8

Australia's bilateral safeguards

> *The stringency of Australia's approach, ensuring Australian involvement in regulating for the full life of its nuclear material … is internationally recognised for the contribution it has made to ensuring such material is not diverted for military purposes. Australia retains the right to be selective regarding the countries with which it is prepared to conclude bilateral safeguards agreements. As such, and with the extent of the world's uranium resources it controls, Australia is uniquely placed to exercise even greater influence to maintain the safety and security of the nuclear fuel cycle.*[1]

1 Uranium Information Centre (UIC), *Submission no. 12*, p. 12.

Key messages —

- **In addition to the International Atomic Energy Agency (IAEA) safeguards described in the previous chapter, Australia imposes additional safeguards requirements on its uranium exports through a network of bilateral safeguards agreements.**
- **The objectives of Australia's safeguards policy are to ensure that Australian Obligated Nuclear Material (AONM) is: appropriately accounted for as it moves through the fuel cycle; is used only for peaceful purposes; and in no way contributes to any military purpose.**
- **Of the five cases where the IAEA has found countries to be in non-compliance with their safeguards agreements and reported the non-compliance to the UN Security Council, none of these cases involved countries eligible to use Australian uranium.**
- **While it cannot be absolutely guaranteed that diversion of AONM for use in weapons could never occur at some point in the future, nevertheless the Committee is satisfied that Australia's safeguards policy has been effective to date. The conditions in safeguards agreements are adequate and there is no reason to impose additional requirements on customer countries at this time.**
- **There is little or no potential for the diversion of AONM for use by terrorists, or for AONM and other radioactive material in Australia to be used in 'dirty bombs'. Australia's conditions for supply of AONM include an assurance that internationally agreed standards of physical security will be applied to nuclear materials in the country concerned.**
- **Conventions and guidelines to help protect against acts of nuclear terrorism have recently been strengthened, including significant amendments to the Convention on the Physical Protection of Nuclear Materials and the Code of Conduct for Safety and Security of Radioactive Sources.**
- **The Committee is pleased to note that Australia has again been at the forefront in negotiating these outcomes, as well as contributing to nuclear security initiatives in the region, such as leading a project to ensure the security of radioactive sources.**
- **The Committee supports the Australian Government's decision to permit exports of uranium to China, while noting that, as with the other bilateral safeguards agreeements, Australia may suspend or terminate sales of uranium should AONM be diverted for weapons programs.**

- **The US-India nuclear cooperation agreement will have a number of important non-proliferation benefits, including that it will expand the application of IAEA safeguards in India, and allow the IAEA enhanced access rights. The majority of India's nuclear activities will be under safeguards by 2014.**
- **It is conceivable that Australian uranium could be supplied to India, which is not a party to the Treaty on the Non-Proliferation of Nuclear Weapons (NPT), in a way that does not undermine the non-proliferation regime. Indeed, the Director General of the IAEA has welcomed the US-India agreement, stating that the agreement is a 'step forward towards universalistion of the international safeguards regime.'**
- **While there are sound reasons to allow an exception to Australia's exports policy in order to permit uranium sales to India, including its record as a non-proliferator, the Committee does not wish to make a recommendation on the matter.**
- **Maintaining the integrity of the non-proliferation regime must remain the top priority and guiding principle for Australia's uranium exports policy. Australia's actions must not undermine the non-proliferation regime and the fundamental importance of the NPT—particuarly given Australia's place as a major uranium producer. For the long-term stability and reputation of the Australian uranium industry, a bipartisan position on the India question should, if at all possible, be developed.**

Introduction

8.1 In this chapter the Committee considers the adequacy and effectiveness of Australia's safeguards policy and the bilateral safeguards agreements it enters into with countries wishing to purchase Australian uranium.

8.2 The chapter commences with an overview of the safeguards policy and the principal conditions for the use of Australian obligated nuclear material (AONM) set out in the bilateral agreements.

8.3 Four main criticisms were made of the safeguards policy and agreements, which the Committee considers in turn, along with rebuttals from the Australian Safeguards and Non-Proliferation Office. These criticisms related to:

- the quantity, complexity of chemical forms, and the variety of locations and circumstances in which Australia's exported uranium is held;

- accounting procedures for nuclear materials involve uncertainties and margins of error which, on the industrial scale involved, means that it cannot be excluded that material sufficient to produce a nuclear weapon(s) could be diverted;
- before comprehensive International Atomic Energy Agency (IAEA) safeguards were imposed on the international uranium trade, Australia sold several tonnes of unsafeguarded uranium to France, India and Japan in the 1960s; and
- since their inception under the Fraser Government, Australia's safeguards have been eroded by being inappropriately modified to accommodate commercial demands.

