 600 years.[139] The Statewide Network of Action Groups told the Committee that radium is highly radiotoxic and that one gram is sufficient to cause cancer in 1000 humans.[140] The Western Australian Department of Minerals and Energy pointed out that the codes of practices allow this type of disposal for long half life radioactive waste provided it is of low enough activity.[141]

6.89 Radon from the barium sulphate material in the Rhone Poulenc waste can be expected to escape more readily than from the monazite but still has to get

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133 Fleischmann, Transcript of Evidence, p.486

134 Hartley, Transcript of Evidence, p. 355

135 Siewert, Transcript of Evidence, p. 324

136 Southern Cross Community Workshop, *WA Rare Earth Project*, 14 June 1995, p.15

137 Peebles, Transcript of Evidence, p. 846

138 Southern Cross Community Workshop, *WA Rare Earth Project*, 14 June 1995, p.19

139 Statewide Network of Action Groups *et al*, Submission No. 50, p. 4

140 Ibid, p. 6

141 Hewson, Transcript of Evidence, p. 260

through five metres of clay.[142] Monazite is up to three times more radioactive than yellowcake and the gangue wastes made up of thorium, radium and uranium are up to nine times more radioactive than uranium yellowcake.[143] The trenches will remain open for two years while they are filled.[144] Should a problem arise in the future or an alternative use be found for this material, a simple mining operation could recover this waste.[145]

6.90 Rhone Poulenc believe that:

> It is probable that exposure of the population to the material will be less, at least in the short term, if placed in secure disposal site than if monazite is released on the Swan Coastal Plain.[146]

Deep Burial

6.91 Geological disposal is the isolation of radioactive waste at depths up to several hundreds of metres using a system of engineered and natural barriers within a geologically stable formation.

6.92 There was some support for deep burial in mines as a method of disposal.[147] The concept of burial was opposed by conservation and environmental groups.[148] However, intermediate and low level waste radioactive waste has been deposited in salt mines in Germany, Sweden and New Mexico.[149] The Uranium Institute points out that:

> Assessments in various countries have concluded that even in the worst case human exposure to ionising radiation from a deep geological repository would be much less than that received continuously from natural background radiation.[150]

6.93 Department of Primary Industries and Energy consider that a deep underground facility would be more expensive than a near surface facility

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142 Hartley, Transcript of Evidence, p. 370

143 Statewide Network of Action Groups *et al,* Submission No. 50, p.2

144 Peebles, Transcript of Evidence, p. 840

145 Hartley, Transcript of Evidence, 361

146 Rhone Poulenc Chimie (Australia) Pty Ltd, Submission No. 71, p. 9

147 Harvey, Submission No. 54, p. 1; Burch, Submission No. 17, p. 1

148 The Nuclear Issues Group of the Conservation Council of South Australia, Submission No. 42, p. 4; Friends of the Earth, Submission No. 47, p. 60; Greenpeace, Submission No. 48, p. 8

149 Uranium Institute, 'The management of radioactive waste' *The Mining Review*, August 1992, p. 11

150 Ibid, p. 10

unless an abandoned mine or other existing facility could be used.[151] Overseas quotes of US$17 billion and $14.45 billion Canadian have been suggested for the construction of deep burial sites.[152]

6.94 The issues that need to be addressed if deep geological burial is considered include the potential ingress of water, adequate knowledge of deep geohydrological pathways and geological stability and the generation of gases by radiolytic and biological processes.

Coal Mines

6.95 Burial in coal mines, which was suggested by Dr Bhattacharyya *et al* as a form of disposal of radioactive waste, is arguably a form of storage because of the accessibility, rather than disposal.

> The disposal of low - to intermediate - level radioactive waste in appropriately designed near surface repositories provide the ideal environment for the secure and managed containment of such material, using continuous monitoring of excavation stability and the atmospheric and hydrological conditions.
>
> In this context, the abandoned coal mines in the Southern Coalfield of NSW offer the facility for establishing carefully engineered repositories for such waste with the advantages of geological suitability, accessibility, ease of construction, site security, monitoring and moderate costs.[153]

6.96 It was pointed out that there have not been any successful attempts at this method of disposal overseas because suitable conditions do not exist in the majority of coal basins in Lorraine (France), Ruhr (West Germany), Silesia (Poland), Donbass and Kuzbass (Russia) or Bowen (Queensland).[154] In many of these situations, the presence of groundwater has rendered such a proposal inappropriate.[155]

6.97 Geological data collected over many years would enable the identification of geological weaknesses and location of areas free of strata movements, subsidence or the presence of ground water.[156] It is estimated that

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151 Department of Primary Industries and Energy, Submission No. 28, p. 6-7

152 Sutherland Shire Environment Centre, Submission No. 7, p. 4

153 Bhattacharyya, Supplementary Submission 52a, p. 1

154 Bhattacharyya, Submission No. 52, p.2

155 Bhattacharyya, Supplementary Submission No. 52a, Appendix 3, p.8

156 Ibid, p. 3

the construction of a 3 000 metre long disposal chamber in an existing coal mine would cost less than ten million dollars.[157] The Committee believes that a proposal such as this is unlikely to be successful in the Sydney coal basin because of its proximity to population centres.

Uranium Mines

6.98 It was suggested that the rehabilitation phase of uranium mines is also a logical way to dispose of low level or medium level waste.[158] Uranium mines leave highly radioactive and chemically toxic tailings and an excavated site from which the original ore was extracted.[159] The Committee was told that tailings dams need to be rehabilitated, and the addition of low and intermediate level waste from other sources including sealed radioactive sources would not measurably increase the hazards.[160]

6.99 Dr Burch stressed that the tailings dams have thousands of curies of radium and other salts. The Committee was told that the disposal of some discrete sources of radium in an operating uranium mine may be appropriate because the quantities involved would be relatively insignificant compared to the radium already present.[161]

6.100 In 1992 the Olympic Dam Joint Venturers and the South Australian Government were prepared to cooperate with the Commonwealth Government in a feasibility study into the disposal of radioactive materials in uranium mines.[162] The Committee believes that this option should be further explored.

6.101 The CSIRO soil from Fishermens Bend contains naturally occurring uranium and thorium. The radioactivity of the soil is about eight times that of granite or one tenth that of uranium ore.[163] Sixty per cent of the waste is at a sufficiently low level to meet the criteria to permit disposal at a municipal tip approved for that purpose.[164] This material has not been placed in a municipal

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157 Bhattacharyya, Submission No. 52, p.3

158 Burch, Transcript of Evidence, p. 499

159 Co-Tech Management Pty Ltd, Submission No. 17, p. 1

160 Burch, Transcript of Evidence, p. 502-503

161 Hartley, Submission No. 24, p. 6

162 South Australian Government, Submission No. 23, p. 3

163 Rolland, Transcript of Evidence, p. 51.

164 Commonwealth Scientific and Industrial Research Organisation, Submission No. 25, p. 5

tip because although the specific activity is very low, shallow burial standards limit the total activity.[165]

6.102 The Australian Nuclear Association suggested that the Fishermens Bend soil would almost certainly be suitable for use as land fill, and the separation of the few drums of soil which have significant radiation emission levels would cost money and potentially irradiate the workers who do the separation.[166] The Committee believes that the possibility of disposing of that portion of the CSIRO waste which is considered suitable for disposal in a municipal tip in an active uranium mine should be considered. The Committee believes that the feasibility study should determine to what extent the contaminated soil could be disposed of in this way without increasing the hazards already present in the tailings.

Recommendation 13

The Committee recommends that a feasibility study be conducted into the suitability of disposing of the low level contaminated soil from Fishermens Bend in an active uranium mine.

6.103 ANSTO has requested a site to dispose of some low level radioactive waste as landfill, but permission has not been granted by the New South Wales Government.[167] The possibility of disposing of this low level waste from ANSTO in a uranium mine should also be considered.

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165 Smiles, Transcript of Evidence, p. 87

166 Hardy, Transcript of Evidence, p. 615

167 Sutherland Shire Environment Centre, Submission No. 7, p. 5

Recommendation 14

The Committee recommends that a feasibility study be conducted into disposing in an active uranium mine of that portion of the ANSTO waste that is suitable for disposal at a municipal tip.

6.104 In 1978, the New South Wales Government attempted to remove about 3000 tonnes of radioactive soil containing thorium and radium residues from Hunters Hill in Sydney to decontaminate six house blocks. Efforts to relocate the waste to a remote rural site at Manara (NSW) and then South Australia were unsuccessful.

6.105 The Committee does not know to what extent other states have similar problems but believes that some of this material may also be suitable for disposal in uranium mines. The potential for this should be investigated in a joint company/State/ Commonwealth project.

Recommendation 15

The Committee recommends that the Commonwealth Government ascertain the extent to which the States and Territories could benefit from disposal of low level wastes in uranium mines.

Other Burial Options

6.106 Mr Fleischmann believes that a fully developed underground burial site is preferable to above ground storage facilities.[168] Stable disposal chambers would include intrinsically safe technologies for remotely operated

168 Fleischmann, Transcript of Evidence, p. 477

construction of seals, control and monitoring systems.[169] The chambers could be made air tight by impregnating the rocks.[170]

6.107 The Committee believes that to construct an underground burial facility may be a protracted and costly process. The United States are planning to build the world's first permanent repository for high level nuclear waste at Yucca Mountain, Nevada. However, 80 per cent of the community militantly opposed the site and no one else is willing to take the waste.[171] A stalemate now exists and protracted legal and political debate continues.[172]

6.108 The question with deep burial is not whether the containment of waste will leak, but when. The National Radiological Protection Board of the United Kingdom pointed out that confidence in any predictions must decrease with increasing timescale. For a period of 100 years normal controls may be sufficient, but for time periods greater than one million years assessments can only be qualitative.[173]

6.109 The Committee believes that the construction of a burial facility for radioactive waste is inappropriate and unnecessary for the type and quantity of radioactive waste which currently needs management in Australia.

Other Methods of Disposal

Sending Radioactive Waste Overseas

6.110 In 1963, 150 spent fuel elements were returned to the United Kingdom from ANSTO's Lucas Heights reactor.[174] In July 1995, the British Government announced a policy of accepting for reprocessing spent sources which had been manufactured in the United Kingdom.[175] On 27 October 1995 the Government announced that ANSTO would negotiate the return of the remaining HIFAR spent fuel rods to the United Kingdom; Australia owns 1100 spent fuel rods of

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169 Bhattacharyya, Submission No. 52, p.2

170 Ibid, p.3

171 Schrader-Frechette, Submission 2, p. 2

172 Ibid, p. 2

173 Cooper J, Barraclough I & Mobbs S, (1992) *The Development of NRPB Advice for the Disposal of Solid Radioactive Waste*, International Radiation Protection Association Conference, Montreal 1992, cited in Rhone Poulenc, Submission No. 71, p. 10

174 Australian Nuclear Science & Technology Organisation, Submission No. 32, p. 7

175 Parliament of the United Kingdom, *Review of Radioactive Waste Management Policy*, Final Conclusions, London, July 1995, p. 39

British origin. The residue from the reprocessing of the spent fuel rods will be returned to Australia.

6.111 Australia will also pursue the return of spent fuel rods which originated in the United States, to that country.[176] In the case of fuel rods being sent to the United States, Australia will not be required to take back the residue from any reprocessing operations. Sutherland Shire Council does not believe that spent fuel rods should go overseas and that Australia has to take responsibility for them.[177]

6.112 Other radioactive materials to be sent overseas include decommissioned radiotherapy sources from hospitals which have been shipped to Asia under aid programs, and radioactive materials that are returned to the manufacturer who is responsible for their reuse or disposal.

Discharge to Normal Waste Stream

6.113 Other disposal options are based on the dilute and disperse principle. Waste which does not contain isotopes above the threshold limits can be buried at secure sites in a way similar to other hazardous waste.[178] The Committee was told that radioactive waste could be disposed of by dividing the waste into a number of loads which each fell below the threshold thus dispersing it and therefore saving months of storage of bulky material.[179] Some Committee members are concerned with the acceptability of the basic principle of dilute and disperse for the 'disposal' of radioactive waste.

Discharge to Sewers

6.114 The National Health and Medical Research Council *Code of Practice for the Disposal of Radioactive Wastes by the User (1985)* defines the maximum activities of each radionuclide which can be discharged into the sewer at twenty times the Annual Limit on Intake by Ingestion for radiation workers, during any period of seven days.

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176 Senator Peter Cook (former Minister for Industry Science and Technology) and Senator Bob Collins (former Minister for Primary Industries and Energy), *Spent nuclear fuel to leave Australia*, Joint Press Release, 27 October 1995, p.1

177 Rankin, Transcript of Evidence, p. 581

178 Wong, Transcript of Evidence, p. 743

179 Ibid, p. 741

6.115 ANSTO discharges liquid waste containing low level radioactivity to the sewer under contract with Sydney Water.[180] Low level liquid waste from ANSTO is disposed of to the cliff ocean outfall adjacent to the Cronulla Beach Complex in Bate Bay in Sutherland Shire.[181] The Committee was told that ANSTO routinely releases amounts of tritium into the sewer which would not be permissible in the United States.[182]

6.116 The Committee was also told that at Potter Point at Cronulla, the sewer system is subject to surcharging into stormwater drainage quite close to the ANSTO facility and presumably before any particular dilution effects occur.[183] As the large tanks containing sedimented liquid effluent become full during heavy rainfall, ANSTO releases the material into the system.[184]

6.117 The Committee was told that ANSTO has substantially increased discharges to sewer of alpha radioactive materials and tritium since 1980 but the measurement of environmental impact of emissions was last conducted in 1981.[185] Mr Fleischmann believes that this was not a major hazard because of the enormous amount of dilution, and the detection of isotopes at the point of ocean discharge or in the food chain would be difficult.[186] When ANSTO discharged into the Georges and Woronora Rivers sampling of fish and oysters detected only very low radioactivities.[187]

6.118 Iodine[131] is emitted in peaks of activity over short periods of time.[188] The maximum levels of emissions required from ANSTO are yearly averages although monthly checks are done to ensure annual limits are not exceeded.[189]

6.119 Defined concentration levels in relation to medical institutions highlighted another problem:

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180 Robertson, Transcript of Evidence, p. 545

181 Sutherland Shire Council, Submission No. 20, p. 7

182 Ibid, p. 8

183 Smith, Transcript of Evidence, p. 547

184 Ibid, p. 548-549

185 Sutherland Shire Council, Submission No. 20, p. 8

186 Fleischmann, Transcript of Evidence, p. 490

187 Ibid, p. 490

188 Smith, Transcript of Evidence, p. 547

189 Fleischmann, Transcript of Evidence, p. 491

> The concentration method can be interpreted in a number of ways, too, and it is a period over which you average your concentration. If you average over a long period, such as a month, you can get away with a lot more than if you are working at the other extreme which is effectively an instantaneous concentration where you are averaging over a few hours or a day or something like that. At the moment, the methods usually average over a month, which is pretty lenient.[190]

6.120 The Committee is concerned that ANSTO is only required to meet yearly averages and believes that maximum monthly and weekly levels should be applied and monitored.

Recommendation 16

The Committee recommends that appropriate maximum emission levels as well as average monthly limits be imposed on emissions of tritium and iodine[131] from ANSTO.

Disposal in Landfill

6.121 The use of domestic smoke detectors is increasing rapidly. It was argued that the disposal of smoke detectors to municipal tips should be prohibited. On the other hand the Committee was told that the radioactive source in each detector is in an insoluble form and the risk associated with its disposal to landfill is considered low.[191] Mr Fleischmann gave the example of two radioactive sources from smoke detectors being swallowed which passed through the body with no known radiation dose to the patient.[192]

6.122 Mr Carter differentiated between americium in general, and the sources used for smoke detectors which meet the current requirements:

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190 Collins, Transcript of Evidence, p. 754

191 Samuel, Transcript of Evidence, p. 390

192 Fleischmann, Transcript of Evidence, p. 478

> Americium is hazardous only when it gets inside the body and stays inside the body. The problem is whether it is soluble and whether it can be dispersed into the air. The evidence on both of those is no ...They [the sources] are quite insoluble and they are resistant at quite high temperature fires.[193]

6.123 It was also argued that the amount of material that ends up in the tip provides an adequate level of dispersal for the volume of smoke detectors distributed in it.[194] The Australian Fire Protection Society (AFPA) and the Fire Protection Industry Association of Australia (FPIAA) support this view.

> The amount of radioactive material contained in any domestic smoke detector is minute ... The associations collectively, the AFPA and the FPIAA, are both of the view that disposal through normal landfill is the way to go.[195]

6.124 Both groups would like to see a nation-wide policy of disposal, as is the case in Western Australia, where the Government allows the disposal of smoke detectors in household garbage provided the americium source does not exceed 40 kBq.[196]

6.125 The Committee believes that insufficient is known about the effects of low levels of radiation and the potential risk in the disposal of ionising smoke detectors to municipal tips in increasing numbers or the unknown effects of the detectors synergising with other chemicals in tips.

6.126 The Committee heard arguments for and against the disposal of smoke detectors to municipal landfills. The Committee appreciates that to ban the disposal of smoke detectors to landfills is impractical and may not be necessary. The Committee is particularly concerned that any attempt to do so by alerting the community to potential danger in smoke detectors may discourage people from installing them, thus endangering lives.

6.127 The Committee believes, however, that a program should be implemented to encourage householders to return smoke detectors to central locations so that they can be returned to the manufacturers or suppliers. The Committee supports industry and government initiatives to develop

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193 Carter, Transcript of Evidence, p. 827

194 Fleischmann, Transcript of Evidence, p. 477

195 Coate, Transcript of Evidence, p. 790

196 Fire Protection Industry Association of Australia, Submission No 76, pp. 8-9; Radiological Council of Western Australia, Amendment to Regulations under the *Radiation Safety Act*, December 1992

mechanisms to facilitate the return of smoke detectors to suppliers, manufacturers or to local collection points.

Incineration

6.128 Incineration is not widely used for the disposal of radioactive materials in Australia. The Edith Cowan University disposes of radioactive waste by incineration after it has decayed to a level when it is no longer considered radioactive.[197] The problem is finding a company which is willing to incinerate the material.[198] The Health Department of Western Australia considers that it may be preferable to incinerate some solid waste from radioisotope laboratories, given the co-existing pathological nature of the material.[199] The Committee is concerned that if incineration is to be used for the disposal of radioactive materials then appropriate measures must be taken to deal with the residues in the ash and the possibility of radioactive emissions.

Immobilisation in other Materials

6.129 The possible use of vitrification for radioactive wastes will depend on the chemical composition of the waste and the pretreatment required to transport the waste from its current storage.

6.130 The Synroc process developed at the Australian National University relies on the incorporation of radioactive elements in a crystal structure of synthetically produced minerals. Nuclear Waste Management Pty Ltd has a commercial agreement for a licence from the Australian National University and has negotiated an agreement with a Russian group to establish a demonstration plant. The process has now stalled as a result of lack of interest by the Australian investors.[200] The Committee was told that costs may restrict the use of Synroc to highly radioactive material such as spent fuel or residues from its reprocessing.[201]

6.131 Tests have been done in the United Kingdom and in Japan using Synroc with radioactive material.[202] On-going research and development has

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197 Edith Cowan University, Submission No. 72, p. 1-2

198 Ibid, p. 2

199 Health Department of Western Australia, *Incineration of Solid Waste from Radioisotope Laboratories*, Approved by the Radiological Council at its 93rd meeting, 9 June 1994, p. 1

200 Dickinson, Supplementary Submission No. 1, p. 1

201 Ibid, p. 1

202 Jostsons, Transcript of Evidence, p. 65

established Synroc as a good technology[203] but the time to develop the process is symptomatic of the long lead times in the industry.[204] The Committee is concerned that this technology may end up overseas because of the lack of large Australian companies with the appropriate technical background required to utilise it.