8.4 The Committee then considers several other proliferation concerns and allegations raised by submitters:

- Australia's uranium exports could free up indigenous sources of uranium in customer countries for use in their military programs;
- reprocessing of spent fuel containing AONM and the storage of Australian-obligated plutonium;
- Australian SILEX enrichment technology; and
- issues associated with export of uranium to China and, potentially, to India.

8.5 The chapter concludes with a discussion of nuclear security, including the possible malicious use of radioactive sources in so-called 'dirty bombs' and efforts to prevent nuclear terrorism.

Australia's safeguards policy

8.6 The principles underlying Australia's nuclear safeguards policy were developed following the publication in 1976 of the First Report of the Ranger Uranium Environmental Inquiry, which was a major Commonwealth Government inquiry under Justice R W Fox (the Fox report) that took place between 1975 and 1977.

8.7 The Fox report emphasised the importance of adequate safeguards measures being applied to Australia's uranium.[2] One of the principal findings of the report was that 'No sales of Australian uranium should take place to any country not party to the NPT' and that uranium exports

2 See: Mr R W Fox, *Ranger Uranium Environmental Inquiry – First Report*, AGPS, Canberra, 1976, pp. 115–149; 185; Uranium Information Centre (UIC), *Submission no. 12*, p. 31.

'should be subject to the fullest and most effective safeguards agreements.'[3]

8.8 Australia's safeguards policy, which was announced on 24 May 1977, provides assurances that exported uranium and its derivatives cannot benefit the development of nuclear weapons or be used in other military programs. This is done by accounting for amounts of Australian Obligated Nuclear Material (AONM) as it moves through the nuclear fuel cycle.[4] The policy ensures that uranium exports are made only to selected countries covered by a bilateral safeguards agreement between Australia and the country concerned. Australia's requirements, set out in the bilateral agreements, are outlined below.

8.9 The objectives of Australia's safeguards requirements are to ensure that AONM:

- is appropriately accounted for as it moves through the nuclear fuel cycle;
- is used only for peaceful purposes in accordance with the applicable agreements; and
- in no way enhances or contributes to any military process.[5]

8.10 Australia's safeguards requirements are superimposed on and compliment the IAEA safeguards, which provide the basic assurance that nuclear material is not being diverted from peaceful to non-peaceful purposes. The UIC observed that:

> The legally-binding bilateral safeguard measures are directed towards preventing any unauthorised or clandestine use of exported uranium or any materials derived from it … They are designed to deter possible diversion of fissile material or misuse of equipment and technology more effectively than standard IAEA safeguards on their own.[6]

8.11 Whereas IAEA safeguards are generally not concerned with origin attribution, that is, the 'national flag' and conditions attached by suppliers (for the IAEA there are limited exceptions, e.g. under certain non-NPT safeguards agreements), this is the purpose of bilateral safeguards agreements. Australia's bilateral agreements specify conditions which are

3 Cited in Hon Alexander Downer MP, *Submission no. 33*, p. 10.

4 AONM is defined as Australian uranium and nuclear material derived therefrom, which is subject to obligations pursuant to Australia's bilateral safeguards agreements. Australian Safeguards and Non-Proliferation Office (ASNO), *Australia's Uranium Exports Policy*, viewed 17 July 2006, <http://www.dfat.gov.au/security/aus_uran_exp_policy.html>.

5 The Hon Alexander Downer MP, *Submission no. 33*, p. 13.

6 UIC, *op. cit.*, p. 32.

additional to IAEA safeguards, for example, with regard to retransfers, high enrichment and reprocessing of AONM.[7]

8.12 Australia's safeguards policy establishes the following criteria for the selection of countries eligible to receive AONM:

- non-nuclear weapon states (NNWS) must be a party to the Treaty on the Non-Proliferation of Nuclear Weapons (NPT) and meet the NPT full scope safeguards standard; that is, International Atomic Energy Agency (IAEA) safeguards must apply to all existing and future nuclear activities;
- from May 2005, NNWS must now also make an Additional Protocol with the IAEA (providing for strengthened safeguards and described in the previous chapter) as a pre-condition for the supply of Australian uranium; and
- in the case of nuclear weapons states (NWS), there must be a treaty level assurance that AONM will be used only for peaceful purposes, and arrangements must be in place under which AONM is subject to that state's safeguards agreement with the IAEA (i.e. in NWS facilities where AONM may be used or processed, these facilities must be on the state's Voluntary Offer Agreement and can be selected by the IAEA for inspections).[8]