6.132 Sir Ben Dickinson urged the Committee to support further developments on the process and the development of a pilot plan.[205] He argued that the radioactive material could be put into Synroc and buried in deep holes or shafts.[206]

6.133 Although the Committee supports the export of Synroc technology, it does not accept that it should ever be used as justification to import radioactive waste into Australia. The Labor Government's position was that it would not establish an industry that imports radioactive waste.[207]

6.134 Professor Samarin suggested encapsulating radioactive waste in building and construction material, as there are 40 million tonnes of concrete produced in Australia annually.[208] The technology already exists for encapsulating small quantities of heavy metals and some other hazardous material into building materials. These can be physically encapsulated as well as chemically and physiochemically immobilised in high performance concretes.[209] Some of these wastes can actually serve the same function as the admixture or additive and improve the quality of the product.[210]

6.135 At Hanford in the United States the Department of Energy experienced difficulties in getting the cement to set in trials with radionuclides, nitrates and organic chemicals,[211] so there needs to be further experimental work on this option before it could be used in Australia. Some naturally radioactive

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203 Hollway, Transcript of Evidence, p. 66

204 Jostsons, Transcript of Evidence, p. 66

205 Dickinson, Transcript of Evidence, p. 201

206 Ibid, p. 201-202

207 Crean S (1992) former Minister for Primary Industries & Energy, *National Radioactive Waste Repository Site Study Released for Public Comment*, Media Release, 7 October 1992, p. 1

208 Samarin, Transcript of Evidence, p. 512

209 Samarin A (1995) 'Encapsulation of Hazardous Heavy Metal Wastes in High Performance Concrete'. Australian Academy of Technological Sciences and Engineering, *Focus* 87:11-14, p.11

210 Samarin, Transcript of Evidence, p. 513.

211 Institute of Energy and Environmental Research, "Hanford', *Science for Democratic Action* 3(3), 1994, p. 17

materials such as granites are used anyway. If the appropriate mixtures were used then the levels of radiation would not be any higher than radiation from that naturally occurring building material while providing a very cost effective way of dealing with the waste.[212]

6.136 The Committee is concerned that workers should not be exposed to additional radiation levels and the precautions needed to ensure the safe handling may increase the cost of road building, but this may be favourably compared with the economics of other radioactive waste disposal options.[213]

Putrescible Waste

6.137 Long term storage of putrescible material such as animal wastes containing long life radioactive substances is a problem,[214] particularly where burial of radioactive material is not permitted by the relevant waste disposal authority.[215] Radioactive putrescible materials at the University of New South Wales are stored in refrigerators in laboratories where they are produced.[216]

6.138 The Committee appreciates the difficulties posed by the requirement to manage putrescible radioactive waste but considers that it is unlikely that a national repository will be able to accommodate it.

Conclusions

6.139 The Committee believes that the national accumulation of radioactive waste has changed significantly since the Commonwealth/State Consultative Council looked at this situation in 1986. The Committee is not convinced that a shallow ground burial site for low level radioactive waste is the appropriate solution.

6.140 The Committee supports a feasibility study into disposing of very low level radioactive waste such as the CSIRO Fishermens Bend contaminated soil in an active uranium mine. This will significantly reduce the volumes of material that would have been suitable for shallow ground burial and may make the proposition totally uneconomic.

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212 Samarin, Transcript of Evidence, p. 514-515

213 Samarin, Transcript of Evidence, p. 520-521

214 Rosen, Transcript of Evidence, p. 751

215 Westmead Hospital and Community Health Services, Submission No. 65, p. 3

216 University of New South Wales, Submission No. 75, p.2

6.141 The Committee believes that there is a significant problem with intermediate level waste which requires urgent attention. The Committee would like the efforts of the Commonwealth Government to be focused on this issue.

6.142 The Committee notes that some of the States and Territories have made substantial progress in managing their radioactive wastes. The Committee applauds this and looks forward to a cooperative, coordinated, national approach which will ensure that all those responsible for the management of radioactive waste will meet the improved standards.

CHAPTER 7

A NATIONAL REPOSITORY FOR RADIOACTIVE WASTE

7.1 The *Australian Nuclear Science and Technology Act 1987* defines a 'national nuclear waste repository' as:

> a site chosen by the Commonwealth ... for the storage of nuclear waste with a view to it never being moved to another site.[1]

In this report the Committee uses 'storage' to refer to facilities that allow for retrieval of the radioactive waste and 'disposal' for repositories intended to hold waste permanently and irretrievably.

7.2 The Department of Primary Industries and Energy told the Committee that waste will be disposed of in a national repository without the intention of retrieval, but it could be retrieved if necessary.[2] ANSTO supports the concept of a national near surface repository for low level and short lived intermediate level waste.[3]

7.3 The Committee believes, however, that other options should be considered as there are a number of ways of achieving an adequate level of safety, which is really the desired goal. The Uranium Institute comments that:

> national strategies for waste management differ considerably. This reflects the availability of a choice of methods for achieving the same objectives and fulfilling the same principles rather than any uncertainty about whether they can be achieved. An adequate level of safety can be assessed and ensured in different ways.[4]

Australia's Approach

7.4 The process of establishing a national repository commenced in 1979 when the Commonwealth wrote to the States inviting them to participate. In 1980 a Commonwealth/State Consultative Committee was established to coordinate policies. It identified radioactive wastes which can be discharged into the environment and those which require long term isolation from the

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1 *Australian Nuclear Science and Technology Act 1987*, subsection 5(1B)

2 Davoren, Transcript of Evidence, p. 6

3 Jostsons, Transcript of Evidence, p. 59

4 Uranium Institute (1992) 'The management of radioactive waste" *The Mining Review*, August 1992, p. 10

biosphere. Australia's problem was defined in terms of waste arising from medical, scientific and industrial uses of radioactive materials.[5] In 1985 a national program of site selection for shallow burial of low level radioactive wastes commenced. The Ministers agreed that one or two shared national facilities would be sufficient for State and Territory needs. No State has agreed to provide the site for a national repository.

7.5 Shallow burial was the only option considered, following the recommendations of the Commonwealth/State Committee.[6] This Committee was told by Mr Davoren that this is the preferred method of disposal of low level waste throughout the world.[7]

7.6 Greenpeace expressed concern that public input was only required after the decision had been made to construct the shallow burial national repository without debate on the possibility of an above ground storage facility. It points out that in New York a recent amendment to the *Low Level Radioactive Waste Management Act* specifies that before a method of disposal is chosen, six or seven options should be investigated.[8]

7.7 The Department of Primary Industries and Energy has received strong support for the concept of a national repository through the public consultation process.[9] There were, however, a number of objections received:

- radioactive waste should be stored in above ground dry stores at the site of origin;
- highly radioactive waste will be stored at the facility;
- the radioactive waste will pose a hazard for thousands of years;
- the public consultation process was insufficient;
- no consideration was given to alternatives to near surface disposal;
- site selection criteria were misapplied resulting in the rating of regions which were unsuitable as suitable; and

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5 Davoren, Transcript of Evidence, p. 31

6 Ibid, p. 36

7 Ibid, p. 37

8 Pearson, Transcript of Evidence, p. 452

9 Davoren, Transcript of Evidence, p. 32

- possible Commonwealth acquisition of a site is undemocratic.[10]

7.8 Concerns were also raised in relation to the risk to future generations, risk associated with transport of radioactive waste, costs of disposal, nature of radioactive waste for disposal, radiation dose limits, possible importation of radioactive waste into Australia for disposal, and the implications of climate change for the siting and design of a repository.[11]

7.9 Australia is not alone in having problems in dealing with low level radioactive waste. In December 1980 the United States Congress enacted the *Low Level Radioactive Waste Policy Act 1980* requiring the States to ensure the safe disposal of low level radioactive waste by 1 January 1996. By June 1995 most States had neither local facilities nor access to facilities elsewhere.[12]

7.10 In relation to the possibility of constructing a shallow burial facility, the Friends of the Earth pointed out that the United Kingdom and the United States have moved away from shallow burial to various forms of engineered surface storage in the United States or deep geological disposal in the United Kingdom.[13] France and Japan use a system of engineered vaults.[14]

7.11 Because the quantities of radioactive waste in Australia are not large by international comparison, the cost of building a national repository designed for final disposal would be relatively high. The Committee believes the aim of minimising the risks of contamination to environment and adverse effects on people, could be better served by the construction of an above ground storage facility.

7.12 The proposal to build a national repository does not address the problem of long lived intermediate and long lived wastes. The Department of Primary Industries and Energy's first discussion paper stated that the radioactive waste which has higher levels of radioactivity, and therefore is unsuitable for near-surface disposal, may be stored on the site on an interim basis.[15]

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10 Department of Primary Industries & Energy, (1993) *National radioactive Waste Repository Site Selection Study, Phase 1, A Report on Public Comment* August 1993, p.3

11 Ibid, p.3-4

12 Abelson P (1995) 'Low Level Radioactive Waste' *Science* 268: 1547

13 Friends of the Earth, Submission No. 47, p. 4

14 Ibid, p. 4

15 Pearson, Transcript of Evidence, p. 452

7.13 There are now a number of intermediate or higher level sources to be considered. Sources include the intermediate level waste currently stored at Lucas Heights and Woomera, the decommissioning of the current HIFAR reactor and its replacement with one of higher capacity and any uranium residue that might be returned as a consequence of future uranium sales. There are fewer than twenty such sources in Western Australia, but similar situations may occur in other States.[16]

7.14 The Committee believes intermediate long lived radioactive waste storage is the most pressing problem. First, because this type of waste will last beyond the life-time of the facility where it is currently stored, and secondly, because it is the more dangerous. Very few people appearing at hearings thought that complete disposal is the answer to this problem. Some scientists said that radioactive waste must be stored until a better solution is found.

7.15 The international nuclear community has been unable to come up with an answer on how to dispose of radioactive waste other than that classified as exempt. It is unlikely that this problem will be solved in the next couple of decades. The Committee notes that internationally a number of countries have postponed their intention of burying radioactive waste for a couple of decades. Australia must, however, address it's own radioactive waste problems before then.

7.16 The Committee does not believe, however, that a final solution must be found now. Much of the evidence to the Committee focused on short term storage and final disposal of radioactive waste. The alternative option to both short term storage and final disposal is mid-term storage for 50 or 100 years. The situation can then be reviewed and a decision made on final disposal at that time.

7.17 The Committee believes that the national facility should have the capacity also to store low level waste on an interim basis while markets are sought for recycling or reuse. It should also have the capacity to store high level waste such as spent fuel rods from ANSTO.

7.18 The volumes of waste requiring storage in this repository could be substantially reduced by putting very low level radioactive material in active uranium mines and compacting as much of the remainder as possible. By having above ground storage, the facility will be able to take higher level waste than that suitable for inclusion in a shallow burial site.

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16 Hartley, Submission No. 24, p. 2

Recommendation 17

The Committee recommends a national above ground storage facility be established which has the capacity to take low, intermediate and high level radioactive waste.

Design of a National Repository

7.19 The Department of Primary Industries and Energy told the Committee that the design of the repository would be considered after a site had been found that had best natural characteristics.[17] The Committee does not accept this approach. The Committee believes that any national facility should be engineered to withstand all climatic conditions and the possibility of earthquake, no matter how low the potential risks are considered to be.

7.20 The Queensland Department of Health pointed out that:

> It is true that if you are prepared to sink funds into something, you can build the engineering to compensate for a lack of some natural situation like an arid climate that will provide an extra measure of safety.[18]

7.21 The Committee believes that this national storage facility should be a standard comparable to the Esk facility constructed by the Queensland Government. The Committee appreciates that a national facility will be used primarily for the radioactive waste generated by ANSTO, particularly if approval is given to replace the existing research reactor with one of greater capacity. The Research Reactor Review concluded that the establishment of a national high level waste facility is unavoidable. The Committee believes that any facility which can accommodate radioactive waste from ANSTO should be able to accommodate low, intermediate and high level waste from other Commonwealth bodies and from State and Territory stores, individuals and organisations.

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17 Davoren, Transcript of Evidence, p. 7

18 Wallace, Transcript of Evidence, p. 715

7.22 The Committee believes that much of the low level waste that is currently being considered for disposal at the national repository, such as the Fishermens Bend contaminated soil, could be disposed of in an active uranium mine.

Site Selection Process

7.23 In June 1992 an Australia-wide selection study to identify a suitable low-level waste repository site was announced. This was supported by State and Territory governments and is managed by the Department of Primary Industries and Energy (DPIE).

7.24 On 7 October 1992 the Discussion Paper *A Radioactive Waste Repository for Australia: Methods for Choosing the Right Site* was published for public comment. Phase II of the site selection study was published in 1994 and also circulated for comment.

7.25 The site selection process developed by the National Resource Information Centre uses a computer-based system to evaluate geographic information against the internationally accepted radioactive waste depository site selection criteria published by the International Atomic Energy Agency. Phase 3 of the process will involve a much more detailed check of the characteristics.

7.26 The computer graphical users interface system enables the exclusion of particular features such as drainage courses, nature conservation reserves and major faults, enabling the mapping of areas suitable both socioeconomically and hydrogeologically.[19]

7.27 The Committee was concerned that some data bases were relatively sparse and are therefore limited.[20] Although much better information would be used on the local scale these gaps in information may fail to identify a number of suitable sites on the macro scale.

7.28 The Committee was also concerned about the relativity between the regions using this system because the most suitable region in one area may not be in the same category as that in an adjacent area. This is a result of adding

19 Veitch, Transcript of Evidence, p. 16

20 Ibid, p. 20

the ratings for some layers of information together and then dividing them into five equal intervals.[21]

7.29 DPIE looked at three additional sites as well as those identified by computer mapping. Mt Isa and Erldunda were included because they were volunteered, and Maralinga was considered because of the public perception that it is already contaminated.[22]

7.30 Eight preferred regions were identified. Phase III of the process, to choose one of the eight broad regions, is now under way. The above process is designed for siting a burial facility. The Committee is aware that an entirely different process will be necessary for the siting of an above ground storage facility.

Control of Land

7.31 Although, in a press release in June 1992, the former Minister Mr Crean referred to the Commonwealth compulsorily acquiring a site for the national repository, the Labor Government's position was that the process was undertaken with the cooperation of the States and Territories.[23] The preference for a site on vacant Crown land may be changed in the light of the Mabo High Court decision.[24] Another issue to be considered is the need to exclude sites listed in the Australian Heritage Commission's Register of the National Estate.[25]

7.32 The Committee believes that the conditions relevant to the siting of a national repository or a national storage facility will not differ greatly in relation to the control of the land. The Committee also believes that it would not be necessary to compulsorily acquire a site if the local communities are informed and their needs and concerns are considered in the design and management of the facility

Climatic Conditions

7.33 The search for the site for the national repository placed considerable emphasis on finding a site which is climatically suitable. The Committee

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21 Ibid, p. 21

22 Veitch, Transcript of Evidence, p. 18

23 Davoren, Transcript of Evidence, p. 30

24 Veitch, Transcript of Evidence, p. 15

25 Ibid, p. 16

believes that this criterion is less critical when constructing an above ground storage facility.

7.34 Should the Commonwealth Government continue with the proposal to construct a national repository, the Committee believes the following matters should be considered. The process of site selection for a national repository that was used assumes that past climate is a reasonable predictor of the future climate.[26] Australian arid zones are particularly variable in relation to both the frequency and intensity of rain.[27] The Committee notes that the basis of this data relates to the ratio of annual evaporation against annual rainfall. The Committee is also concerned that in many areas, climatic records are very sparse.

7.35 The Department of Primary Industries and Energy assured the Committee that the national repository site will be one where there is no beneficial use of water.[28] For reasons of safety and community confidence, the Committee believes that the engineering structure of a national repository should be adequate to cope with all climatic conditions.

Recommendation 18

The Committee recommends that the national facility be adequately engineered to withstand all possible climatic conditions, no matter how unlikely.

Remoteness

7.36 Opposing views concerning the need for a remote location for the national repository should be reconciled. On the one hand, locating the facility in a remote area may encourage an 'out of sight out of mind' mentality, reducing the incentive to minimise the creation of waste. The advantage of

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26 Veitch, Transcript of Evidence, p. 5-6

27 Baker, Transcript of Evidence, p. 141, 150

28 Davoren, Transcript of Evidence, p. 39

having the national facility reasonably close to a population centre is that it would make it easier to use, monitor, maintain institutional control and gain access in the case of an emergency. On the other hand, location in a populous area could affect more people if there is an accident. Mr Ian Taylor told the Committee that:

> Our other concern was that it was such a remote location for a facility like that, and trying to make sure that it works properly, that in fact it is up to standard on a continuous basis, is not easy when you are looking at a facility right out in the middle of nowhere.[29]

7.37 The Esk storage facility in Queensland is used regularly and therefore needs to be reasonably close to the Queensland Department of Health.[30] The Committee was told that an underground burial site would not be used on a frequent basis.

7.38 The siting of a facility in a remote area may be more related to community wishes than to safety.[31] Governments may be tempted to choose a remote site because there would be less community reaction. The Committee was told that in order to gain public acceptance it would be easier in a remote area, although technically this would not be necessary as it only needs to be secure and properly sited in terms of environmental risks and exposures.[32]

7.39 There is a perception that rural areas have become the dumping grounds for cities' problems.[33] Friends of the Earth expressed concern that outback Australia is treated as an ecological sacrificial zone and a site for activities that urban populations would not allow:

> The effect of disposing of radioactive and toxic wastes in this manner inevitability leads to hazardous industries being forced onto communities suffering relative economic and political

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29 Taylor, Transcript of Evidence, p. 860

30 Wallace, Transcript of Evidence, p.715

31 Hartley B, Wall B, Munslow Davies L, Touissaint L, Hirschberg K, Terry K And Shepherd M (1994) 'The Establishment of a Radioactive Waste Disposal Facility in Western Australia for Low Level Waste', Paper presented to the Institution of Engineers Australia, Australian Nuclear Association, 9th Pacific Basin Nuclear Conference, Sydney 1-6 May 1994, p. 910

32 Wong, Transcript of Evidence, p. 744

33 Hartley B, Wall B, Munslow Davies L, Touissaint L, Hirschberg K, Terry K and Shepherd M (1994) 'The Establishment of a Radioactive Waste Disposal Facility in Western Australia for Low Level Waste', Paper presented to the Institution of Engineers Australia, Australian Nuclear Association, 9th Pacific Basin Nuclear Conference, Sydney 1-6 May 1994, p. 910

> disadvantage and, as this issue all too clearly illustrates, it is usually rural communities and indigenous peoples that bear that burden. The disposal of radioactive waste is, therefore, a social justice issue.[34]

7.40 Friends of the Earth believe that there is a danger that a remote site would be abandoned more quickly than a site in the middle of Sydney.[35] This must, however, be balanced against the greater likelihood of changing land use in a city as compared with a remote site. People who live in remote areas do so because they need the land and resources for survival.[36] Remote area land uses can change, for example, a mine has been established near the Mt Walton facility since the concept was first proposed.[37]

7.41 The Committee was told that the establishment of a national facility creates a 'hot spot'. The small volumes of radioactive material generated in Australia differentiates our situation from that overseas where these facilities are constantly manned because they service a nuclear industry. In England, waste disposal sites serve the private sector and are generally manned and used every day, and are generally within a few kilometres of a township.[38] Security at a remote site without staff must be handled differently.