8.13 A basic requirement of Australia's policy is the conclusion of a safeguards agreement between Australia and the country concerned, setting out the various conditions which apply to AONM. The principal conditions for the use of AONM set out in the bilateral safeguards agreements are summarised as follows:

- an undertaking that AONM will be used only for peaceful purposes and will not be diverted to military or explosive purposes, and that IAEA safeguards will apply;[9]
- none of the following actions can take place without Australia's prior consent:
  - ⇒ transfers to third parties;
  - ⇒ enrichment to 20 per cent or more in the isotope uranium-235;
  - ⇒ reprocessing;[10]

7 ASNO, *Australia's Uranium Exports Policy*, *loc. cit.*

8 The Hon Alexander Downer MP, *Submission no. 33*, p. 13.

9 In this context 'military purpose' means nuclear weapons, nuclear explosive devices, depleted uranium munitions and military nuclear propulsion systems.

10 Consent has been given in advance to reprocessing on a programmatic basis in the case of five Agreements: Euratom, France, Japan, Sweden and Switzerland.

- provision for fallback safeguards or contingency arrangements in case NPT or IAEA safeguards cease to apply in the country concerned;
- an assurance that internationally agreed standards of physical security will be applied to nuclear material in the country concerned;
- detailed 'administrative arrangements' between ASNO and its counterpart organisation, setting out the procedures to apply in accounting for AONM;
- regular consultations on the operation of the agreement; and
- provision for the removal of AONM in the event of a breach of the agreement.[11]

8.14 The safeguards agreements stipulate coverage of uranium exports by IAEA safeguards from the time they leave Australian ownership, and continuation of coverage by IAEA safeguards for the full life of the material or until it is legitimately removed from safeguards. Contracts for the export of Australian uranium are also required to contain a clause noting that the contract is subject to the relevant bilateral safeguards arrangement.[12]

8.15 Australia currently has a network of 19 bilateral agreements, covering 36 countries, and Taiwan.[13] These agreements are listed in table 8.1.

8.16 In addition to the agreements listed, in April 2006 Australia and China entered into a bilateral safeguards agreement on the transfer of nuclear material, whereby sales of uranium to China will now be permitted.[14] Australian uranium cannot be transferred to China until the agreement is in force and administrative arrangements have been concluded between ASNO and the China Atomic Energy Authority.[15]

8.17 Under the *Nuclear Non-Proliferation (Safeguards) Act 1987* (the Safeguards Act), ASNO is responsible for ensuring that exports of uranium take place only under the terms of the bilateral safeguards agreements, including conducting the relevant nuclear materials accountancy. Under the Safeguards Act ASNO is also responsible for: ensuring uranium produced in Australia is properly accounted for; ensuring effective control of uranium (including the physical protection of such material); and

11 The Hon Alexander Downer MP, *Submission no. 33*, pp. 13–14.

12 ASNO, *Australia's Uranium Exports Policy*, *loc. cit*.

13 25 of the countries making up this total are EU member states.

14 ASNO, *Agreement Between the Government of Australia and The Government of the People's Republic of China on the Transfer of Nuclear Material*, viewed 26 June 2006, <http://www.dfat.gov.au/geo/china/treaties/nuclear_material.html>.

15 ASNO, Australia-China Nuclear Material Transfer Agreement and Nuclear Cooperation Agreement, *Frequently Asked Questions*, viewed 17 July 2006, <http://www.dfat.gov.au/geo/china/treaties/faq.html#2>.

administering the agreement between Australia and the IAEA for the application of safeguards in Australia.[16]

Table 8.1 Australia's Bilateral Safeguards Agreements and their dates of entry into force

Country[i]	**Date of Entry into Force**
Republic of Korea (ROK)	2 May 1979
UK	24 July 1979
Finland	9 February 1980
USA	16 January 1981
Canada	9 March 1981
Sweden	22 May 1981
France	12 September 1981
Euratom[ii]	15 January 1982
Philippines[iii]	11 May 1982
Japan	17 August 1982
Switzerland	27 July 1988
Egypt[iii]	2 June 1989
Russian Federation[iv]	24 December 1990
Mexico	17 July 1992
New Zealand[v]	1 May 2000
Czech Republic	17 May 2002
USA covering supply to Taiwan	17 May 2002
Hungary	15 June 2002
Argentina	12 January 2005