7.42 Mr Hallam believes that it does not automatically follow that there will be greater institutional surveillance if all material is stored at one remote site.[39] The Committee believes that the national facility for intermediate level waste should have automatic surveillance. Personal inspection could be carried out regularly and much more easily if the store is close to a population centre. The Esk storage facility shows the possibilities: it has wide barriers, electronic surveillance and regular inspections.

The Committee appreciates that a facility which is able to accommodate high and intermediate level waste will require greater security on site and a remote location may not be appropriate unless there is existing security for other purposes.

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34 Baker, Transcript of Evidence, p. 138

35 Hallam, Transcript of Evidence, p. 443

36 Country Womens" Association of Western Australia, Submission No. 12, p. 1

37 Peebles, Transcript of Evidence, p. 847

38 Davies, Transcript of Evidence, p. 258

39 Hallam, Transcript of Evidence, p. 443

Geological Stability

7.43 It was pointed out to the Committee that earthquakes can happen anywhere, although some places are more likely than others.[40] Mr Rawson told the Committee that a map of Australia which recorded incidents over the last few decades showed that:

> The number of black spots all over the map of Australia was incredible. It is incredibly active.[41]

7.44 The Department pointed out, however, that earthquakes are not a critical factor in near surface disposal sites unless there is a very large dislocation along a fault line, which is an extremely rare event in any earthquake.[42] The Committee accepts that this aspect can be dealt with by adequate engineering solutions for both the repository and the storage facility options.

Institutional Arrangements for Managing a National Storage Facility

7.45 The New South Wales Environment Protection Authority believes that there is no reason why private companies with professional expertise cannot establish such a store and charge for holding waste, providing they are properly regulated.[43] There were, however, a number of concerns because a private company may not exist as long as the institutional control period, who has liability if the company defaults, aim of the private company is to make a profit and would not be adverse to the generation of further waste to increase the profit.[44]

7.46 It was suggested that there could be a perception that a private operator may be tempted to cut corners to increase profit; companies change, priorities change and staff numbers change and companies are more susceptible to budgetary constraints than some government departments.[45]

7.47 When dealing with radioactive waste, the issue should not be one of economics but public safety:

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40 Veitch, Transcript of Evidence, p. 12

41 Rawson, Transcript of Evidence, p. 13

42 Davoren, Transcript of Evidence, p. 13

43 Samuel, Transcript of Evidence, p. 392

44 Women Opposing Uranium Mining, Submission No. 39, p. 5

45 Hartley, Submission No. 24, p. 6; Fleischmann, Transcript of Evidence, p. 479

> I would hate to see a competition of any sort set up between people who may wish to dispose of or look after radioactive waste for you ... you are talking about public safety, you do not want people to start taking short cuts in their financial interest ... primary concern is handling of a potentially hazardous material in a manner which protects the public.[46]

7.48 Mr Davoren told the Committee that the length of time required for institutional control of a repository will depend on the type and concentration of waste. The institutional control period is proposed to be 100 to 200 years, depending on the type of waste. The Committee was told that if a shorter institutional control period is envisaged then the permitted concentration of radioactivity in the waste would be less.[47] The length of the institution control period is based on a facility that does not have high concentrations of long lived materials.[48] The Friends of the Earth were still concerned, however, that the active life of the waste will exceed the period of institutional control.[49]

State Facilities

7.49 Even if a national repository is established, it would still be expected that the States/Territories would require temporary storage facilities, with transfers to a national repository every few years.[50]

7.50 The Committee was told that:

> Other states have not been able to proceed to the establishment of a site and their storage facilities are in many instances inadequate and the storage of waste far from ideal.[51]

7.51 The Northern Territory is to construct a new storage facility and Queensland and Victorian Health departments have modern storage facilities.[52]

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46 Collins, Transcript of Evidence, p. 774

47 Davoren, Transcript of Evidence, p. 39

48 Ibid, p. 39

49 Baker, Transcript of Evidence, p. 136

50 Rawson, Transcript of Evidence, p. 41; NSW Environment Protection Authority, Submission No. 45, p. 2-3

51 Hartley, Submission No. 24, p. 1

52 Northern Territory Government, Submision No. 14, p. 4; Department of Primary Industries and Energy, Submission No. 28, p. 6

The storage facilities at Lidcombe, NSW, were not purpose built and are considered temporary only.[53]

7.52 Even if the facilities in each State/Territory could adequately deal with radioactive waste produced in its jurisdiction, this does not address the fact that most of Australia's radioactive waste belongs to the Commonwealth. It was suggested that the issue is whether the waste generated in each State, including that of Commonwealth origin, should be dealt with in each State. Mr Taylor told the Committee that:

> with ANSTO ... in New South Wales they have the jobs and get the economic benefits ... they also have a responsibility to deal with the disbenefits of those facilities.[54]

7.53 This raised the concern that the Commonwealth could move facilities to States therefore leaving the State to deal with the hazardous material.[55] The Committee believes that the Commonwealth should retain responsibility for any radioactive waste produced in its jurisdiction.

Types of conditioning

7.54 The Committee accepts that radioactive waste may need to be conditioned prior to removal to a national facility. The conditioning process can significantly increase the volume of the material to be transported[56] so this should be balanced against the need to condition to ensure the safe transportation of the radioactive wastes.

7.55 The Committee also believes that nationally agreed standards should be developed to ensure compatible conditioning of material. The type of conditioning and packaging will depend on the repository's acceptance criteria, when these are established.

7.56 International recommendations for the management of intermediate level waste should become available in the next year under the RADWASS program.[57] The methods used for conditioning this waste for storage or

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53 NSW Environment Protection Authority, Submission No. 45, p. 2

54 Taylor, Transcript of Evidence, p. 859

55 Wright, Transcript of Evidence, p. 870

56 Samuel, Transcript of Evidence, p. 400

57 Australian Nuclear Science & Technology Organisation, Submission No. 32, p. 5

transport, as far as possible, should not preclude options for different treatments in future years.

7.57 The Committee believes that the establishment of an above ground storage facility as opposed to a burial facility, would provide a number of additional options. For example, volumes could be reduced to 25 per cent by compacting or shredding low level waste. This would increase the concentration of radioactivity, but this could be accommodated in an above ground facility although this would require additional safety precautions.

7.58 There was considerable support for doing very little conditioning at this stage, to enable materials to be recycled or reused in some other form, as technologies are developed. An important aspect is that researchers may need access to waste materials to be able to develop new procedures and processes for handling waste in the future. So it is essential that there is reasonable and relatively easy access while ensuring secure storage.[58]

7.59 The Committee was told that individual hospitals do not have the resources necessary to condition waste before transportation, and it is therefore necessary for a State or Commonwealth body to do this.[59] Friends of the Earth supports a special provision to enable ANSTO to condition waste on the Lucas Heights site but considers that conditioning waste on the site of production should not be a problem.[60]

7.60 The Committee supports the suggestion by the Conservation Council of Western Australia Inc of a nationally agreed code of practice for the storage and disposal of radioactive waste.[61] This would enable the incorporation of international best practice techniques in a readily available form. This should assist in the standardisation of appropriate conditioning prior to relocation of waste to a national store.

A User Pays System

7.61 The Committee believes that the implementation of a full user pays system for the national facility may be inappropriate in that the radioactive waste to be stored will mainly originate from ANSTO, other Commonwealth

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58 Hanlon, Transcript of Evidence, p. 422

59 Towson, Transcript of Evidence, p. 523-524

60 Hallam, Transcript of Evidence, p. 450

61 Conservation Council of Western Australia Inc, Submission No. 44, p. 1

bodies, hospitals, universities and other public institutions. The taxpayer will therefore be required to pay for this facility.

7.62 The situation is further complicated by issues raised previously in relation to those institutions which for various reasons hold 'historic' waste but which were not responsible for creating it. The Northern Territory Government believes that:

> It is anticipated that no charges would be made for disposal into a national facility for wastes currently held by regulatory authorities. Regulatory authorities have been collecting waste materials because no appropriate disposal route has been available.[62]

7.63 The Committee was told that:

> Since a significant fraction of the radioactive materials which require storage were accumulated over past decades, it is clearly not possible for those who acquired the sources in the past to pay the cost. The cost must therefore be borne by the whole community, i.e., the Commonwealth Government.[63]

7.64 Further, the possibility of sending radioactive materials from obsolete technologies to a national storage facility without cost impediment may encourage others to change to non-radioactive technologies.

7.65 In answer to the 'out of sight, out of mind' concern, it was argued that sending radioactive waste to a national repository would discourage the creation of more waste, as there is still the cost of handling and transportation which will be an incentive to minimise creation of waste.[64]

7.66 A fee may, however, be appropriate for waste created in future. If the cost of disposal is paid at the time of purchase this should provide an incentive to minimise use and encourage correct disposal processes.[65] The cost of transport to and disposal at the national repository will influence its acceptability.[66] The Committee was told that economic factors in the cost of disposal would dictate the degree of waste minimisation.[67]

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62 Northern Teriritory Government, Submission No. 14, p. 10

63 Fenton, Submission No. 18, p. 2

64 Smart, Transcript of Evidence, p. 769; Collins, Transcript of Evidence, p. 769

65 Hartley, Submission No. 24, p. 7

66 University of Western Australia, Submission No. 22, p. 6

67 Hartley, Submission No. 24, p. 7

7.67 Sutherland Shire Council suggests a cost of $30-40 million for a low level waste repository for 3000-4000 cubic metres of solid waste.[68] The Commonwealth Budget for establishing a national repository is $0.5 million in 1995-96, $1.5 million in 1996-97 and $3 million in 1997-98.[69]

7.68 A full cost recovery regime per volume for the national repository would be relatively high.[70] Any pricing regime would need to consider the capital costs of the facility, operating costs including post-closure activities, and incentives for minimisation. Charges should be low enough not to encourage illicit disposal or abandonment of waste.[71] Department of Primary Industries and Energy believes that:

> setting charges too high can lead to reduction of the volume for disposal which leads to still higher charges and a spiral of decreasing volume for disposal and increasing charges per unit volume disposed.[72]

7.69 On the other hand, some commercial interests may wish to avail themselves of a national facility. The South Australian Government believes that :

> There are potentially important resource developments in Australia which require a means of disposal to be developed for radioactive by-products before they can proceed. Establishment of national radioactive waste disposal facilities would assist these projects.[73]

7.70 Commercial activities may fall into a different category to many of the examples discussed in this report. It was suggested that:

> The user pays is inevitable in the current economic climate but it needs to be tempered with commonsense and with an eye to the potential public health consequences of full economic rationalism.[74]

7.71 It is considered that although continuing costs to store radioactive materials in their present locations may be small, the concern is not the cost but

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68 Sutherland Shire Council, Submission No. 20, p.17

69 Department of Primary Industries and Energy, Submission No. 28, p. 4

70 Ibid, p. 5

71 Ibid, p. 5

72 Ibid, p. 6

73 South Australian Government, Submission No. 23, p. 8

74 University of Western Australia, Submission No. 22, p. 6

the security, particularly in situations where storage facilities are inadequate.[75] The ongoing costs to hospitals of storing low level radioactive waste are modest but the costs of dealing with a leak would be 'absolutely astronomical'.[76]

Conclusions

7.72 The Committee is not convinced that shallow burial of Australia's low level or short lived intermediate waste is appropriate or necessary. The main disadvantages of shallow land burial are the lack of community confidence in this approach and the difficulties in monitoring the facility and retrieving the materials. There is an international trend towards above ground tumulus for the storage of intermediate and low level waste.

7.73 It is the Committee's preference to see this material stored in an above ground storage facility which would enable retrieval when technologies appear to dispose of, reuse or recycle the material. This approach would enable radioactive waste to be conditioned only to the extent deemed necessary for its safe transport and handling, enabling greater flexibility in taking advantage of future technological developments.

7.74 The Committee believes that any solution to the problem of disposing of ANSTO's waste should accommodate waste currently held by the States. Consequently the design of the facility should include the capacity to store higher level waste, such as ANSTO's spent fuel rods, waste products produced by reprocessing spent fuel rods and residue from uranium.

7.75 The Committee believes that the national facility should not only deal with Commonwealth generated waste but consideration should be given to the inclusion of:

- intermediate and/or long lived wastes held by hospitals, universities or industry, where their storage facilities are inadequate;
- waste from States or organisations where their existing facilities are full or unsuitable for a particular type of waste;
- waste from those who are willing to pay rather than maintain a storage facility on site;

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75 Collins, Transcript of Evidence, p. 765

76 Towson, Transcript of Evidence, p. 767

- waste from situations where hospitals and companies are closing, leaving no one to maintain the waste in safe storage; and
- radioactive waste held by the host state.

7.76 Based on the principle that if one State is to host the radioactive waste produced elsewhere in Australia then some compensation is appropriate, the siting of the national facility may be easier if the host State is able to use the facility for State-generated waste, saving the substantial cost of constructing its own facility.

7.77 The South Australian Premier, the Hon Dean Brown suggested to the former Prime Minister that:

> In addition, the South Australian Government wishes to discuss with the Commonwealth the possibility of transferring to the bunker at Woomera Rangehead, some radioactive waste that is presently held in temporary storage sites in South Australia.[77]

7.78 It was suggested that the national facility should have the capacity to accept smoke alarms. An automated process could be developed to remove the radioactive material[78] and thousands could then be stored in drums.[79]

7.79 Mrs Towson believes that the storage of liquid waste needs to be considered in the establishment of a national facility.[80] ANSTO has been attempting to solidify intermediate level waste from radioisotope production since 1987.[81] The Committee believes that the technical aspects will need to be considered during the design phase of the national facility.

7.80 The Committee supports the finding of the Research Reactor Review that a decision on the possible replacement of the research reactor should not be made until the issue of the management of the radioactive waste is resolved:

> a crucial issue is final disposal of high level wastes, which depends upon identification of a site and investigation of its characteristics.

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77 Premier of South Australia, Letter to the former Prime Minister, the Hon PJ Keating, 28 February 1995, p. 1

78 Carter, Transcript of Evidence, p. 826

79 Wallace, Transcript of Evidence, p. 725

80 Towson, Transcript of Evidence, p. 768

81 Sutherland Shire Council, Submission No. 20, p.18

A solution to this problem is essential well prior to any future decision about a new reactor.[82]

82 Research Reactor Review, (1993) *Future Reaction, Report of the Research Reactor Review*, August 1993, p. 216

CHAPTER 8

RISK MANAGEMENT AND COMMUNITY CONCERNS

Introduction

8.1 The objectives of radioactive waste management are to manage radioactive waste in a manner which protects worker safety, public health and the environment. Safety considerations are planned to ensure that only a small fraction of the permitted exposure limits can occur.[1]

8.2 The International Commission on Radiological Protection recommendations, on which Australian radiation protection regulations are based, assume a linear hypothesis; that is, the risks from exposure to ionising radiation are proportional to dose, without a threshold. The Australian Nuclear Association argued that the linear hypothesis almost certainly overestimates risks at low doses and low dose rates.[2] The ANA argues that low level radiation may be beneficial and points out that the adverse effects have not been scientifically proven.[3]

8.3 However, the linear hypothesis is generally accepted as a precautionary measure because of the uncertainty of the effects at low radiation levels. Using the linear hypothesis does have important implications for risk assessment and formulation of public policy. The absence of a threshold implies that there is no such thing as an absolutely safe level of exposure. Every increment of dose above zero, however small, results in an increment of risk. The question that must be answered is thus not 'What is the safe dose?' but 'How safe is safe enough?'

8.4 The Committee was told that radioactive waste management was based on the ALARA principle (as low as reasonably achievable, social and economic factors taken into account) which tries to balance the benefits against the harms of the use of radioactive materials.[4] However, this approach is regarded with mistrust by some, as being a way of justifying economically profitable strategies, without regard for best practice.[5] It was argued that the ALARA

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1 Fleischmann, Submission No 9, p. 3

2 Australian Nuclear Association, Submission No 16, p. 1

3 Ibid, p. 1

4 Carter, Transcript of Evidence, p. 824

5 Sutherland Shire Council, Submission No 20, p. 14

principle is unscientific and should be replaced by ALATA (as low as technically possible) which achieves the safest possible outcome.[6]

Risk Management

8.5 The Committee agrees that there can never be a complete absence of risk in radioactive waste management policies. It was pointed out that:

> Safety can never be unconditionally guaranteed in any process. The only procedure that is absolutely safe is one that never starts.[7]

> Nothing in life is totally without risk. The whole idea of the codes, of the regulations, of the management approach is to minimise that risk to the community.[8]

> adequate safety does not consist of the complete absence of risk. This is quite an impossible concept and we cannot live in this world without accepting some levels of risk. ... we are exposed to risks from industries which apparently we accept, like transportation and chemical industry, the supply of gas, water, electricity etc.[9]

8.6 Quantitative risk analyses are used to establish the guidelines for most safety procedures, including the codes used by governments for radioactive waste management. They are divided into two parts: risk assessment, which attempts to measure the risk associated with the activity, and risk level, which is determined by comparing the activity to other risk producing agents. The International Atomic Energy Agency considers that:

> The standards recognise that radiation is only one of many sources of risk in life and that the risk associated with radiation should not only be weighed against experiences but also viewed in perceptive of all the risks.[10]

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6 Medical Association for the Prevention of War, Submission No. 51, p.2

7 Fleischmann, Submission No 9, p. 2

8 Makeham, Transcript of Evidence, p. 688

9 Higson, Transcript of Evidence, p. 605

10 International Atomic Energy Agency (1994) *International Basic Safety Standard for Protection Against Radiation and the Safety of Radiation Sources*, Safety Series No. 115-I, Interim Edition, Vienna, Preface, p. 1.

8.7 Risk analysis relies on probability; it seeks to quantify both the probability and the magnitude of adverse consequences that individuals, populations, or ecosystems might suffer from specific hazards.[11]

8.8 Mr Fleischmann said that:

> The level of safety (or hazard) can be assessed on the basis of both experience and considered opinion and can then be compared with safety assessments for other procedures. ... These levels of risk can be given numerical values that provide the chances of a fatal accident or of a severe injury.[12]

8.9 The concept of what constitutes an acceptable risk is based on an attempt to measure the risk or hazard associated with the use of a substance or technology. To this must be added consideration of the benefits to society of using the substance or technology and the cost to society of reducing the risks.[13] For example, compulsory X-rays for tuberculosis were not required once the risk to the population of getting cancer from the radiation was greater than the risk of getting tuberculosis. Witnesses who strongly opposed radioactive procedures in Australia maintained that, in general, the risks far outweigh the benefits.