Source The Hon Alexander Downer MP, *Submission no. 33*, p. 17.
Notes:
i This list does not include Australia's NPT safeguards agreement with the IAEA, concluded on 10 July 1974 (reproduced as Schedule 3 to the *Nuclear Non-Proliferation (Safeguards) Act 1987).* In addition to these Agreements, Australia also has an Exchange of Notes constituting an Agreement with Singapore Concerning Cooperation on the Physical Protection of Nuclear Materials, which entered into force on 15 December 1989. The texts of these Agreements are published in the Australian Treaty Series.
ii Euratom is the atomic energy agency of the European Union. Czech Republic, Finland, France, Hungary, Sweden and the UK are members of Euratom and AONM in these countries is covered by the Australia/Euratom Agreement.
iii In the case of Egypt and the Philippines, Administrative Arrangements pursuant to the Agreements have not been concluded, so in practice the Agreements have not yet entered into operation.
iv The Australia/Russia Agreement covers the processing (conversion, enrichment or fuel fabrication) of AONM in Russia on behalf of other partner countries, but does not permit the use of AONM by Russia.
v The Australia/New Zealand agreement covers the supply of uranium for non-nuclear use.

8.18 As described in the previous chapter, there have been five cases, all involving undeclared plutonium separation or enrichment activities, where the IAEA has found that the country concerned was in non-compliance with its safeguards agreement, and reported the non-compliance to the Security Council: Iraq in 1991, Romania in 1992, DPRK

16 The Hon Alexander Downer MP, *Submission no. 33*, p. 8.

in 1993, Libya in 2004 and Iran in 2007. None of these cases involved countries eligible to use Australian uranium, and none were operating nuclear power programs at the time.[17]

Criticisms of Australia's safeguards policy and agreements

8.19 Several submitters argued that, despite the existence of safeguards, complete accounting for the uses to which uranium is put once it leaves Australian shores is a difficult task, and that 'we have no way of knowing whether our uranium is being used in any military capacity.'[18]

8.20 These submitters argued that the Australian public cannot be assured that safeguards have prevented or will continue to prevent the diversion of AONM from civil to military uses.[19] For example, the Arid Lands Environment Centre (ALEC) asserted that:

> The idea that Australia can guarantee that its uranium is only ever used for peaceful purposes is patently false. No treaty or safeguard process has ever proven to be leak-proof.[20]

8.21 Four arguments were advanced for this contention:

- the quantity, complexity of chemical forms, and the variety of locations and circumstances in which Australia's exported uranium is held;
- accounting procedures for nuclear materials involve uncertainties and margins of error which, on the industrial scale involved, means that it cannot be excluded that material sufficient to produce a nuclear weapon(s) could be diverted;
- before comprehensive IAEA safeguards had been imposed on the international uranium trade, Australia sold several tonnes of unsafeguarded uranium to France, India and Japan in the 1960s; and
- since their inception under the Fraser Government, Australia's safeguards have been eroded by being inappropriately modified to accommodate commercial demands.

8.22 Friends of the Earth—Australia (FOE) was also critical of the fact that Australian policy only requires that the NNWS adhere to Additional Protocols and not the weapon states.[21]

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17 *ibid*., pp. 12–13.

18 Ms Rita Warleigh et. al., *Submission no. 83*, p. 1; Medical Association for the Prevention of War (MAPW) (Western Australian Branch), *Submission no. 8*, p. 5.

19 See for example: Dr Gavin Mudd, *Submission no. 27*, p. 7; APChem, *Submission no. 38*, p. 4.

20 Arid Lands Environment Centre Inc. (ALEC), *Submission no. 75*, p. 2.

8.23 These claims are summarised in the sections which follow. ASNO provided responses to each criticism of the adequacy and effectiveness of Australia's safeguards policy and the rebuttals are cited in the discussion of each issue. In general, ASNO observed that while AONM is fully accounted for and Australia's policies and practice on uranium supply seek to minimise the risk of diversion, it cannot of course be absolutely guaranteed that diversion could never occur in the future.[22]

The quantity, complexity of chemical forms and the variety of locations and circumstances in which exported uranium is held