8.10 The Report of the Research Reactor Review referred to these risks:

> The risks of radiation-induced cancer are well studied and well documented and are the basis of all radiation protection standards and systems. The public perception is that such risks are high; but they are, in fact, relatively low.[14]

8.11 The International Commission on Radiological Protection confirmed this view:

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11 Institute of Energy and Environmental Research (1995) *Science for Democratic Action* 4(1): p.6

12 Fleischmann, Submission No 9, p. 2

13 Gail de Planque E (1994), 'The Science and Philosophy of Developing Programs for Radiation Protection', Paper presented at the Institution of Engineers Australia Australian Nuclear Association, *9th Pacific Basin Nuclear Conference*, 1-6 May 1994, Sydney, p. 527

14 Research Reactor Review (1993) *Future Reaction, Report of the Research Reactor Review*, August 1993, pp. 146-7

> All those concerned [with radiological protection] have to make value judgments about the relative importance of different kinds of risk and about the balancing of risks and benefits.[15]

8.12 However, the Committee was given the example of the Rasmussen report in 1974 in which the New South Wales Government's policy for hazard risk analysis indicated that the Kurnell AOR Caltex refinery had a risk of one in one million of a fire; it has recently had two fires.[16]

8.13 Also, the Committee was told that statistically it would be impossible to prove one way or another whether low levels of radiation have a deleterious or a beneficial impact on humans.[17] Over the next 30 to 40 years it can be expected that one million cancers will result from the accident at Chernobyl. However, in a population of 250 million this will not be statistically detected. Therefore sufficiently large sample sizes and good health records would be needed to detect any significant changes.

8.14 Dr Lokan told the Committee that it is difficult to detect the effects of the atomic bomb on the Hiroshima community, in which the fatalities measured 500 out of 100 000 under conditions where exposures were very high.[18] In Australia, as the number of people working in the radiation field is quite small, statistical analysis would be insignificant.

8.15 The Australian Radiation Laboratory believes that the exposure off site from the ANSTO facilities are so low that any effects would be undetectable.[19] The Committee was told, however, that a risk assessment conducted in relation to the air emission at the Lucas Heights Research Laboratories has not been made public to enable peer review.[20]

8.16 The Committee was told that in Australia it would be difficult to have a sufficiently controlled population for the purposes of collecting meaningful statistics on population exposure to radiation.[21] It would be impossible to prove scientifically, based on statistics, that very low levels of radiation either

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15 *International Commission on Radiological Protection*, ICRP Publication 60, *1990* Recommendations of the International Commission on Radiological Protection, Pergamon Press, p. 67

16 Robertson, Transcript of Evidence, p. 579

17 Samuel, Transcript of Evidence, p. 410

18 Lokan, Transcript of Evidence, p. 111

19 Lokan, Transcript of Evidence, p. 111

20 Sutherland Shire Council, Submission No. 20, p. 22

21 Burch, Transcript of Evidence, p. 501

did or did not have a deleterious impact on humans.[22] Mr Fleischmann pointed out, however, that if statistics are not used then there is virtually nothing.[23]

Community Perceptions of Risks

8.17 In the evidence presented to the Committee, there was a clear divergence of views between scientists and those representing the community on the perception of risk from radioactive waste. Radiation is a scientific matter, but public perceptions value judgments play an important role in weighing the risks against the benefits in radiation protection.

8.18 The Committee believes that the scientific and engineering considerations in determining the siting of a national facility will prove to be less challenging than convincing the local community of its acceptability. Attempts by the Department of Radiation Oncology at the Royal Hobart Hospital to establish a repository have been frustrated by the public's perception of risk.[24] The accomplishment of radiation management objectives is viewed very differently by the public and the experts.

8.19 The point was emphasised that although there was no technical urgency in removing the radioactive waste held at Lucas Heights, the local community felt differently.[25] In relation to interim storage facilities for radioactive waste at many sites in Australia, Mr Davoren said:

> There is also the very real issue of concern in a number of communities in built-up areas of Australia at the storage of radioactive waste. Technically, these things do not present a serious hazard, but the reality is that people are upset about it and that reality has to be addressed.[26]

8.20 Mr John Wallace told the Committee that:

> Public perception of risk is something that is going to take a long time to change, so any education program has to realistic in its targets and expectations ... It is not going to turn the world around no matter how much you invest in it[27]

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22 Samuel, Transcript of Evidence, p. 410

23 Fleischmann, Transcript of Evidence, p. 494

24 Chappell, Submission No. 70, p. 1

25 Jostsons, Transcript of Evidence, p. 72; Rolland, Transcript of Evidence, p. 79

26 Davoren, Transcript of Evidence, p. 32

27 Wallace, Transcript of Evidence, p. 717

8.21 A number of factors must be considered in dealing with people's perceptions of risk:

- people's perceptions of risk generally undervalue high risks and over value low risks compared with levels estimated by various risk analysis techniques;
- risk managers may need to accept the reality of perception rather than the reality of the mathematics;
- perceived risks can damage the quality of life as much as the real risk;
- decisions must also take into account popular opinion as well as technical advice;
- perceptions of risk can be distorted by factors such as who imposes the risk, who benefits from it, how many are affected, how dreaded the outcome is, outrage factors, whether risks can be avoided or are part of our way of life and so on; and
- risk can be acceptable provided people are aware of the risk, there is some commensurate benefit and the acceptability increases as the odds increase.[28]

Community Concerns

8.22 A United States study by Hinman found that radioactive waste causes the second or third highest feelings of dread among the public, greater than nuclear power itself, despite the fact that waste risks form the smallest component of the total nuclear fuel cycle.[29]

8.23 It was suggested that public concerns in Australia about radioactive waste stem from the following perceptions:

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28 Fleischmann, Submission No. 9, p. 3; Selinger B (1995) 'Changing the perception of risk' *Search* 26(10): 313-315, pp. 313-314; Royal Alexandra Hospital for Children, Submission No. 5, p. 3

29 Hinman G, Rosa A, Kleinhesselink R and Lowinger T (1993)' Perception of Nuclear and Other Risks in Japan and the United States', *Risk Analysis 13(4):* 449-456; quoted in Inhaber, H (1994) 'Risk Analysis and Solving the Nuclear Waste Siting Problem', Paper presented at Institution of Engineers Australia and Australian Nuclear Association, *9th Pacific Basin Nuclear Conference*, 1-6 May 1994, Sydney, p. 519

- not enough is known about radioactivity. Nobody can promise that unforeseen events will not happen;
- the effects of a nuclear accident are disproportionate to any quantified risk associated with radioactivity. There is perceived potential for catastrophic disasters;
- no kind of burial or containment is safe;
- any unseen, unfelt hazard is more threatening than one you can see and grasp. Exposure may go unnoticed at the time but may have effects which go even across generations. The risk to future generations cannot be predicted;
- if it has to be safely contained and removed far from human habitation, it must be extremely dangerous;
- radioactive waste management has to be controlled for thousands of years. Nobody can predict the certainty of such management;
- transporting waste across land, with the possibility of spillage, will detract from the value of the land;
- rural areas will become a dumping ground for cities' problems;
- the government cannot be trusted to make public all the facts;
- the government is not sufficiently accountable; and
- nuclear waste disposal is a threat to civil liberties.

8.24 Public perception of the dangers of radioactive waste were considered by some as linked to the origin of nuclear activity in war:

> Because there is a perception that all radiation is man-made, visions of the bomb seem to be the first thing that comes to people's minds. I think that is poor because firstly it creates a panic mentality ... which blocks the opportunity to rationally educate people about what they should be doing either for their own safety relating to radiation matters or for where it is appropriate for radiation to be used.[30]

30 Schache, Transcript of Evidence, p. 287

8.25 Evidence to the Committee suggests that radiation is principally seen by the public as something intangible and therefore more threatening, and as having such long term effects that decisions made now could affect many generations to come. The latter point particularly reflects the value basis of the public perception.

> I am aware that it can take up to 40 years for health effects to show up in the population so I think what we have seen so far is just the tip of the iceberg. I am very concerned about what is going to show up in the future.[31]

> People have been told constantly that there is no problem with low level waste. Yet, repeatedly, we are also told that low level radioactive wastes cause mutation of the cells, increase the aging capacity of the body, and increase leukemias, birth defects, breast cancers and general lung cancers for hundreds, possibly thousands of years.[32]

> I feel that we have a moral responsibility - to not only the rest of the State but to our unborn children and grandchildren for whom we caretake this planet - to protect our river from radioactive contamination likely to cause cancers for thousands of years.[33]

8.26 These views are confirmed by a statement about risk in the Research Reactor Review, which asserts:

> Heightened perceptions of risk usually relate to new or unfamiliar risks, where the risks are thought to be beyond the individual's control, where the effects may be delayed for a long period, where the detection of danger is impossible because it is invisible and odourless and where children's health is involved.[34]

All of these criteria apply to radioactivity.

Community Concerns in Relation to the Transport of Radioactive Waste

8.27 Concern was also evident in relation to transporting radioactive waste, despite the fact that no accidents with serious radiological consequences had ever been encountered in the transport of radioactive waste anywhere. This

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31 Ward, Transcript of Evidence, p. 592

32 Lannstrom, Transcript of Evidence, p. 190

33 Lannstrom, Submission No 29, p.1

34 Research Reactor Review (1993) *Future Reactions Report of the Research Reactor Review*, August 1993, p. 146

may be attributed to a history of incidents and disputes involving the transportation of other hazardous wastes, eg pesticides.

8.28 When radioactive waste was to be transported from Sydney to Woomera, a petition of 3000 signatures was collected asking the South Australian Government to make the Riverland area a Nuclear Free Zone to stop transport of radioactive waste through the area.[35] Ms Lannstrom spoke to almost one thousand people, the majority of whom were angry.[36]

> The Riverland communities have since begun a petition: their concern is that they have not been involved in any sort of consultation about the development of the appropriateness of the route and the risks that the transportation poses to them as a community.[37]

8.29 The Committee was told that when a community is given assurances that everything will be all right and then there is an incident such as the one at Port Augusta, the community is rightly concerned that they not have been told the complete story.[38] It was also suggested to the Committee that the community should be more informed about the transportation of radioactive waste and then there may be more acceptance of it.[39]

Community Concerns in Relation to the Lucas Heights Research Laboratories

8.30 Professor Baxter, the then Chairman of the Australian Atomic Energy Commission, told the Sutherland Shire Council and the community in the 1950's that there would be no emissions to air and water from the Lucas Heights site.[40] It was pointed out by the Sutherland Council that this was an example of misinformation right at the beginning of the process.[41]

8.31 The Sutherland Shire Environment Centre expressed its concern about the lack or inadequacy of epidemiological studies being carried out on radiation

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35 Lannstrom, Submission No. 29, p. 1

36 Lannstrom, Transcript of Evidence p. 197

37 Hine, Transcript of Evidence, p. 148

38 Ibid, p. 180

39 Botten, Transcript of Evidence, p. 183

40 Rankin, Transcript of Evidence, p 537

41 Ibid, p. 537

workers and communities adjacent to ANSTO facilities.[42] Mr Robinson told the Committee that the research reactor review:

> requested an epidemiological study together with a review of the medical histories of all workers and ex-workers in the plant. ANSTO put up a furphy in response to them, claiming that there were such privacy implications to anonymously reviewing medical histories that it would have created so-called industrial relations problems on the site.[43]

> Residents have been calling for adequate health studies for well over 15 years.[44]

8.32 ANSTO referred the Committee to two recent studies which showed no significant differences in the health of residents of Sutherland Shire compared with that of other residents of New South Wales. A detailed survey of the health of workers at Lucas Heights in the mid-seventies also concluded that there was no evidence of internal effects of exposure to radiation.[45] ANSTO is participating in an international study of nuclear industry workers which is being conducted in 14 countries.[46]

8.33 Technical difficulties at ANSTO have allowed community concerns to persist. Attempts by ANSTO to solidify high level molywaste from the Australian Radioisotopes so that it is stabilised and safer have been going on for some years.[47] In 1987 this was recognised as a significant safety problem. Solidification has still not been achieved and ANSTO is now looking at alternative possible processes from overseas.[48] Some in the Sutherland community claimed to have heard about radioactive accidents with fuel rods coming out of the reactor at Lucas Heights.[49]

8.34 The Committee was told that the Sutherland Shire Environment Centre had door knocked residents of Lucas Heights and Menai. It claims people had been told by real estate agents that the reactor would soon be closed.[50] There

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42 Sutherland Shire Environment Centre, Submission No. 7, p. 6

43 Robertson, Transcript of Evidence, p. 557

44 Rankin, Transcript of Evidence, p. 557

45 Australian Nuclear Science & Technology Organisation, Supplementary Submission No 32a, pp. 7-8

46 Australian Nuclear Science & Technology Organisation, Supplementary Submission No. 32b, pp. 8-9

47 Smith, Transcript of Evidence, p. 564

48 Ibid, p. 565

49 Ibid, p. 547

50 Priceman, Transcript of Evidence, p. 596

were also claims that to avoid widespread panic, the general community had not been informed that iodine tablets to be taken in the event of exposure to radiation, were kept at Engadine Police Station.[51] Nevertheless real estate values in the area have remained high.[52]

8.35 One submission stated that the exemption of ANSTO from State legislation:

> clearly rekindled the widespread and deep distrust of ANSTO which had tended to decline in recent years.[53]

8.36 Sutherland Shire Council claimed that its community and any other communities affected by radioactive waste management practices should have some representation on the appropriate decision-making bodies.[54] Mr Smith from the Sutherland Council is a member of the ANSTO Safety Review Committee. However, he is unable to report to Council on confidential information that is tabled at the Committee.[55] The former Mayor pointed out that the existing Safety Review Committee is to be abolished and that after the establishment of the proposed Australian Institute of Radiation Protection is set up, she believed that there would be no community representation.[56]

8.37 Community representatives are also concerned that important information may be being withheld. The Committee was told that neither the Interdepartmental Committee report from 1994 which considered the management of high level waste, nor a risk assessment of the air emissions from Lucas Heights Research Laboratories, have been made available to the public.[57]

Community Concerns in Relation to the Mt Walton East Site

8.38 There was significant community opposition to the establishment of the Mt Walton East repository. Petitions containing approximately 9000 signatures were collected in relation to the proposal.[58] The site is in a mining area where

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51 Ward, Transcript of Evidence, p. 596-597

52 Priceman, Transcript of Evidence, p. 597

53 Women Opposing Uranium Mining, Submission No. 39, p. 3

54 Sutherland Shire Council, Submission No. 20, p. 23

55 Rankin, Transcript of Evidence, p. 538

56 Ibid, p. 538

57 Sutherland Shire Council, Submission No. 20, p. 21

58 Botica, Transcript of Evidence, p. 852; Goldfields Against Serious Pollution, Submission No. 57, p. 1

it was claimed that people do not publicly oppose the site for fear of losing their jobs.[59]

8.39 The Committee was told that the intention at the time of the establishment of the Mt Walton Intractable Waste Facility was that:

> There was always a commitment that the community would be involved, there would be the community consultative committee and they would be directly involved in what was going on out there. They would know what is happening all the time and we would know what is going out to Mount Walton and when it would go.[60]

8.40 Prior to the construction of Mt Walton the community took a considerable length of time to develop a degree of trust.[61] In November 1988, before the establishment of the Mt Walton East facility, a Community Liaison Committee was set up.

> This process allowed a full and frank exchange of information and views between the officers representing State Government and other members of the Committee. While this has been successful in building some level of trust between members, on a one-to-one basis, there were consistent ongoing concerns expressed by the community group members.[62]

8.41 The efficacy of this Committee, however, was brought into question in one submission:

> In actual fact the community liaison process was totally manipulated by the Health Department ... The Health Department orchestrated the whole thing, allowing us only an avenue to 'question, growl and complain.' And when the meetings were over the Health Department went ahead and did exactly what they were going to do anyway. The committee had no decision making powers nor could pass any recommendations.[63]

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59 Botica, Transcript of Evidence, p. 852

60 Taylor, Transcript of Evidence, p. 857

61 Munslow-Davies, Transcript of Evidence, p. 310

62 Hartley, B *et al* (1994) 'The Establishment of a Radioactive Waste Disposal Facility in Western Australia for Low Level Waste', Paper presented at the Institution of Engineers Australia Australian Nuclear Association, 9th Pacific Basin Nuclear Conference, Sydney, 1 -6 May 1994, p. 909

63 Peebles, Submission No 43, p. 6

8.42 The Committee was told of a long saga of public relations difficulties concerning the Mt Walton site. The community living adjacent to Mt Walton was told by the Commissioner of Public Health that no new industries relying on the Mt Walton facility would be established; rather it was for radioactive and other hazardous material which had accumulated to that point and which amounted to no more than a few hundred weight.[64]

8.43 The community became aware of a proposed increase in the dimensions of the Mt Walton site after the proposal appeared on the Department of Minerals and Energy's Tengraph computer system in July 1995.[65] At community liaison meetings the changes were denied by the Acting Director of the Waste Management Division on 14 August and 30 October 1995 at.[66] On 9 December 1994 that officer had written a letter to the Department of Land Administration stating that:

> I can also confirm that we will be pursuing the extension of the reserve to the north west as outlined in your earlier correspondence, and have reached informal agreement with DOME on this. The matter, at a policy level, will be dealt with in a pending Cabinet minute which I hope will set general government policies for the use of the site.[67]

The Committee was given copies of letters dated 11 April 1995 and 5 May 1995 which commented on the proposed extension.

8.44 The community liaison meetings are run by the managers of the Mt Walton East site. This situation is unacceptable to some members of the liaison committee.[68] The liaison meetings are a requirement of the Environmental Protection Authority approval and it was suggested that an independent party such as the EPA should manage the community liaison process, not the proponent.[69]

8.45 The community living adjacent to the Mt Walton East site expressed its concern that this site may be used for a national repository because it is part of

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64 Cohen, Transcript of Evidence, p. 318

65 Peebles, Transcript of Evidence, p. 834

66 Peebles, Transcript of Evidence, p. 834

67 Schuster, Letter to Department of Land Administration, 9 December 1994, p. 1

68 Peebles, Transcript of Evidence, p. 835

69 Ibid, p. 835

the Jackson Region. The community's concerns were heightened by a number of events:

- the federally funded upgrade of the Esperance port facilities can now handle radioactive materials;
- the federally funded upgrade of the Jaurdie railway siding (near Mt Walton) at a cost of $1.5 million;
- alleged comments by the former Minister for the Commonwealth Department of Primary Industries and Energy that the Commonwealth Government was not prepared to pay the price asked by the Western Australian Government to dispose of waste at Mt Walton East, despite the fact that the site was to be for Western Australian waste only;
- the failure of the Western Australian Government to incorporate a clause in the legislation designating the Mt Walton site for Western Australian waste only;
- the number of changes that have already occurred in the proposed uses of the site for disposal;
- the proposed extension to the existing Mt Walton East area;
- the announcement by the Waste Management Division that they had $1 million dollars to spend at the site but were not prepared to reveal the purpose for which the funding would be used;
- the support of the local Federal member for the project; and
- the listing of the Jackson Region as one of the eight preferred sites.[70]

8.46 Of particular concern to the community was the disposal of radioactive waste at Mt Walton East which was of a higher level than that revealed in the public consultation process.[71] This was explained as confusion of two inventory lists,[72] items being mislabelled[73] and a data management error.[74] It

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70 Peebles, Transcript of Evidence, p. 839-844; Botica, Transcript of Evidence, p.853; Taylor, Transcript of Evidence, p. 865

71 Peebles, Transcript of Evidence, p. 839

72 Schuster, Transcript of Evidence, p. 247-248

73 Hewson, Transcript of Evidence, p. 250

74 Hutchinson, Transcript of Evidence, p. 384

was stated that this type of problem still undermines the community's confidence in the Government's management ability.