8.24 Professor Richard Broinowski argued that AONM cannot be effectively safeguarded because of the quantity, complexity of chemical forms and the variety of locations and circumstances in which exported uranium is held.[23] It was argued that:

> Despite assurances of the Safeguards Office to the contrary, it is not credible that *none* of this material has been lost through accounting errors, illegally diverted, or otherwise mishandled without detection.[24]

8.25 ASNO responded that there is no basis for this assertion and that the factors listed (quantity, form, locations and 'circumstances') have no adverse effect on the ability to apply safeguards to nuclear material. It was argued that Australian safeguards requirements are built on IAEA safeguards. Each of Australia's bilateral partners, in accordance with its safeguards agreement with the IAEA, is required to maintain a national system for nuclear material accountancy and control, under which detailed data are recorded and updated for all safeguarded nuclear material. These records are based on specific batches or items of nuclear material (e.g. individually numbered fuel elements). The IAEA also has some 45 years experience verifying states' inventories of nuclear material—confirming whether actual nuclear material holdings correspond to declared inventories—through inspections, measurements, containment and surveillance, and so on.[25]

8.26 It was submitted that Australia's bilateral partners are required to maintain records which enable AONM to be identified. These records are based on the records maintained to meet IAEA requirements—the usual

21 FOE, *Submission no 52*, p. 22.

22 The Hon Alexander Downer MP, *Submission no. 33.1*, p. 2.

23 Professor Richard Broinowski, *Fact or Fission: the truth about Australia's nuclear ambitions*, Scribe Publications, Melbourne, 2003, p. 256.

24 *ibid*., p. 257. Emphasis in original.

25 The Hon Alexander Downer MP, *Submission no. 33.1*, p. 7.

mechanism is to add to the IAEA *pro forma* an additional column in which safeguards obligation is recorded (e.g. 'A' or 'AUS' for Australian-obligated material). This enables specific batches of nuclear material to be identified as AONM.[26]

8.27 ASNO explained that facility operators in countries receiving Australian nuclear material are obliged to keep detailed accounts of all the Australian material going through their facilities. Nuclear material is identified in batches and whether there are any safeguards obligations on that batch of material. In some cases uranium producers have no requirements, which is referred to as unobligated material, while some intermediate countries impose a 'peaceful use' obligation but do not attempt to track the material as Australia and some other countries (such as Canada and the US) do. Mr John Carlson, the Director General of ASNO, explained that:

> At the facility there are very detailed records of each batch of material and whether or not that material has a safeguards obligation. The accounting records will follow that material through the entire fuel cycle as it goes from conversion to enrichment to fuel fabrication, into a reactor and then into a spent-fuel pond, and maybe through reprocessing for the recovery and recycling of plutonium. Part of the formulas we apply take account of plutonium production, of course, so that Australian obligated nuclear material not only means the uranium we originally exported in its various forms as it goes through different processes but also covers material that is generated by using that uranium.
>
> Our counterparts in the countries that are using Australian uranium prepare detailed reports to us of how much Australian obligated nuclear material there is at the different stages of the fuel cycle at different periods and how much material changed its form—for instance, became irradiated, produced plutonium, was enriched or whatever. We receive all of that information. We do a consistency check on it, cross-checking information from other countries. One of the features of the fuel cycle is that it is very international, such that there is a regular flow of material from country to country, so you can cross-check reports from one country against reports from another, and we also cross-check from our knowledge of the facilities involved. So we have our own appreciation of the burn-up in particular types of reactors, the plutonium production rates and so on, and we compare the

26 *ibid.*, pp. 7–8.

> reporting we get against our expectation of what should be happening in the country concerned.
>
> The end result is that we have very detailed figures on the disposition of Australian uranium, and we have not found that there are any major concerns about any of that material being improperly accounted for, disappearing or whatever. I have seen some of the so-called evidence you have been given about Australian material disappearing and so on. I can assure you that it has not happened.[27]

8.28 In its *Annual Report 2004–2005*, ASNO stated that all AONM is accounted for satisfactorily. On the basis of the IAEA's Safeguards Statement for 2004 and ASNO's analysis of reports and other information from counterparts overseas, ASNO concluded that no AONM was used for non-peaceful purposes in 2004–05. ASNO officers visited all major bilateral partners to reconcile the AONM accounts.[28] Table 8.2 summarises the disposition of AONM at 31 December 2004.

Table 8.2 Summary of AONM by category, quantity and location at 31 December 2004

Category	Location	Tonnes[i]
Depleted uranium	EU, Japan, ROK, US	74 143
Natural uranium	Canada, EU, Japan, ROK, US	19 311
Uranium in enrichment plants	EU, Japan, US	10 392
Low enriched uranium[ii]	Canada, EU, Japan, Mexico, ROK, Switzerland, US	9 598
Irradiated plutonium[iii]	Canda, EU, Japan, Mexico, ROK, Switzerland, US	86
Separated plutonium[iv]	EU, Japan	0.4
TOTAL		113 531

Source ASNO, *Annual Report 2004–2005*, p. 44.

Notes:

i All quantities are given as tonnes weight of the element uranium, plutonium or thorium.

ii An estimated 80–90 per cent of Australian obligated low enriched uranium is in the form of spent reactor fuel.

iii Almost all Australian obligated plutonium is irradiated, i.e. contained in irradiated power reactor fuel or plutonium reloaded in a power reactor following reprocessing.

iv Separated plutonium is plutonium recovered from reprocessing. The figure for separated plutonium is not accumulative, but fluctuates as plutonium is fabricated with uranium as mixed oxide (MOX) fuel and returned to reactors for further power generation. On return to reactors the plutonium returns to the 'irradiated plutonium' category. During 2004, 0.2 tonnes of plutonium was fabricated into MOX fuel and transferred to reactors.

27 Mr John Carlson (ASNO), *Transcript of Evidence*, 10 October 2005, p. 23.

28 ASNO, *Annual Report 2004–2005*, Commonwealth of Australia, Canberra, 2005, pp. 44–45.

Accounting procedures for nuclear materials cannot exclude the possibility that material sufficient to produce a nuclear weapon could be diverted

8.29 The MAPW (Victorian Branch) argued that:

> Accounting procedures for nuclear materials involve uncertainties and margins of error which, on the industrial scale involved, means that it cannot be excluded that material sufficient to produce one or more nuclear weapons could be diverted.[29]

8.30 ASNO's *Annual Report 2003–2004* explained how the accounting for AONM is undertaken. Australia's bilateral partners holding AONM are required to maintain detailed records of transactions involving AONM, and ASNO's counterpart organisations are required to submit regular reports, consent requests, transfer and receipt documentation to ASNO. ASNO accounts for AONM on the basis of information and knowledge including:

- reports from each bilateral partner;
- shipping and transfer documentation;
- calculations of process losses and nuclear consumption, and nuclear production;
- knowledge of the fuel cycle in each country;
- regular liaison with counterpart organisations and with industry; and
- reconciliation of any discrepancies with counterparts.[30]

8.31 ASNO responded to MAPW's allegation by observing that accounting procedures for nuclear materials can be very precise, depending on the form of the material. It was acknowledged that there are measurement uncertainties or margins of error for nuclear material in certain forms. Examples include plutonium in spent fuel, where the plutonium content is a calculated value which cannot be confirmed by precise measurement unless the plutonium is recovered by reprocessing, and nuclear material undergoing bulk processing (such as reprocessing, where fuel elements are dissolved and uranium and plutonium recovered).[31]

8.32 In these cases, conclusions on non-diversion of nuclear material are not based on accountancy alone. In addition to nuclear accounting, the IAEA uses surveillance and containment methods, e.g. cameras and radiation detectors covering process lines, possible withdrawal points, and exit points. Even if the quantities of nuclear material undergoing processing

29 MAPW (Victorian Branch), *Submission no. 30*, p. 3.

30 ASNO, *Annual Report 2003–2004*, Commonwealth of Australia, Canberra 2004, p. 116.

31 The Hon Alexander Downer MP, *Submission no. 33.1*, p. 8.

are not known precisely at a particular moment, these measures are said to provide assurance that no materials have been removed from the process.[32]

Sales of unsafeguarded uranium in the 1960s

8.33 Professor Broinowski argued in his book, *Fact or Fission*, that before comprehensive IAEA safeguards had been imposed on the international uranium trade, Australia sold several tonnes of unsafeguarded uranium to France, India and Japan in the 1960s. It was argued that some of this material may have 'ended up in French or Indian nuclear weapons, or in weapons research programs of countries or sub-national groups to which a portion of it may have been traded.'[33]

8.34 ASNO responded that Australia's current policies on uranium exports, including the current bilateral agreements and the concept of AONM, date from 1977. Obviously, uranium exports prior to that time were not covered by current policies.[34]

8.35 However, ASNO argued that Professor Broinowski's statement is incorrect in two respects. First, although comprehensive or full scope safeguards were introduced following entry into force of the NPT in 1970, IAEA safeguards pre-date the NPT, and in fact have existed since 1959. Before the NPT, IAEA safeguards applied on an 'item-specific' basis, i.e. to specified materials and facilities (and this is still the case in the countries not party to the NPT).