8.47 Mr Ian Taylor, who was the Western Australian Minister for Health at the time the Mt Walton project commenced, told the Committee that:

> There seems to me to be an unnecessary degree of secrecy surrounding what is happening at Mount Walton ... In more recent times ... the organisation that looks after it has denied any knowledge and involvement on proposals to expand the size, yet questions in parliament show quite clearly that they have been involved. All of those sorts of things are the absolute wrong way to approach these sort of issues. There is only one way to approach it - that is, you have to be absolutely open with people ... unless it is open and unless they know what is going on, they feel they are being conned.[75]

8.48 This was reinforced by the Mayor of Kalgoorlie-Boulder who said that:

> People want to be told up front what is going on and they do not want the issues sidelined.[76]

8.49 Mr Taylor told the Committee that:

> We will use our rail system and anything else we can use to stop these wastes [from other states] being transported to Western Australia. We will not accept them because they are not our responsibility ... They [Commonwealth Government] may be allowed to overrule but what they will not overrule is the overwhelming community view that this is not for us to deal with, I believe the entire city would not accept that. Quite frankly, they would not get the waste through. People would sit on the railway line and blockade the railway line to stop those wastes coming through.[77]

8.50 The local Mayor also told the Committee that the City of Kalgoorlie-Boulder is unanimously opposed to the establishment of a national radioactive waste repository in the Goldfields Region.[78] He went on to say that:

> The people of Kalgoorlie-Boulder have galvanised themselves against the establishment of a radioactive waste facility in our area.

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75 Taylor, Transcript of Evidence, p. 857-858

76 Yuryevich, Transcript of Evidence, p. 866

77 Taylor, Transcript of Evidence, p. 863

78 Yuryevich. Transcript of Evidence, p. 865

> It has been the biggest single issue that I have been involved in the seven years that I have been in local government.
>
> The situation has not changed. The people of Kalgoorlie-Boulder as one, are opposed to it and will continue to oppose it. What Mr Taylor mentioned before - about having the unions support us in blockading the railway line, and the Esperance port if need be, to stop the waste of the rest of Australia moving into Kalgoorlie-Boulder and the surrounding district - has already been mooted. That is not an idle statement.[79]
>
> Any failed site selection procedure will simply make the next approval much more difficult.[80]

Community Concern in Relation to the Esk Facility

8.51 Initially there was community opposition to the Esk Radioactive Waste Storage Facility, but the community has since been included in the consultation process. It appears that the Queensland Government has accepted a number of the conditions requested by the community. The management committee has an equal number of representatives from both the Department and the Shire Council.

8.52 The Queensland Government announced that the Esk facility would be used to store waste which had previously been stored under the Storey Bridge and there was only 11 cubic metres of waste.[81] The Committee was told that it now appears that the Esk facility will be receiving waste for the next 100 years and that waste is doubling every five years.[82]

Community Consultations

8.53 Principle 10 of the Declaration on Environment and Development 1992, known as the Rio Declaration, to which Australia is a signatory, states:

> Environmental issues are best handled with the participation of all concerned citizens at the relevant level. At the national level, each individual shall have appropriate access to information concerning the environment that is held by public authorities, including information on hazardous materials and activities in their

79 Yuryevich. Transcript of Evidence, p. 865

80 Hartley, Submission No. 24, p. 6

81 Mahoney, Transcript of Evidence, p. 620

82 Ibid, p. 620

> communities, and the opportunity to participate in decision-making processes.

8.54 The Women Opposing Uranium Mining were concerned that:

> the prevailing ethos is one that sees community consultation merely as a criteria to be met rather than a pivotal aspect of waste management policy development.[83]

8.55 In a comprehensive report to the previous Federal Government in 1984, *Australia's Role in the Fuel Cycle,* Australian Science and Technology Council recommended:

> Radioactive waste methods must conform to the highest practicable standards and be acceptable to the general public. Because of public concern over the hazards of radioactivity, there must be an emphasis on a consensus approach to decisions in relation to nuclear waste management with responsibility accepted jointly by government and the industry producing the waste.[84]

8.56 Allan & Stephens stated that:

> The general public and potential host communities are important constituencies which contribute to the decision-making when identifying options for waste management. Building public confidence in a program is therefore an important part of its development. The process to be followed in reviewing the program and deciding on future steps should involve consultation with, and the active participation of, the communities and public affected. Decision-makers need to have a mechanism to take public concerns into account when advancing major projects such as a disposal facility.[85]

8.57 Many authorities, both in Australia and overseas, have echoed this approach. For example, the French nuclear authority (ANDRA) has become an independent public service company with a mandate for three inter-related programs: information, disposal and research. Public information must be provided on all waste types. A national waste register is being established, collecting data from all waste-generating facilities, and making the information widely available. Community participation in the French search for a suitable

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83 Women Opposing Uranium Mining, Submission No. 39, p.2-3

84 Australian Science and Technology Council (1984) *Australia's role in the Fuel Cycle,* p. 19

85 Allen C and Stephens M (1994) *Status of Canada's Nuclear Fuel Waste Management Program: On the Threshold of the Environmental Review of the Disposal Concept*, Institution of Engineers Australia and Australian Nuclear Association, 9th Pacific Basin Nuclear Conference, Sydney, 1-6 May 1994, p. 854

repository (*Waste Act 1991*), includes economic incentives up to about 60 million francs a year, to be provided to local communities to assist in its development and for environmental protection.

8.58 The Committee was told that the public should have the opportunity to contribute to any discussions on radioactive waste storage or disposal. This should include decisions on retrievability, siting, monitoring and measures of institutional control. Information on any transport of radioactive waste should be openly available, including the content of the load, the route to be taken and the safety precautions in place. The Committee sees the lack of information on radioactive waste as partly the cause of public mistrust of both State and Commonwealth governments.

> Policies pertaining to radioactive waste management must be developed with the full participation of the public. The public does have the right to know what is going on. We believe there are cover-ups.[86]

> It is of great concern to us that, through the community liaison process, the community has not been able to access its full democratic rights.[87]

8.59 There is an awareness by communities now that enables them to obtain government documents which would not have been previously available. If a particular site is chosen by the Federal Government for a national repository the Committee believes that the Government should be straight forward and liaise with the community about their requirements for the storage of the nation's radioactive waste at that site.

> Whilst history shows continued pressure from public on government will result in higher safety standards and there appears to be no reason why the pressure should be assumed to be exhausted.[88]

8.60 The Committee received requests for much more detailed information to establish public trust:

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86 Mahoney, Transcript of Evidence, p. 629

87 Peebles, Transcript of Evidence, p. 835

88 Organisation for Economic Cooperation and Development (1995) *Nuclear Safety Issues in OECD Countries* - Nuclear Energy Agencies, p. 18

> We would like to recommend that an annual report of radioactive waste is prepared and to be made available on request to concerned individuals or public organisations.[89]

8.61 One of the recommendations of the Pacific Nuclear Council's Taskforce on the Management of Low Level Radioactive Waste states:

> The importance of early and good public information programs should be recognised as essential for radioactive waste management to be successfully accomplished. A pro-active public information program is more effective than a retrospective program after there has been public opposition to a particular management proposal.[90]

8.62 The Committee believes that a decision to construct a national repository or store should involve adequate consultation with the public.

Recommendation 19

The Committee recommends that the public, particularly the local community, should be involved in consultation on the construction of a national storage facility and the transport arrangements to any such facility.

8.63 Further, should there be contemplation of a change to the type or quantity of radioactive material stored there, there should be a further public consultation process. The community should also have input into the ongoing management of the facility.

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89 The Queensland Greens, Submission No 15, p. 5

90 Pacific Nuclear Council (1995) *The Management of Low Level Radioactive Waste,* Report to PNC Meeting Tokyo April 1995, Taskforce on the Management of Low Level Radioactive Waste, March 1995, p. 30

Recommendation 20

The Committee recommends that a management committee for the facility be established including an equal number of representatives from the local community and the users of the national storage facility, together with a representative from the Australian Institute of Radiation Protection and one from the relevant State or Territory authority. This Committee should oversee the design, construction and management of the facility.

8.64 The Committee believes that as part of the accountability process for the management of the radioactive waste facility the managers should be required to produce an annual report to Parliament.

Recommendation 21

The Committee recommends that the managers of the national storage facility be required to produce an annual report to Parliament.

Community Confidence

8.65 The Committee was told that adequate government accountability to the public will be a major factor contributing to community satisfaction with the management of radioactive waste in Australia. To establish credibility, the regulator must be seen to be independent and apply criteria which are relevant through credible and comprehensive assessment procedures. The community must be convinced that the entire process is subject to independent assessment.[91]

91 Botten, Transcript of Evidence, p. 184

> An independent body would be much more likely to convince me than having that information come from ANSTO, which obviously has a vested interest. Also, I would probably want some supporting evidence from overseas...[92]

8.66 The Committee believes that governments must also be seen to be minimising the amount of radioactive waste created, particularly by ANSTO but also by hospitals. This can be achieved by implementing effective justification procedures, using alternative technologies and recycling or reusing sources where possible. The public must feel confident that these measures are being actively pursued.

8.67 The 1991 ICRP 60 recommendations for public and occupational radiation protection require more stringent local regulations to protect people from ionising radiation. The fact that scientists have deemed it necessary to upgrade safety standards has instilled doubt in people's minds.

8.68 The Committee was told that public confidence in the governments' ability to manage radioactive waste is also being undermined by the failure to decide on a long term strategic plans:

> The lack of defined plans for the long term management of this waste, reinforced by lack of public understanding of the significant differences in potential hazards from different radioactive wastes, has had an important effect on public confidence.[93]

8.69 The Committee believes that undue secrecy has had a negative effect on community trust and organisational credibility.

> When we asked for further information from the CSIRO regarding their soil, we were told they were not allowed to talk to us. What does that say to you? It says to me there is a cover-up.[94]

8.70 An article in the *Journal of the American Medical Association* confirms the perception of undue secrecy and also criticises the confident approach of scientists.

> In part, these problems reflect a growing public distrust in governmental agencies that has been characterised as 'the decline of deference.[95]

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92 Ward, Transcript of Evidence, p. 598

93 Uranium Institute (1992) 'The management of radioactive waste' *The Mining Review* (August 1992): 8-15, p. 11

94 Gosling, Transcript of Evidence, p. 348

8.71 The Committee was also told that confusion associated with the classification of radioactive waste is an important element in the public's perception of the dangers inherent in radioactive waste management. This is particularly so where the public believes it is being deceived.

> One method used by the nuclear industry to attempt to reduce the problem of nuclear waste stocks is to alter the standards used to define waste, e.g. by changing intermediate level to low level or high level to intermediate.[96]

8.72 Of the three classes of radioactive waste, low level waste has up until now made up the greatest volume of waste generated in Australia, and much discussion about management of radioactive waste has centred on this category. The waste includes a very wide variety of material, from contaminated clothing to large volumes of liquid waste. When terms such as 'low level' are used in discussion to avoid quantitative detail, because the classification of radioisotopes is a complex issue, problems occur. It is therefore considered not surprising that reports of higher level material being included in so-called low level waste have been easily believed by the community.[97]

> It is said to be low level, but I notice the company [Rhone Poulenc] is now calling it medium level waste; and a lot of people would think it is more than medium level waste.[98]

8.73 Evidence to the Committee indicated that a clearer understanding of waste classification by the public would be aided by a more detailed breakdown of the low level waste category, closer supervision of boundaries between the categories and a better information policy. Information about the classification system should be widely disseminated in plain English accessible to the non-scientific community:

> a variety of units of measurement are used, making it difficult for a lay person to feel confident that they have understood the basis of the material.[99]

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95 Hendee W (1993) 'Disposal of Low-Level Radioactive Waste', *Journal of the American Medical Association* 269(18):2405-6

96 Sutherland Shire Environment Centre, Submission No 7, p. 2

97 Friends of The Earth, Submission No 47, pp. 22

98 Cohen, Transcript of Evidence, p. 318

99 Environment Centre Northern Territory Inc, Submission No. 35, p. 1

The Role of the Media in Enhancing Community Concerns

8.74 Some misinformation was blamed on the media which seems to present nuclear-related activities in a negative light. For instance, during the controversy over the transportation of radioactive waste from Sydney to Woomera, the print media gave considerable coverage to the quantity of waste being transported and the regions through which it was transported, but little to its composition or the protection measures taken. Coverage was given to the alleged leakage in January 1995, but the fact that it was a false alarm was barely mentioned. Coverage was given to public comment criticising the project but reassurances from government or scientists received little media attention. More recently, during the French nuclear testing program, television channels screened several programs highlighting the dangers of radioactivity.[100]

8.75 The role of the media during the transportation of radioactive waste to Woomera was summarised to the Committee as follows:

> The media really has raised everybody's concern on it, I think, because they reported probably the negative side of it more than giving us in detail what precautions have been taken.[101]

8.76 The Australian Radiation Laboratory and the Department of Industry Science and Technology believed that the precautions were adequate. A transport plan does not eliminate the risk of incidents but minimised the risk to acceptable limits and specifies action to be taken in the event of a mishap. In general, radioactive incidents are considered newsworthy, and many in the Australian community have consequently been made aware of the negative experiences with waste leaking from facilities in the United States.

Public Education

8.77 The Committee was told that community concerns may be partly allayed by appropriate public education programs. These programs should:

- discuss the benefits of nuclear medicine for diagnosis and treatment, and the inevitable consequence of a certain amount of waste creation;

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100 Walshe, Transcript of Evidence, p. 595

101 Pitt, Transcript of Evidence, p. 165

- include discussion on waste minimisation; they should explore the likelihood of technological advances reducing the dangers of radioactivity;
- state the importance of Australia's place in international research so that we may contribute with credibility in determining international best practice; and
- establish international safety regimes, even though we do not use nuclear power for energy.

8.78 The view was presented that:

> All Australians, one way or another, have benefited from the medical, chemical, agricultural and industrial processes which have produced or used them.[102]

8.79 Dr William Hendee said:

> Surveys have shown that when laypersons are informed about the beneficial uses and low risks of tracer quantities of radioactivity, they support the availability of disposal facilities for low-level radioactive waste. Yet, when siting of a facility is proposed in a particular state or community, opposition invariably arises that in part expresses a 'not in my back yard' (NIMBY) reaction and in part reflects past packaging and transportation incidents, legitimate concerns about requirements, such as isolation of radioactive waste from the environment and the need for continuous monitoring, and fears that expenses of operating the facility will drive disposal costs to new heights.[103]

8.80 In conclusion, achieving an outcome for radioactive waste management in Australia acceptable to the community, may depend on a better public knowledge of the facts; appreciation and inclusion of community concerns; and regulatory controls which satisfy both government and community.

8.81 Most witnesses agreed that a public education program could address some of the difficulties associated with reconciling community and expert views. The difficulty of achieving a satisfactory level of trust was summed up by Mr Wallace of the Queensland Health Department:

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102 Harvey, Submission No. 54, p. 1

103 Hendee W (1993) 'Disposal of Low-Level Radioactive Waste', *Journal of the American Medical Association* 269(18):2403

> Radioactive material is one of those things that our society currently treats as anathema to everything. There is a significant emotional content in this area. While an education program will be helpful - there is no question about that; it is absolutely essential - one has to be realistic about it. The reality is that it is going to take major cultural change and that is not going to happen in the life time of the project even if it runs for several years. We are talking about, I think, decades...
>
> But it is inevitable that in any of these things which attract a lot of public attention and sensitivity - and radiation is certainly one of them - that there will be misunderstanding and, I dare say, some misinformation generated too.[104]

Ethical Considerations

8.82 The Committee is also concerned that the siting of a national facility should be based on issues of public safety rather than political expediency. The South Australian Premier, the Hon Dean Brown suggested to the Prime Minister that:

> ... the South Australian Government believes the prerequisite to establishing radioactive waste storage sites or repositories in the Woomera region is that the adjacent Lake Eyre region should not be considered for world heritage listing. It therefore seeks an agreement from the Commonwealth that it will not proceed with World Heritage listing of the Lake Eyre region on the grounds that such listing is inconsistent with the location of storage sites for radioactive waste on the edge of that region.[105]

8.83 The Committee was told that the Queensland Department of Housing and Local Government wrote a letter to the Esk Council saying that it would not accept the Esk Shire Council strategic plan because it did not include the proposed radioactive waste facility, and the Council was given ten days to do so or the whole strategic plan for the Shire could not be accepted.[106]

8.84 The Conservation Council of South Australia is concerned that:

> the contentious nature of the issue of radioactive waste management is susceptible to the vagaries of the interaction of

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104 Wallace, Transcript of Evidence, p. 717

105 Premier of South Australia, Letter to the former Prime Minister, the Hon PJ Keating, 28 February 1995, p. 1

106 Mahoney, Transcript of Evidence, p. 640

> State and Commonwealth political agendas at the expense of public interest, effective public consultation and sound environmental management.[107]

8.85 The Committee believes that the issue of radioactive waste management, in the interest of public health and safety and the protection of the environment, should not be subjected to the type of political deals outlined above.

107 Nuclear Issues Action Group, Submission No. 42, p. 8

CHAPTER 9

SUMMARY AND CONCLUSIONS

9.1 A number of States and Territories have improved their radioactive waste storage facilities in recent years and some have made considerable progress in compacting existing stores of waste. However, there is a need for a new national inventory of radioactive waste to take into account changes since 1986 and changed in the quantities and types of radioactive waste that are expected in future. The inventory should be kept up to date to identify emerging trends and to take advantage of possible markets for recycling or reuse of waste materials.

A National Repository for Radioactive Waste

9.2 Radioactive waste is now stored in many places, from government operated repositories to individual institutions such as hospitals, universities and industries. Evidence to the Committee indicated that there was considerable variation in the suitability of existing storage facilities. Many are in populous areas, and although the safety arrangements may be technically adequate they are perceived as a danger by nearby communities. Many witnesses representing bodies such as hospitals and universities were anxious to have a national storage facility to which they could send waste that is now stored in less than ideal conditions.

9.3 The Committee believes that many of the current concerns can be dealt with by construction of a national above ground storage facility combined with the retained use of existing facilities where they are suitable.

9.4 The Committee believes that the permanent, irretrievable disposal of Australia's radioactive waste is neither necessary or appropriate and that storage rather than permanent disposal is warranted. Internationally, there is considerable research effort directed at improving storage and disposal technologies. The Committee believes that radioactive waste currently being stored in Australia should continue to be stored for at least two decades, after which the situation could be reviewed. Most storage facilities in Australia would be adequate for this time frame.

9.5 The Committee does not favour the current proposal for a national shallow burial permanent disposal site, for several reasons:

- An above ground storage facility could be designed to receive all types of waste, including that which is not suitable for shallow burial;
- An above ground storage facility makes it easier to recover waste in future for recycling, reuse or conditioning if future new technologies make these viable; and
- The expense of shallow burial is not warranted for very low level radioactive waste suitable for disposal at municipal landfill sites.

The Committee believes that a feasibility study should be conducted to see if any of this waste could be disposed of in an active uranium mine.

9.6 It is essential to conduct the most rigorous environment and safety assessment for a national storage facility, with full public consultation. If the national storage facility was also the 'State' facility for the host State or Territory, gaining community support would be a cooperative task between Commonwealth and State Governments.