8.36 Second, ASNO argued that it is not correct that all exports prior to introduction of the current policies were 'unsafeguarded'. For example, uranium exports to Japan were covered by the 1972 Australia-Japan nuclear cooperation agreement, which required Australian uranium to be covered by IAEA safeguards (which at that time were 'item-specific') or by safeguards applied by Australia. The current Australia-Japan agreement, concluded in 1982, required nuclear material supplied by Australia under the 1972 agreement to be brought under the new agreement. ASNO also noted that *Fact or Fission* itself indicates that in the France and India cases these were only 'sample quantities', not the tonnes suggested.[35]

32 *ibid*.
33 Professor Richard Broinowski, *Fact or Fission, op. cit.,* p. 255.
34 The Hon Alexander Downer MP, *Submission no. 33.1*, p. 8.
35 *ibid*.

Erosion of Australia's safeguards

8.37 Professor Broinowski argued that the package of bilateral safeguards adopted in 1977 were substantially modified over the following ten years in order to 'accommodate the demands of consumers and the anxieties of Australian uranium mining companies not to lose customers.'[36] It was argued that, as a consequence of the modifications, the safeguards were 'gutted of its potency'.[37]

8.38 The People for Nuclear Disarmament (NSW) asserted that as a result of these modifications:

> Any decision to increase uranium exportation from Australia will need to be undertaken with the expectation that these safeguards will fail, that some Australian uranium will go missing, and that the possibility that some Australian uranium will end up in a nuclear weapons program cannot be excluded.[38]

8.39 Professor Broinowski alleged that there have been seven modifications to Australia's policy and these have eroded Australia's safeguards and increased the likelihood that AONM could be used in nuclear weapons. It was also alleged that 'it is absolutely clear' that some Australian uranium has already gone into weapons programs.[39] The seven alleged modifications are considered in turn.

Sales of uranium to France prior to its becoming an NPT Party

8.40 In June 1977, sales of uranium were allowed to France, which had not then signed the NPT.[40]

8.41 ASNO responded that from the outset of the current policy (the policy announcement of 24 May 1977), the requirement for NPT membership applied *only* to NNWS, on the basis that the NPT would ensure full scope safeguards applied to all their nuclear activities. In the case of the existing nuclear weapon states (including France), the policy has always been that exports may be permitted to such states where they give assurances that AONM will be used for exclusively peaceful purposes and will be covered by IAEA safeguards. Thus, conclusion of a bilateral agreement with France was totally consistent with the 1977 policy.[41]

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36 Professor Richard Broinowski, *Fact or Fission, loc. cit.*

37 Professor Richard Broinowski, *Submission no. 72*, p. 2.

38 People for Nuclear Disarmament (NSW) Inc, *Submission no. 45*, p. 9.

39 Professor Richard Broinowski, *Transcript of Evidence*, 16 September 2005, p. 18.

40 Professor Richard Broinowski, *Submission no. 72*, p. 2.

41 The Hon Alexander Downer MP, *Submission no. 33.1*, p. 9.

Australian uranium no longer had to attract IAEA safeguards when leaving Australian ownership

8.42 In October 1977 Australian uranium no longer had to attract IAEA safeguards when leaving Australian ownership (because uranium is shipped from Australia as uranium oxide, which did not attract IAEA safeguards, rather than as uranium hexafluoride (UF_6), which did).[42]

8.43 ASNO responded that the 1977 announcement recognised that this requirement presented a practical problem—Australia exports uranium oxide concentrate (UOC), which is before the 'starting point' of safeguards. UOC exports are reported to the IAEA, and the IAEA confirms their receipt, but the full range of safeguards procedures do not apply until the uranium conversion stage, when UOC is processed into UF_6 or uranium tetrafluoride (UF_4). To give effect to this requirement would have required establishment of uranium conversion facilities in Australia, but there was no commercial interest in this. Accordingly this requirement was modified.