9.7 Transportation of radioactive waste is one of the public's major concerns. It is essential that problems such as those encountered during the transfer of radioactive waste to Woomera in 1994-95 do not recur, as this could substantially undermine public confidence. The appropriate mode of transport should be considered for each significant shipment of higher level or large quantities of radioactive waste.

9.8 The Committee accepts that a central facility may encourage an 'out of sight out of mind' approach, but believes that this can be largely addressed by placing acceptance criteria on the material to be stored there. Radioactive waste which poses a public health risk at its current location, or where institutions have stored waste generated by others, or where companies have progressed to nonradioactive technologies, could all be considered for storage at this location. Where bodies continue to produce radioactive waste or where existing storage facilities are considered suitable, the radioactive waste should remain on site.

Community Concerns

9.9 Public anxiety about radioactive waste is real and must not be ignored. This anxiety arises from the special features of radiation: the genuine uncertainties about some of its long term effects; the imponderable element in valuing uncertain, unlikely or far-off risks; the strong emotional content of some of the issues raised (such as radiation as a possible cause of cancer or

congenital abnormalities); or the lack of information and lack of trust of authorities in charge of radiation safety.

9.10 Public concerns must be accepted as important: they must be accepted as a 'social factor' which is part of the ALARA ('as low as reasonably achievable') principle. The proper responses are better information, genuine consultation and representation for public concerns. These are matters, where attitudes are often emotionally charged, which even the best intentioned experts ignore at their peril.

9.11 These principles imply an energetic approach to avoiding and minimising the creation of radioactive waste. They imply government regulation which is independent, firm, consistent and open. Regulation must not only be done, it must be seen to be done.

9.12 The Committee believes that an effective consultation program should be undertaken with the local community as soon as a national storage site is chosen. The Committee is concerned that a number of communities have the threat of a national repository 'hanging over' them since the identification of eight possible regions for the site. The Committee urges the Government to announce its decision as soon as possible and to enter into liaison with local communities about their concerns.

Need for Independent Audit

9.13 A large part of community concern with radioactive waste relates to trust, or lack of trust, in official regulators. This was exemplified in this Inquiry by witnesses' concern about the 'regulatory gap' which leaves Commonwealth bodies' radiation activities without external monitoring. The creation of the Australian Institute of Radiation Protection (AIRP) as Commonwealth regulator of Commonwealth bodies should go some way to repairing this gap. It is essential that the AIRP should be separate from the 'industry' and have no substantive operational functions. Since the AIRP and the regulated bodies will both be Commonwealth bodies, the AIRP must be independent and must be seen to be independent.

9.14 The Committee heard both good and bad examples of public consultation processes in the establishment and operation of State radioactive waste facilities. The Committee believes that a national storage facility should have a management committee which has an equal number of representatives from adjacent community and the users of the facility, one member from the Australian Institute of Radiation Protection and one member from the host

State's relevant authority. If national security activities require secrecy, waste arising from secret activities should be retained by ANSTO or Defence, not sent to a national storage facility, so that the operation of the national facility can remain open information.

9.15 All relevant Commonwealth facilities should also be subjected to regular audits by the Australian Institute of Radiation Protection.

A Nationally Agreed Regulatory Scheme

9.16 Many witnesses at the Inquiry called for greater compatibility in State regulations controlling radioactive materials. Present differences are mostly matters of detail, and greater compatibility should be achievable. In most Australian jurisdictions radiation control laws and codes of practice are currently being or have been revised in the light of the latest basic standards for radiation exposure recommended by the International Commission on Radiological Protection in 1991 (ICRP 60). Further revisions may be needed to incorporate the outcome of the RADWASS international publication program now in progress.

9.17 The Australian Institute of Radiation Protection, as the Commonwealth's regulator of Commonwealth activities, should conform to a nationally agreed scheme.

The Role of ANSTO in Managing Waste

9.18 ANSTO requires a regulation made in Parliament to allow it to condition, manage and store radioactive waste belonging to others.[1] This is admittedly cumbersome, but the Committee believes that this form of external control should only be removed if it is replaced by effective external regulation of ANSTO by the Australian Institute of Radiation Protection. The regulatory scheme could distinguish between everyday activities and emergency activities, and could distinguish between national security activities and everyday or commercial activities which should be open to public scrutiny and which may not deserve any advantages over ANSTO's private sector competitors.

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1 *Australian Nuclear Science and Technology Organisation Act 1987*, subsection 5(1)(ba)(iv)

Concluding Comments

9.28 The Committee urges the Commonwealth Government to announce its policies in relation to the management of radioactive waste as soon as possible. The Committee believes that there is considerable anxiety within the community about the adequacy of existing arrangements and the possibility of a national repository being constructed in their area. A decision on the siting and design of a national facility would enable the State and Territory governments, hospitals, universities and industries to develop long term strategic plans for the management of their radioactive waste.

9.29 The Committee believes that there is a prevailing understanding that the construction of a national facility will provide a solution for all of Australia's low level and short lived intermediate level radioactive waste. The Government's position on what type of waste will be accepted and the required conditioning of that waste, prior to acceptance, should be made clear as soon as possible.

9.30 The Committee also believes that the Government should maintain a watching brief on international developments in technologies for dealing with radioactive materials.

- most of the waste which would be catered for in a national storage facility is government-owned, and charges would simply be intra-government transfers;
- part of the purpose of the national repository will be to take waste which would be a public health risk in its present location. It might be argued that removing the risk is a public good;
- some bodies have quantities of 'old waste' but produce little waste now, or have accepted waste from others over the years as a co-operative gesture. It might be argued that these bodies do not deserve to be relatively penalised; and
- a charge at the time of disposal may be an incentive to holders of waste to dispose illegally or retain waste in inadequate stores and there must be adequate penalties for those disposing of radioactive waste illegally.

9.25 A flexible system is necessary, in which moderate charges act as an incentive to minimise the creation of waste, but are not so great as to encourage unsafe disposal or to prevent the beneficial uses of radioactive materials. The overriding principle in operating a national storage facility must be public health, not an arbitrary level of cost recovery. However, there will be instances in which private enterprise may wish to utilise the facility rather than build its own, and in these cases an appropriate fee should be charged.

Avoiding and Minimising Creation of Radioactive Waste

9.26 The introduction of waste audits has made significant progress in reducing creation of radioactive waste. A number of new technologies were also cited which reduce the production of radioactive materials by avoidance or by using less dangerous or smaller quantities of materials.

9.27 On the other hand, the Committee was given several examples of situations where it would be unsafe to impose minimisation requirements too strictly, particularly when it means additional handling of materials, thus increasing the exposure levels of radiation workers. Open minded consideration must be given to the costs and benefits of all possibilities in terms of public health.

9.22 Because of the peculiar features of radiation and the special anxieties that it arouses in the public, the Committee would favour a committee which is independent of the major research bodies, to allocate research funding. This could reassure the public of Government's commitment to radiation safety. Members of the committee could be predominantly representatives from the Australian Institute of Radiation Protection, the National Health and Medical Research Council and Commonwealth authorities, State and Territory authorities, the academic community and industry with relevant expertise.

Recommendation 22

The Committee recommends that the Commonwealth Government establish a Committee with representatives from a cross section of relevant bodies to recommend the allocation of research funding for radiation issues. The Committee could comprise representatives from the Australian Institute of Radiation Protection, the National Health and Medical Research Council and Commonwealth authorities, State and Territory authorities, the academic community and industry with relevant expertise.

9.23 Compliance with regulations requires not only external monitoring but also - and probably more importantly - adequate training of people responsible for radioactive materials on a day to day basis. The Committee believes that there are sufficient training opportunities available for radiation workers in Australia. However the complexity of the various codes and regulations was mentioned in some submissions, and more work on plain English versions or summaries for special situations is desirable.

Whether User Pays is Appropriate?

9.24 The desirable extent of a user pays system for storage in a national facility is problematic. Some issues are:

- the difficulty in determining an appropriate charge for storage indefinitely;

Research and Training

9.19 ANSTO's research and development program includes projects such as Synroc, cementation of radioactive waste, and a number of projects relevant to the uranium industry.[2] ANSTO believes that research into radioactive waste management should be a key area of ANSTO research.[3]

9.20 The fact that ANSTO is both a key player in the industry and, potentially, a giver of research grants is a matter of possible concern.[4] It raises the possibility of conflict of interest, for example if ANSTO was asked to fund research into minimising the use of radioactive materials or minimising the use of ANSTO's reactor. This charge was made during the inquiry in respect of cyclotron research:

> they [ANSTO] do not seem to be keen to put any intellectual investment into alternatives to reactors for medical radioisotope production... we made a good case that economically it would make reasonably good sense to look at accelerator technology for production of expensive short-lived radioisotopes for medicine and import some short-lived ones from overseas if necessary without a reactor technology. It would be a major reduction in the waste and probably come out ahead economically.[5]

9.21 As for other possible routes for research funding, funding by the National Health and Medical Research Council generally has significantly declined in recent years, and this is likely to particularly affect areas that do not have a high public profile, where there is no dedicated fund:[6]

> The handling, storage, transport and security of radioactive waste is not a subject which has the emotional appeal of, say, medical research, nor the logical appeal of industrial research and development. For these reasons there is never likely to [be] sufficient funds available for good research in these areas, unless a dedicated grant is made available.[7]

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2 Australian Nuclear Science & Technology Organisation, Submission No. 32, p. 17-18

3 Ibid, p. 18

4 Subsection 5(1)(k) of the *Australian Nuclear Science and Technology Organisation Act 1987* allows ANSTO to make grants in aid of research.

5 Smith, Transcript of Evidence, pp. 569-570

6 Royal Alexandra Hospital for Children, Submission No. 5, p. 4

7 Ibid, p. 4

DISSENTING REPORT TO THE DANGERS ON RADIOACTIVE WASTE INQUIRY

SENATORS MARGETTS AND BELL

At the outset, we would like to emphasise that there IS no safe method of DISPOSAL of radioactive waste, so that all community considerations still need to address the safe handling and storage of radioactive waste so that it is secure, monitored and retrievable. We thus need to concentrate our efforts on waste minimisation.

Future technological changes may either find a use for what is currently considered radioactive waste or may find a truly safe way of protecting society from its dangers in perpetuity. Such a method has not yet been developed.

There are several areas of concern about the report as it stands, but many of the Report's recommendations will be a positive step, if implemented, towards better procedures in management of radioactive waste.

There are, however, some points where we disagreed with the Committee conclusions or which we believe require qualification.

These areas include:

1. The creation and handling of radioactive waste from hospitals and research institutions (think of what you could do NOW in preventative health care with what it would cost the community to look after radioactive waste with a half life of 300 000 years!)

2. The use of 'user pays' in the pricing of radioisotopes and the rationale for the continued operation of the Lucas Heights nuclear reactor

3. The need for regulatory controls of industries which create nuclear waste to be independent of the industry's willingness to pay

4. The handling of spent fuel rods from the Lucas Heights nuclear reactor

5. The feasibility of dumping low (or intermediate?) level radioactive waste in active uranium mines

6. Whether a national radioactive waste storage facility is an acceptable proposition and the possibility of State-based facilities, where

necessary, for very limited quantities of historic radioactive sources (from institutions which NO longer produce radioactive waste)

7. The promotion and use of photo electric smoke detectors

8. The export of used medical radiotherapy sources as 'aid' requiring no waste management plan

9. The practice of dilution and dispersal of radiotoxins into the environment is not an acceptable approach.

Dealing with each of these in turn.

1. The creation and handling of radioactive waste from hospitals and research institutions (think of what you could do NOW in preventative health care with what it would cost the community to look after radioactive waste with a half life of 300 000 years!)

Radioactive waste from hospitals is, of course, a problematic issue.

Many radiation managers in hospitals support a centralised waste facility to handle the more long lived wastes which operations such as hospitals are claiming they are unable to look after.

Not all of this waste is historic waste. The question arises as to whether provision of such a national storage facility will only encourage the production of more radioactive waste. It has to be asked to what extent it is necessary for hospitals to continue to handle longer lived radioisotopes at all.

The Committee report cites the example of research into enterotoxigenic *Escherichia coli* at the Royal Alexandra Hospital for Children which could possibly save children's lives, as a reason why hospitals and other institutions undertaking medical research should not need to bear the brunt of the storage of the radioactive waste which their research is producing, because this could cause valuable medical research to be jeopardised.

We believe that the better approach is to consider the net benefits of any research proposal. That is, if there is a public good resulting from such research, it is as a result of the benefits to the community minus the costs, including the public health and environmental costs of the storage of long lived radioisotopes. One of the radioisotopes used in this particular research, chlorine^{36}, has a half life of 300 000 years.

It may well be that hospitals may be able to find another funding body to cover the cost of dealing with the waste they produce, but that is quite different from not having to consider such community costs when making decisions about undertaking such a research program.

Evidence to the Committee seemed to be clear that the difficulties in dealing with radioactive waste tempered many decisions as to the use of the radioisotopes. A significant number of submissions from community and environmental groups felt that lifting that responsibility from these institutions would lead to a greater use of such radioisotopes in the future, especially by those who think the current responsibilities are restricting research.

The use of radioisotopes in medicine is also used by the nuclear industry to legitimate their own subsidies. We don't think the case has been proven to exempt hospitals from user pays fees, but perhaps to pay a lower rate than other industry users. The fees could be based on both volumes and levels of radioactivity - and ensure that radioactive waste is dealt with properly at the end of its use.

As was mentioned in the main committee report, hospitals produce a small volume of radioactive waste compared to industry. What needs to be changed is the balance of who pays what, determined by a user pays rate which accurately reflects the cost of disposal.

This should occur in a context in which hospitals should have a realistic basis for assessing whether research should go ahead based on the full social and environmental costs and benefits of the chosen research methods. This should include consideration of whether it can change its procedures to ones which use alternatives to isotopes or shorter lived isotopes etc. If the public benefit exceeds the cost, then the hospital should be able to make a case for more funding, as the problem is one of hospital funding rather than the determination of costs and benefits.

Perhaps, in the future, those medical isotopes which cannot be produced by more benign technology, such as cyclotrons, will be in such small quantities that maintaining a reactor for their production is not viable.

The question is whether the storage of radioactive waste is safer in a hospital where it is under supervision than during transportation or in a national facility. This question must be addressed in the transport arrangements and the siting and design of the national storage facility.

2. The use of 'user pays' in the pricing of radioisotopes and the justification of the Lucas Heights nuclear reactor or even a future reactor

ANSTO is currently being subsidised to produce hazardous waste such as spent fuel rods. There is little 'public good' justifying this subsidy. ANSTO has admitted that its business is uneconomical, it cannot compete with imports from the United Kingdom. Industries such as ICI, BHP, Comalco and Pacific Power (which is also subsidised) which use these isotopes must be charged the full costs of the production of the isotopes, including the costs of operating and decommissioning the reactors and the management of the radioactive wastes arising from these activities.

One of the industry concerns about the purchase of radioisotopes with longer half lives from overseas is that they will have to pay the full cost of shipping them safely back to the producer after use and this is MORE expensive than the current arrangements. So be it. Further, there should be a regulatory mechanism to ensure that countries to which radioactive materials are returned are dealing with the waste in an environmentally acceptable manner and that the purchase price covers the full costs of adequate storage.

Similarly, it has been argued that communities would be less concerned about State/Territory radioactive waste storage facilities if they were well engineered and adequately monitored. Those who say this would make the cost of using radioisotopes too expensive are, in fact, advocating that the community should continue to subsidise their use.

3. The need for regulatory controls of industries which create nuclear waste to be independent of the industry's willingness to pay. That is, if waste cannot be handled safely it should not be put onto the community to subsidise that company's profit margin, either in covering the long term costs of waste management in a storage facility, or in bearing the health, social and environmental costs of having the waste left on site in an unsatisfactory manner, for example, the sand mining industry

There appears to be a substantial difference between how we expect hospital and research institutions to handle radioactive waste and much of the mining industry, which produces by far the greatest bulk of our radioactive waste.

Whilst the use of technologies which use radioactive materials has wider application in industry than in the past, it is true that most of industry's

radioactive waste is considered to be of low level, although much of it has extremely long half lives.

Many of the original mineral sands mining sites have had their thorium/uranium stored on site, either mixed with the slurry, in tailings or concentrated in pits. It has been admitted that there has been little regulation in the handling of such waste.

Rhone Poulenc argued that the proposal to bury thousands of tonnes of thorium/uranium waste in plastic bags at Mt Walton, in Western Australia may be an improvement on the current situation of releasing monazite on the Swan Coastal Plain!

That this situation has been allowed to continue in this way is perhaps less a comment on the environmental and health hazards of concentrating radioactive material through the mining process as the ability of the industry to control the regulatory environment by arguing that their margins will not allow better waste management.

It is also true that the indications are that many people in the industry do not believe that they are creating an environmental or health hazard.

We agree with those in the community who argue that if proper handling of radioactive waste means that a mining and milling operation is not viable, then there is no reason for the community to subsidise that industry any more than any other. While other regions in Western Australia such as Mt Weld-Meenaar have rare earth ores containing less radioactivity it cannot be argued that it is necessary to produce these large quantities of waste with these concentrations of radioactivity.

4. The handling of spent fuel rods from the Lucas Heights nuclear reactor

Prior to the recent shipment of spent fuel rods to Dounreay in the United Kingdom, ANSTO stored almost 1700 spent fuel rods on site at Lucas Heights. Having been responsible for creating this high level radioactive waste (although ANSTO does not classify its spent fuel rods as high level waste because it claims they are not officially classified as waste), ANSTO wants to get rid of them conveniently by exporting them.

If the Lucas Heights nuclear reactor is really not necessary, then we have lost the rationale for producing such high level waste in the first place.

Even if we send the spent fuel rods to the United Kingdom, after reprocessing they will be stored for up to 25 years for further decay cooling (now classified as high level waste although ANSTO considers them to be intermediate level waste) so that they can be sent back here! If we send spent fuel rods to the United States, we are simply dumping the waste of our industry somewhere else.

It is hardly surprising that Greenpeace is opposed to the practise of transporting such materials backwards and forwards across the world to become someone else's problem!

5. The feasibility of dumping low (or intermediate?) level radioactive waste in active uranium mines

Although the main report recommends that only very low radioactive waste, mainly soil contaminated with thorium and uranium isotopes, be considered for placing in an active uranium mine, a number of submissions suggested that this was a suitable disposal option for intermediate and all low level waste. In the absence of any full study into the health and environmental implications of uranium mining for workers or surrounding communities, we believe any 'feasibility' study of adding further waste to the mess would be irresponsible.

6. Whether a national radioactive waste storage facility is an acceptable proposition and the possibility of State-based facilities, where necessary, for very limited quantities of historic radioactive sources (from institutions which NO longer produce radioactive waste)

This debate is in many ways similar to the debate about the need for a national high temperature incinerator for toxic and intractable waste. As in the radioactive waste debate, the toxic waste debate was partly about the transportation of hazardous waste and the perceived risk of concentrated storage.

The Senate Standing Committee on The Environment, Recreation and the Arts conducted an Inquiry into Waste Disposal in 1994 and was confronted with changing definitions of 'waste' and developments in our technological capacity to use 'waste' for further processing. These factors changed the eventual answer to the question of what could be done with waste. With regard to radioactive waste, our progress with the above fundamental questions is still very limited.

Therefore it would be premature to make a commitment to a national storage facility with its associated national infrastructure, before a full debate and full development of alternatives occurs. It has not been possible for this committee to conduct that full debate, even though the committee has provided a useful forum for part of the debate. Much more time and much more information would be necessary before conclusive findings could be reached.

Until Australia is able to resolve the risks of transportation of radioactive wastes; until Australia is able to fully catalogue the existing stockpile (and thereby properly determine the nature and extent of the risk); until Australia is able to resolve the question of whether a national storage facility would encourage irresponsible production of unnecessary amounts of waste; until all Australians have had ample opportunity to make an informed contribution to the debate, any proposal for a national storage facility is premature and in fact, a potential complication rather than a resolution.

This is one point where we would challenge the assumption of the main Committee Report that we should be considering a national nuclear waste facility at all.

It is our belief that creators of nuclear waste should be responsible for its safe storage, where possible, at the place of production. Certainly the Commonwealth should retain responsibility for the radioactive waste it has created, but that still does not mean that waste must be transported across Australia to a single national storage facility.

Residents of Sutherland Shire are right to be concerned that the storage and handling of radioactive waste at Lucas Heights is not as good as it could be. However, sending such waste to another site is not solving the problem, merely shifting it.

It is possible that the Commonwealth could develop facilities in any of the States or Territories in which it is considered that Commonwealth radioactive waste is not adequately housed. At such facilities, there may also be a case for storing some categories of historical waste sources from hospitals WHO HAVE CEASED TO PRODUCE RADIOACTIVE WASTE THAT CANNOT BE MANAGED ON SITE.

The residents of the Goldfields of Western Australia are right to be concerned that the siting of any national waste storage facility appears to be more dependent on political and economic expediency than health and environmental considerations or any real concept of 'worlds best practice'.

7. The promotion and use of photo electric smoke detectors

As with the previous discussion in relation to medical radioisotopes, it would seem that there is no real argument to subsidise the purchase of ionising smoke detectors by not including the cost of safe disposal in the purchase price. Once again we are talking about public good, we should be considering NET public good.

At the very least, non ionising smoke detectors should receive a subsidy which reflects the fact that they do NOT have to be stored for a period well beyond the life of the device. There must also be real incentives for industry to develop effective smoke detectors without a huge waste problem.

8. The export of used medical radiotherapy sources as 'aid' requiring no waste management plan

The citing, in the main report of spent radiation sources such as Caesium^{137} being sent over seas as 'aid' is shocking, as there appears to be no provision for final disposal either here in Australia or in the recipient country as a condition of the 'gift'. We have thus exploited the lack of medical technology in those countries as a means of dumping our radioactive problems on someone else!

If we give such 'aid', it should include the cost of safe storage after its use by date, or the ability to return the equipment to Australia or the original manufacturer for storage.

9. The practice of dilution and dispersal of radiotoxins into the environment is not an acceptable approach

Put quite simply, where radioactivity is concerned, dilution is not the solution to pollution. The fact that some witnesses have argued that it is not fair that big hospitals are not permitted to disperse radioactivity according to a per patient ratio is symbolic of the way we have dealt with radioactive waste in Australia. Perhaps much of this relates to the assumption that there is a safe level of radioactivity.

This does not accord with the linear dose hypothesis as outlined in the main report. It is NOT acceptable that ANSTO releases radiotoxins into the sewer which leads to an ocean outfall. If such bodies do this because it is TOO EXPENSIVE to handle waste safely, then they should not be given a license to handle nuclear waste.

We have suffered too long in Australia from a gung-ho attitude by the very authority which has control of much of what happens to the nuclear waste produced in this country.

It is time we planned the future, NOT just to keep the jobs of those who have a vested interest in maintaining the status quo.

GLOSSARY

Words in italics are also listed in the glossary.

accelerator: device that accelerates charged atomic particles to very high speeds.

accident: any unintended event, including operator errors, equipment faiures or other mishaps, the consequences or potential consequences of which are not negligible from the point of view of protection of safety.

activity: number of nuclear disintegrations per unit time in a *radioactive* material. The standard international unit of activity is the *becquerel* (Bq) which is one disintegration per second. A historic unit of activity is the *curie*, which is 3.7×10^9 becquerels.

ALARA: as low as reasonably achievable, economic and social factors being taken into account.

ALARP: as low as reasonably practicable.

alpha emitter: a *radioactive* material that emits *alpha particles*.

alpha particle: a positively charged particle emitted from the *nucleus* of an *atom* during radioactive *decay*. It contains two *protons* and two *neutrons*. Alpha particles are normally highly energetic but travel only a few centimetres in air and are stopped by a sheet of paper or the outer layer of dead skin.

annual limit on intake by ingestion: that quantity of a radioactive material which, taken into the body during one year, would to a committed effective dose equal to the occupational annual limit on effective dose.

atom:the smallest piece of matter that cannot be broken up by chemical reactions. Atoms have a *nucleus* consisting of positively charged *protons* and uncharged *neutrons*, and a number of negatively charged *electrons* in orbit around the nucleus.

background radiation: *ionising radiation* in the environment to which every person is exposed. It comes from many sources such as outer space, the sun, rocks and soil, buildings, air, food and radioactive materials within our bodies. In Australia the average radiation *dose* from background radiation is about 1-2 *millisieverts* per year.

becquerel: unit of measurement of *radioactivity*: one nuclear disintegration per second.

beta emitter: a *radioactive* material which emits *beta particles*.

beta particle particles emitted from a *nucleus* during radioactive *decay*, which may be either negatively charged *electrons* or positively charged *positrons* High energy beta particles can travel metres in air and several millimetres into the human body; low energy beta particles are unable to penetrate the skin. Most beta particles can be stopped by a small thickness of light material, such as aluminium or plastic sheeting. Beta particles have more penetrating power but are less damaging to tissues than *alpha particles*.

cation: negatively charged *ion*.

cell: the simplest unit of living things and the site of the chemical processes associated with life.

concentration: concentration of a radioactive substance in a material expressed in terms of the *activity* in becquerels (Bq) per kilogram of the material.

conditioning: treatments which convert radioactive *waste* into an acceptable condition for packaging, transport, storage and disposal. May involve solidification of the waste, enclosure of the waste in containers and/or encapsulation in a stable matrix such as concrete.

criticality: a *nuclear reactor* has reached criticality when the rate of *neutrons* produced is equal to the rate of neutron loss and a self-sustaining chain reaction can occur.

curie: a historic unit of *radioactivity*: 3.7×10^9 nuclear disintegrations per second. Also, an amount of *radioactive* material which has one curie of radioactivity.

cyclotron: machine which *accelerates* charged atomic particles to high energies using electromagnetic forces. These particles can be used to produce *radioisotopes*.

decay, radioactive: disintegration of an *atom's nucleus* resulting in the release of *alpha* or *beta* particles or *gamma* radiation.

dispersal: the effect of processes such as transport, diffusion and mixing of wastes or effluents in water or air, ultimately leading to dilution.

disposal: disposal of radioactive *waste* without the possibility or intention of ever retrieving it, either by *dispersing* it into the environment or by permanently isolating it from the environment.

dose: an amount of radiation energy received by an object such as the human body. Often used to mean *dose equivalent*.

dose equivalent: *dose,* weighted to take account of the different biological effects of the different types of radiation on different tissues; a measure the impact of a radiation dose on living tissue. The unit of dose equivalent is the *sievert* (1 joule per kilo), usually expressed as the *millisievert* (one thousandth of a sievert).

dose limit: in radiation protection standards, the maximum *dose* of radiation that a person is allowed to receive over a stated period of time.

electron: a negatively charged subatomic particle.

element: substance that cannot be divided into simpler substances by chemical reactions.

equivalent dose: *dose equivalent.*

exempt waste: *waste* that is released from regulatory control in accordance with clearance levels, because the associated radiological hazards are considered negligible.

fission: splitting of a heavy *nucleus* into two smaller parts. It is accompanied by release of energy and usually two or three *neutrons*.

fuel rods: rods of fissionable material, which are the fuel of a *nuclear reactor.*

gamma radiation: high energy electromagnetic radiation emitted after nuclear *fission* or by *radioactive* materials. *Gamma* rays are highly penetrating (more so than X-rays) and, depending on their energy, can require a considerable thickness of lead or concrete to absorb them. Because gamma radiation causes ionisation, it constitutes a biological hazard.

gangue: part of the ore that is not the objective in working the ore deposit.

geological disposal: isolation of radioactive *waste* using a system of engineered and natural barriers at depths up to several hundred metres in a geologically stable formation. Typical plans call for disposal of *long lived* and *high level* wastes in geological formations.

half life: the time required for the activity of a *radioactive* material to decrease by half. Half-lives of different radioactive materials vary from less than a millionth of a second to more than one billion years.

high level waste: radioactive *waste* that emits sufficiently large and penetrating amounts of *ionising radiation* to require the maximum standards of radiation protection when it is handled, transported or stored. It requires substantial shielding and cooling.

incident: a technical event or anomaly which, although not directly or immediately affecting safety, is liable to lead to subsequent re-evaluation of safety provisions.

intermediate level waste: waste of a lower activity and heat output than *high level waste*, but which still requires shielding during handling and transport. Includes materials such as spent radiotherapy sources, level and moisture gauges, smoke detectors, liquids from *radiopharmaceutical* production and spent ion exchange resins from ANSTO or an unusually large proportion of radium^{226} which has a half life of 1600 years. Radium is present in older luminous paint and watches, contaminated articles etc.

ion: an atom that has gained or lost one or more *electrons*, thus becoming electrically charged.

ionising radiation: *radiation* which removes *electrons* from *atoms* that it encounters, creating electrically charged variants called *ions*.

irradiation: exposure to *neutrons*, charged particles or *ionising radiation*.

isotopes: variants of an *element* which have the same number of *protons* but a different number of *neutrons*. Different isotopes of an element have the same chemical properties, but somewhat different physical properties.

kilobecquerel: 1,000 *becquerels*.

long lived waste: radioactive waste containing long lived materials having sufficient radiotoxicity in quantities and/or *concentrations* requiring long term isolation from the biosphere. 'Long lived' refers to *half-lives* usually over 30 years.

long term: in relation to *disposal* of radioactive *waste*, refers to periods of time which exceed thge time during which active institutional control can be expected to last.

low level waste: radioactive *waste* requiring minimum standards of protection for personnel when it is handled, transported or stored. It mainly consists of material of low *activity* and short *half life* (up to 30 years) which does not have to be specially shielded and which contains little or no long lived *alpha emitters*. These wastes can consist of contaminated clothing, packaging, equipment, soil, some mining wastes etc. Very low level waste has such low activity and short half life that disposal by controlled release into the environment is permissible.

microcurie: a millionth of a *curie*.

microsievert: a millionth of a *sievert*.

millisievert: a thousandth of a *sievert.*

monazite: mineral containing phosphate of rare earth metals.

near surface disposal: disposal of radioactive *waste*, with or without engineered barriers, on or below the ground surface where the final protective covering is of the order of a few metres thick, or in caverns a few tens of metres below the earth's surface. Typically *short lived low level* and *intermediate level wastes* are disposed of in this manner.

neutron: uncharged particle found in the *nucleus* of *atoms*.

noble gases: a group of gases which do not react chemically with other elements. They include *radon*, and some have *radioactive isotopes*. Also known as inert gases.

nuclear energy: energy released by atomic *fission* or fusion or by radioactive *decay*.

nuclear fuel cycle: all operations associated with production of *nuclear energy*, including mining, refining and enriching uranium; fabrication of fuel elements and their use in a *nuclear reactor*; reprocessing spent fuel; re-enrichment of the fuel material and its refabrication into more fuel elements; and waste management, including *spent fuel* disposal.

nuclear medicine: medical speciality that uses radioactive materials.

nuclear reactor: a structure in which *fission* reactions release controlled energy.

nucleus: the core of an *atom;* consists of positively charged *protons* and uncharged *neutrons*.

nuclide: *isotope.*

positron: a positively charged subatomic particle.

proton: a positively charged subatomic particle located in the *nucleus* of an *atom.*

radiation: term that embraces all the ways in which energy may be given off by an *atom*: electromagnetic waves (including x-rays and *gamma rays*) as well as streams of fast-moving charged particles (*electrons*, *protons*, etc.) and *neutrons*.

radioactive, radioactivity: property of certain materials of spontaneously emitting subatomic particles or *radiation*, or of emitting radiation following orbital electron capture, or of undergoing spontaneous fission.

radioisotope: an *isotope* that is *radioactive.*

radionuclide: *radioisotope.*

radiopharmaceuticals: pharmaceuticals containing a radioactive materials.

radon: a *radioactive element*, the heavest of the *noble gases*, which gives rise to the major part of the radiation *dose* from natural *background radiation.*

repository: facility where radioactive *waste* is emplaced where future retrieval is not intended.

reprocessing: treatment of spent nuclear fuel to separate unused uranium and plutonium from fission products and other transuranic elements. The recovered uranium and plutonium can then be recycled into new fuel elements.

short-lived waste: regarded as that with a *half life* of up to 30 years.

sievert: unit of *dose equivalent*: one joule per kilogram.

spallation: nuclear reaction in which bombardment by high energy particles produces a large number of disintegration products.

specific activity: the *activity* of a radioactive material per unit mass. Expressed as becquerels per gram.

spent fuel: nuclear fuel elements in which *fission* products have built up and the fissile material depleted to a level where a chain reaction does not operate efficiently. Also referred to as irradiated fuel.

storage: placing radioactive *waste* in a facility designed so that the waste may be retrieved later.

Synroc: synthetic rock based on titanate minerals that can immobilise the elements in high level wastes within its crystal structures. This is a synthetic mineral produced through chemical bonding of waste *radioactive atoms* to stable material.

tailings: Material left over after minining and milling of ores. Tailings from milling uranium ore contain *radioactive* radium and thorium and will remain radioactive for hundreds of thousands of years.

tritium: a *radioactive isotope* of hydrogen, with a half life of 12.5 years.

uranium: *radioactive* element with two fissile *isotopes* (uranium^{235} and uranium^{233}) and two that are fertile (uranium^{238} and uranium^{234}). Uranium is the basic raw material of nuclear power generation.

vitrification: formation of a glassy solid containing radioactive *waste* products.

waste: material for which no further use is foreseen.

yellowcake: mixture of uranium oxides produced from uranium ore. Uranium is exported from Australia in this form.

APPENDIX 1

LIST OF SUBMISSIONS

1	Sir Ben Dickinson, SA
2	Dr Kristin Shrader-Frechette, USA
3	Mr F Schroeder, NSW
4	City of Port Augusta, SA
5	Mr M Hanlon, NSW
6	District Council of Paringa, SA
7	Sutherland Shire Environment Centre, NSW
8	Mr P Jones, TAS
9	Mr A W Fleischmann, NSW
10	Mr B Pitt, SA
11	Messrs A, R & M Starkey & R Thomas, NT
12	The Country Women's Association of WA (Inc), WA
13	Professor A Samarin, NSW
13a	Professor A Samarin, NSW
14	Northern Territory Government, NT
15	The Queensland Greens, QLD
16	Australian Nuclear Association Inc, NSW
16a	Australian Nuclear Association, Inc, NSW
17	Co-Tech Management Pty Ltd, NSW
18	Dr K B Fenton, TAS
18a	Dr K B Fenton, TAS
19	ACT Government, ACT
20	Sutherland Shire Council, NSW
21	Australian Radiation Laboratory, VIC
21a	Australian Radiation Laboratory, VIC
21b	Australian Radiation Laboratory, VIC
22	Radiation Safety Committee, University of Western Australia, WA
23	South Australian Government, SA
23a	South Australian Government, SA
24	Dr B M Hartley, WA
25	Commonwealth Scientific and Industrial Research Organisation, ACT
26	Department of Foreign Affairs & Trade, ACT
27	University of South Australia, SA
28	Department of Primary Industries and Energy, ACT
29	Ms K J Lannstrom, SA

30	Government of Queensland, QLD
31	Nuclear Safety Bureau, NSW
32	Australian Nuclear Science and Technology Organisation, NSW
32a	Australian Nuclear Science and Technology Organisation, NSW
32b	Australian Nuclear Science and Technology Organisation, NSW
32c	Australian Nuclear Science and Technology Organisation, NSW
33	Department of Defence, ACT
33a	Department of Defence, ACT
34	The Chamber of Mines and Energy, WA
34a	The Chamber of Mines and Energy, WA
34b	The Chamber of Mines and Energy, WA
35	The Environment Centre NT Inc, NT
36	Department of Minerals and Energy, WA
36a	Department of Minerals and Energy, WA
37	Government of Victoria, VIC
38	Confidential submission
39	Women Opposing Uranium Mining, VIC
40	Department of Transport, ACT
41	Government of Tasmania, TAS
42	Conservation Council of Australia and Friends of the Earth, SA
43	Ms S Peebles, WA
44	Conservation Council of Western Australia Inc, WA
45	New South Wales Environment Protection Authority, NSW
45a	New South Wales Environment Protection Authority, NSW
46	Environment Protection Authority, ACT
46a	Environment Protection Authority, ACT
47	Friends of the Earth, NSW
48	Greenpeace, NSW
49	Government of Western Australia, WA
49a	Government of Western Australia, WA
50	Statewide Network of Action Groups, WA
51	Medical Association for Prevention of War, WA
52	Dr A Bhattacharryya, NSW
53	Mr J Elbourne, NSW

54	Dr N D M Harvey, SA
55	Penrice Soda Products Pty Ltd, SA
56	Coca-Cola Amatil (SA) Ltd, SA
57	Goldfields Against Serious Polution, WA
58	Long Products Division, BHP Steel, SA
59	St Vincents Hospital, NSW
60	Adelaide Brighton Cement Ltd, SA
61	North West Institute of TAFE, TAS
62	Townsville General Hospital, QLD
63	Women's and Children's Hospital, SA
64	Royal Brisbane Hospital, QLD
65	Mr L Collins, NSW
66	St George Hospital, NSW
67	The Alfred Healthcare Group, VIC
68	Australian & New Zealand Society of Nuclear Medicine, NSW branch, NSW
69	Royal Perth Hospital, WA
70	Confidential submission
71	Rhone-Poulenc Chimie (Aust) Pty Ltd, VIC
72	Edith Cowan University, WA
73	Mater Misericordiae Public Hospitals, QLD
74	Department of Industry, Science and Technology, ACT
75	The University of New South Wales, NSW
76	Fire Protection Industry Association of Australia, VIC
77	Dr G F Egan, VIC
78	Mr P Wong, NSW

APPENDIX 2

INDIVIDUALS WHO APPEARED BEFORE THE COMMITTEE AT PUBLIC HEARINGS

Friday, 23 June 1995, Canberra

Department of Primary Industries and Energy -
- Mr P J Davoren, Manager, Rehabilitation and Radioactive Waste Policy
- Mr M N Rawson, Assistant Secretary, Uranium and Nuclear Policy Branch
- Mr S M Veitch, Manager, National Datasets, National Resource Information Centre

Australian Nuclear Science and Technology Organisation -
- Mr P S Bull, Head, Nuclear Services
- Dr G Durance, Principal Research Scientist
- Dr A Jostons, Director, Advanced Materials Program
- Mr J M Rolland, Director, Information Services

Department of Industry Science and Technology
- Mr D Dewar, Assistant Director, Science and Technology Policy Coordination
- Mr S Hollway, Secretary

Commonwealth Scientific and Industrial Research Organisation
- Mr A W Blewitt, Director, Corporate Services
- Mr G Harley, General Manager, Corporate Property Branch, Corporate Services
- Dr D E Smiles, Chief Research Scientist

Nuclear Safety Bureau
- Mr M R Allen, Director
- Mr D I MacNab, Leader, Technical Assessment

Australian Radiation Laboratory
- Mr P A Burns, Acting Section Head, Radiation Health Section
- Dr K H Lokan, Director

Department of Defence

Mr M J Curtis, Business Enterprises Munitions and Aerospace, Industry Programs and Operations Branch
Commodore (RAN) M H Dowsett, Director-General, Corporate Health Services and Programs
Mr A Mamalis, Director, Environment and Heritage, Facilities and Property Division
Mr E J B O'Dovovan, Senior Professional Officer, Defence Science and Technology Organisation
Mr J R Popham, Acting Assistant Secretary, Industry Programs and Operations Branch, Industry Involvement and Contracting Division
Squadron Leader B Wood, Staff Officer, Environmental Health, Office of the Surgeon-General

Wednesday, 5 July 1995, Adelaide

University of South Australia

Dr M B M Hochman, Manager, Research Office
Mr D Paix, Radiation Safety Officer and Senior Lecturer in Applied Physics

Mr S Baker, National Spokesperson for FOE Australia on Nuclear Issues, Nuclear Issues Action Group, Conservation Council of South Australia and Friends of the Earth Australia

Mr G E F Botten, Acting City Manager, Corporation of the City of Port Augusta

Sir Ben Dickinson

Miss M Hine, Volunteer Member, Nuclear Issues Action Group, Conservation Council of South Australia

Ms K J Lannstrom

Mr B Pitt

Thursday, 27 July 1995, Perth

Chamber of Mines and Energy
Mr P H Dench, Titanium Minerals
Mr J Nayton, Consultant (Public Affairs)
Mr P T O'Shaughnessy, Titanium Minerals Committee Member
Mr A E Petersen, Member, Occupational Health and Safety Committee and Conservation Environment and Land Management Committee
Mr I S Schache, Chairman, Titanium Minerals Committee

Department of Environmental Protection
Mr N J Davies, Assistant Director, Waste Disposal
Mr C J Schuster, Acting Director, Waste Management Division

Country Women's Association of Western Australia
Mrs M T Gosling, Member of Social Issues Fact Finding Team and Member of Metropolitan Branch
Mrs M R Nilsson, Vice-President, Eastern Division, International Officer, Southern Cross Branch

University of Western Australia
Mr L Munslow-Davies, Senior Physicist, Radiation Protection Office
Mr M Rafferty, Radiation Safety, Radiation Protection Office

Dr H Cohen, President, Conservation Council of WA and National President, Medical Association for the Prevention of War

Mr G D Fee, Environmental Superintendent, Cable Sands (WA) Pty Ltd

Dr B M Hartley

Mr G S Hewson, Acting Assistant Director, Research and Technical Services, Mining Operations Division, Department of Minerals and Energy

Mr D E Hutchinson, Secretary, Radiological Council of WA

Ms J Lowe, Western Australian Coordinator, Medical Association for Prevention of War

Ms R M Siewert, Coordinator, Conservation Council of Western Australia

Mr L F Toussaint, Physicist, Radiological Council of Western Australia

Wednesday, 2 August 1995, Sydney

NSW Environment Protection Authority
Mr P J Colgan, Manager, Radiation Control Section
Mr E Samuel, Director, Hazardous Substances

Greenpeace Australia Limited
Mr S A Moreland, Assistant Nuclear Campaigner
Mr B Pearson, Nuclear Campaigner

Dr W M Burch

Mr A W Fleischmann

Mr J R Hallam, Nuclear Campaigner, Friends of the Earth

Mr M G Hanlon, Radiation Safety Officer, Royal Alexandra Hospital for Children

Professor A Samarin, Member, Sustainable Development Committee, Australian Academy of Technological Sciences and Engineering

Mrs J E Towson, Radiation Safety Officer, Royal Prince Alfred Hospital

Thursday, 3 August 1995, Sutherland

Sutherland Shire Council
Councillor G Rankin, Mayor
Councillor D R Carter, Member
Councillor D Emerson, Member
Mr T F Robertson, Legal Counsel
Dr G J Smith, Principal Environmental Scientist

Australian Nuclear Association
Dr P L Airey, President
Dr C J Hardy, Secretary
Dr D J Higson, Committee Member

Sutherland Shire Environment Centre

Mr M G Priceman, Convenor, Nuclear Issues Committee
Mr R D Walshe, Chairman
Mrs L Ward, Secretary and Education Officer

Friday, 4 August 1995, Brisbane

Queensland Greens Inc

Mr M Lewis, Media Coordinator and Party Agent
Ms D S Mahoney, State Spokesperson

Monday, 16 October 1995, Canberra

Department of Foreign Affairs and Trade

Ms C M Adams, Executive Officer, Legal Office
Mrs M Grant-Thomson, Legal Officer, Environmental Law Unit
Mr L R Luck, Assistant Secretary, Nuclear Policy Branch, International Security Division
Mr A J McCarthy, Acting Unit Leader, Defence, Outer Space and Nuclear Law Unit
Mr P G Scott, Defence, Outer Space and Nuclear Law Unit
Mr R R Smith, Acting Director, Nuclear Affairs Section, Nuclear Policy Branch

Department of Transport

Ms J A Scott, Senior Officer, Airport Regulation Branch, Aviation Operations Division
Mr P Anyon, Director, Regulation Policy and Projects, Federal Office of Road Safety
Ms D A Campbell, Director, International Relations Section, Maritime Policy Division
Mr P M Makeham, First Assistant Secretary, Federal Office of Road Safety
Mr D A Zaal, Senior Officer, Regulation Policy and Projects Section, Federal Office of Road Safety

Qantas Airways Limited

Mr M P Montuori, Training Manager, Freight Division
Mr M Quinn, Manager, Air Safety Investigation

Mr P A Burns, Head, Scientific Services Section, Australian Radiation Laboratory

Mr J A Carlson, Director of Safeguards, Australian Safeguards Office

Mr E L Clements, Principal Marine Surveyor, Ship and Personnel Safety Services, Australian Maritime Safety Authority

Mr A D Johnston, Environment Radiation Officer, Office of the Supervising Scientist, Commonwealth Environment Protection Agency

Mr C Roberts, Superintendent, Rescue and Fire Fighting Service, Airservices Australia

Mr P Steele, Dangerous Goods Coordinator, South East Region, Civil Aviation Safety Authority

Monday, 23 October 1995, Canberra

Rhone-Poulenc Chimie (Australia) Pty Ltd
- Dr B M Hartley, Consultant
- Mr D H Newton, Chief Executive

Department of Health, Queensland
- Mr R I Kleinschmidt, Senior Physicist, Radiation Health Unit
- Mr J D Wallace, Principal Physicist, Radiation Health Unit

Dr K B Fenton

Monday, 13 November 1995, Canberra

Mr P D Wong, Managing Director, Contaminated Waste Disposal Service Pty Ltd

Monday, 11 December 1995, Sydney

Mr L T Collins, Chair, Division of Allied Health, Principal Physicist, Radiation Safety Officer, Westmead Hospital

Mr R A Balsillie, Executive Director, Australian Fire Protection Association

Dr A K Bhattacharyya, Visiting Fellow, Department of Mining Engineering, University of New South Wales

Mr M W Carter, Principal Consultant, Radiation Safety Consultants

Mrs C M Coate, National Executive Director, Fire Protection Industry Association of Australia

Dr G F Egan, Principal Scientist, Centre for Positron Emission Tomography, North Eastern Healthcare Network

Mr J Elbourne

Mr F Fairclough

Mr M R Griffiths, Scientific Officer, Department of Nuclear Medicine, Acting Radiation Safety Officer, St Vincent's Hospital

Mr M G Hanlon, Radiation Safety Officer, Senior Hospital Scientist, Immunology, Royal Alexandra Hospital for Children

Mr C C Orr, National Councillor, Fire Protection Industry Association of Australia

Dr R Rosen, Chairman, University Radiation Safety Committee, Senior Lecturer, Department of Safety Science, University of New South Wales

Dr R C Smart, Radiation Safety Officer, Principal Medical Physicist, St George Hospital

Mrs J E Towson, Radiation Safety Officer, Royal Prince Alfred Hospital

Wednesday, 13 December 1995, Kalgoorlie

Goldfields Against Serious Pollution
Mrs D Botica, Secretary
Mrs L Powlesland, Member

Mrs S H Peebles

Mr I F Taylor, MLA

Mr L B Wright

Mr R S Yuryevich, Mayor, City of Kalgoorlie-Boulder

APPENDIX 3

COMMONWEALTH DEPARTMENTS AND AUTHORITIES INVOLVED IN RADIATION POLICY AND MANAGING RADIOACTIVE WASTE

This list follows the administrative arrangements gazetted in the Commonwealth Gazette, 11 March 1996. Submissions to the Inquiry were made under former names.

Department of Primary Industries and Energy

The Department has overall responsibility for Commonwealth policy on radioactive waste. It has a Uranium and Nuclear Policy Section within the Coal and Minerals Division. The Minister administers the *Atomic Energy Act 1953,* which deals mainly with the Ranger uranium mine, Northern Territory.

Department of Industry, Science and Tourism

The Department oversees the Australian Nuclear Science and Technology Organisation, the Safety Review Committee, CSIRO and the Australian Customs Service. The Minister admnisters the *Australian Nuclear Science and Technology Act 1987* except the parts of it that relate to the Nuclear Safety Bureau, which are administered by the Minister for Health and Family Services.

Australian Nuclear Science and Technology Organisation (ANSTO)

ANSTO is a statutory authority with activities including operating a nuclear reactor, scientific research, producing radioactive materials and other irradiation services for medical use on a commercial basis, providing advice to Government, and assisting industry develop new or improved products and processes. ANSTO supplies about 85 per cent of the demand for radioisotopes and radiopharmaceuticals in Australia.

Safety Review Committee

The *Australian Nuclear Science and Technology Act 1987* (section 26) establishes a Safety Review Committee to oversee the safety of ANSTO's activities. The Safety Review Committee may advise the Minister or ANSTO, but has no powers of enforcement.

Commonwealth Scientific & Industrial Research Organisation (CSIRO)

CSIRO is a statutory authority which holds and produces a variety of radioactive wastes. CSIRO's Fishermens Bend radioactive soil, now in store at Rangehead, Woomera, represents about 60 per cent of Australia's Commonwealth/State owned radioactive waste by volume.

Australian Customs Service

The *Customs Act 1901* prohibits the import of radioactive substances without a permit.[1] The Australian Radiation Laboratory advises Customs on applications for permits, after consulting State authorities.

Department of Health and Family Services

The Department oversees the National Health and Medical Research Council, the Nuclear Safety Bureau, the Australian Radiation Laboratory and the Australian Ionising Radiation Advisory Committee. The Minister administers the *Environment Protection (Nuclear Codes) Act 1978,* and the parts of the *Australian Nuclear Science and Technology Act 1987* which relate to the Nuclear Safety Bureau.

National Health and Medical Research Council

This is a statutory authority which, among other things, recommended standards on all aspects of handling ionising radiation, through its Radiation Health Standing Committee. This Committee is now renamed the Radiation Health Committee and its secretariat is located in the Australian Radiation Laboratory.

Nuclear Safety Bureau

The *Australian Nuclear Science and Technology Act 1987* (section 37) establishes the Nuclear Safety Bureau to monitor the safety of ANSTO's nuclear reactor. The Bureau has power to impose conditions on the operation of the reactor and provides technical advice to the Commonwealth on other nuclear matters.

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1 Customs (Prohibited Import) Regulations (Amendment) (Statutory Rules 1989 No 60).

Australian Radiation Laboratory

The Australian Radiation Laboratory is part of the Department.[2] Its functions are to provide research, advice and national standards on the health effects of radiation. It participates in international collaboration on radiation health and (by delegation under regulations of the *Customs Act 1901*) decides applications to import radioactive materials.

Australian Ionising Radiation Advisory Council

The Council is a non-statutory body established to advise the Commonwealth Government on radiation matters. It has fallen into disuse and it is proposed to abolish it and absorb its functions within the proposed Australian Institute of Radiation Protection.

Department of Industrial Relations

The Department oversees the National Occupational Health and Safety Commission (which has collaborated with the National Health and Medical Research Council in producing new standards for occupational exposure to radiation[3]) and Comcare, which is responsible for the occupational health and safety of Commonwealth-employed radiation workers.

Department of Environment, Sport and Territories

The Department oversees the operation of the *Environment Protection (Impact of Proposals) Act 1974*, which is generally relevant to control of the Commonwealth's environmentally significant actions. The Minister also administers the *Environment Protection (Alligator Rivers Region) Act 1978,* the main purpose of which is to protect the Alligator Rivers region (Kakadu National Park, Northern Territory) from the effects of uranium mining.

Department of Transport and Regional Development

The Department controls transport of radioactive material by air (regulations under the *Civil Aviation Act 1988,* administered by the Civil Aviation Safety

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2 The Australian Radiation Laboratory is established by Order in Council; *Commonwealth Gazette*, 7 October 1987, p. 1360

3 *Recommendations for limiting exposure to ionising radiation and National standard for limiting occupational exposure to ionising radiation* (1995).

Authority) and by sea (regulations under the *Navigation Act 1901*, administered by the Australian Maritime Safety Authority).

Department of Defence

The Department regulates and monitors visits by nuclear warships. It produces small amounts of radioactive waste, and has some waste in store, most of which dates from the 1950s and 60s.

Department of Foreign Affairs and Trade

The Department co-ordinates Australia's position on international treaties to do with radioactivity and (through the Australian Safeguards Office) oversees Australia's adherence to the international Nuclear Safeguards Agreement. The Minister administers the *Nuclear Non-Proliferation (Safeguards) Act 1987*.

APPENDIX 4

RADIATION PUBLICATIONS BY THE NATIONAL HEALTH AND MEDICAL RESEARCH COMMITTEE'S RADIATION HEALTH STANDING COMMITTEE

Radiation publications are available from State and Territory health authorities, not direct from the NHMRC.

In 1994 the Radiation Health Standing Committee was renamed the Radiation Health Committee, and its secretariat was transferred to the Australian Radiation Laboratory, a branch of the Department of Health and Family Services.

Notes on Medical Procedure for Radiation Accidents and Radioactive Contamination (1960)

Code of Practice for the Safe Use of Radioactive Luminous Compounds (1971)

Recommendations for Exemptions from Licensing of Gaseous Tritium Light Devices (1975)

RADIATION HEALTH SERIES

RH 1 Recommended Radiation Protection Standards for Individuals Exposed to Ionising Radiation (1980) **Superseded by RH39**

RH 2 Code of Practice for the Design of Laboratories Using Radioactive Substances for Medical Purposes (1980)

RH 3 Code of Practice for the Safe Use of Ionizing Radiation in Veterinary Radiology: Part 1 and 2 (1982)

RH 4 Code of Practice for the Safe Use of Radiation Gauges (1982)

RH 5 Recommendations Relating to the Discharge of Patients Undergoing Treatment with Radioactive Substances (1983)

RH 6 Code of Practice for the Safe Use of Lasers in Secondary Schools (1983) **Superseded by RH36**

RH 7 Guidelines for the Safe Use of Lasers in the Entertainment Industry (1983) **Superseded by RN37**

RH 8 Code of Nursing Practice for Staff Exposed to Ionizing Radiation (1984)

RH 9 Code of Practice for Protection Against Ionizing Radiation Emitted from X-Ray Analysis Equipment (1984)

RH10 Code of Practice for the Safe Use of Ionizing Radiation in Veterinary Radiology: Part 3 - Radiotherapy (1984)

RH11 Code of Practice for the Safe Use of Soil Density and Moisture Gauges Containing Radioactive Sources (1984)

RH12 Administration of Ionizing Radiation to Human Subjects in Medical Research (1984)

RH13 Code of Practice for the Disposal of Radioactive Wastes by the User (1985)

RH14 Recommendations for Minimizing Radiological Hazards to Patients (1985)

RH15 Code of Practice for the Safe Use of Microwave Diathermy Units (1985)

RH 16 Code of Practice for the Safe Use of Shortwave (Radiofrequency) Diathermy Units (1985)

RH17 Procedure for Testing Microwave Leakage from Microwave Ovens (1985)

RH18 Code of Practice for the Safe Handling of Corpses Containing Radioactive Materials (1986)

RH19 Code of Practice for the Safe Use of Ionizing Radiations in Secondary Schools (1986)

RH20 Code of Practice for Radiation Protection in Dentistry (1987)

RH21 Statement on Cabinet X-Ray Equipment for Examination of Letters, Packages, Baggage, Freight and Other Articles for Security, Quality Control and Other Purposes (1987)

RH22 Statement on Enclosed X-Ray Equipment for Special Applications (1987)

RH23 Code of Practice for the Control and Safe Handling of Radioactive Sources Used for Therapeutic Purposes (1988)

RH24 Code of Practice for the Design and Safe Operation of Non-Medical Irradiation Facilities (1988)

RH25 Recommendations for Ionization Chamber Smoke Detectors for Commercial and Industrial Fire Protection Systems (1988)

RH26 Policy on Stable Iodine Prophylaxis Following Nuclear Reactor Accidents (1989)

RH27 Australia's Radiation Protection Standards (1989) **Superseded by RH39**

RH28 Code of Practice for the Safe Use of Sealed Radioactive Sources in Borehole Logging (1989)

RH29 Occupational Standard for Exposure to Ultraviolet Radiation (1989)

RH30 Interim Guidelines on Limits of Exposure to 50/60 Hz Electric and Magnetic Fields (1989)

RH31 Code of Practice for the Safe Use of Industrial Radiography Equipment (1989)

RH32 Intervention in Emergency Situations involving Radiation Exposure (1990)

RH33 Interim Statement on Australian Radiation Practice Standards (1991) **Superseded by RH39**

RH34 Safety Guidelines for Magnetic Resonance Diagnostic Facilities (1991)

RH35 Code of practice for the Near-surface Disposal of Radioactive Waste in Australia (1992)

RH36 Code of practice for the safe use of lasers in schools (1995)

RH37 Code of practice for the safe use of lasers in the entertainment industry (1995)

RH38 Recommended limits on radioactive contamination on surfaces in laboratories (1995)

RH39 Recommendations for limiting exposure to ionising radiation (1995) and National standard for limiting occupational exposure to ionising radiation

APPENDIX 5

STATE/ TERRITORY RADIATION CONTROL LEGISLATION

Under the Constitution control of radioactive materials generally lies with States and Territories. All States and Territories have laws controlling possession and use of radioactive materials. These are listed here. Others laws relating to public health, environment protection, nuclear non-proliferation, occupational health and safety, dangerous goods and mining control may also be relevant.

Australian Capital Territory
Radiation Act 1983

New South Wales
Radiation Control Act 1990
Radiation Control Regulation 1993

Northern Territory
Radiation (Safety Control) Act

Queensland
Radioactive Substances Act 1958-1978
Radioactive Substances Regulations 1961

South Australia
Radiation Protection & Control Act 1982
Ionising Radiation Regulations 1985

Tasmania
Radiation Control Act 1977
Radiation Control Regulations 1994

Victoria
Health Act 1958
Health (Radiation Safety) Regulations 1994

Western Australia
Radiation Safety Act 1975-1984
Radiation Safety (General) Regulations 1983