8.44 An Inquiry conducted in 1984 by the Australian Science and Technology Council (ASTEC), *Australia's Role in the Nuclear Fuel Cycle*, reviewed this requirement, and found that this modification did not weaken the policy. ASTEC concluded:

> Indeed, the original policy appears to have been based on a misconception that ownership gives additional safeguards control. In fact, safeguards control ... is independent of ownership.[43]

Pre-1977 sales of uranium to Japan were not subject to prior consent; subsequently prior consent was dropped altogether in favour of a 'program' approach

8.45 By October 1977 Japan was informed that Australia would not insist that uranium contracted for supply before that date must be subject to the prior consent rule on transfer, enrichment or reprocessing, and then in January 1981 Australia dropped the provision altogether in favour of a 'program' or 'toll' approach.[44]

8.46 ASNO responded that the 1977 policy was not intended to be retroactive. Not unreasonably, Japan argued that uranium supplied pre-1977 should not be subject to new conditions. However, as noted above, pre-1977 material was rolled into the 1982 Australia–Japan agreement.

42 Professor Richard Broinowski, *Submission no. 72*, p. 2.

43 ASTEC, *Australia's Role in the Nuclear Fuel Cycle*, AGPS, Canberra, 1984, p. 161.

44 Professor Richard Broinowski, *Submission no. 72*, p. 2.

8.47 As regards programmatic consent, ASNO argued that this does not represent a derogation from the requirement for consent. The requirement for consent is that prior written consent must be obtained from Australia before nuclear material is transferred to a third country, high enriched (to 20 per cent or more U-235), or reprocessed. Rather than process numerous individual consent applications, the government decided it was more convenient to all concerned to give generic consent in advance under circumstances where in any event individual consent would have been given. The conditions of such consents are carefully defined, and Australia can withdraw consent if there are any difficulties. ASNO argued that this is entirely consistent with the 1977 policy but simply makes for more efficient implementation.[45]

8.48 Under most of Australia's agreements, consent has been given in advance for transfers at the 'front-end' of the fuel cycle, i.e. prior to irradiation, from one Australian agreement partner to another in accordance with the conditions in the respective agreements. This is intended to save time and administrative work, compared with case-by-case approvals. These advance consents apply in circumstances where approval would have been given if consent had been requested on a case-by-case basis. Australia is free to revoke advance consents at any time if necessary.

8.49 As noted above, in some agreements advance consent has also been given for reprocessing to take place. These consents allow reprocessing and associated 'back-end' transfers (e.g. transfers of irradiated fuel and nuclear material recovered from reprocessing), in accordance with a fuel cycle program agreed with Australia, hence the term 'programmatic consent'. Here too consents are given only in circumstances where consent would be given if sought on a case-by-case basis, and Australia is free to revoke advance consents at any time if necessary. ASNO commented that:

> There has been some ill-informed comment that programmatic consent is a diminution of Australian conditions. This is untrue and simply demonstrates ignorance of how the bilateral agreements function.[46]

Allowing uranium contracts to be negotiated before conclusion of bilateral agreements

8.50 In January 1979 the Commonwealth Government permitted sales contracts to be negotiated before the negotiation of bilateral safeguards agreements.[47]

45 The Hon Alexander Downer MP, *Submission no. 33.1*, pp. 9–10.

46 The Hon Alexander Downer MP, *Submission no. 33*, p. 14.

47 Professor Richard Broinowski, *Submission no. 72*, p. 2.

8.51 ASNO responded that this issue was examined by the 1984 ASTEC Inquiry. ASTEC found that, rather than placing Australia under pressure to dilute its policy:

> … there is some evidence to suggest [this] ... placed pressure on the *customer* country to meet Australia's requirements and conclude an agreement so that deliveries might proceed.[48]

8.52 ASTEC concluded that the change in policy did not result in any detriment and, on balance, provided neither negotiating side with an advantage.[49]

Sales from off-shore warehouses

8.53 By November 1982 sales of uranium were permitted from offshore warehouses outside Australian jurisdiction and through offshore brokers.[50]

8.54 ASNO noted that the applicable safeguards arrangements, rather than ownership, determine how nuclear material can be transferred and used. Establishing an offshore inventory, e.g. at a uranium conversion plant, gives the producer the opportunity to move quickly to secure contracts. However, the safeguards authority of the country where the inventory is located will not permit transfers outside the terms of the applicable safeguards agreements.[51]

The principle of 'equivalence' and the practice of international 'flag swaps'

8.55 It was claimed that in 1986 the Hawke Government introduced two reforms which allegedly 'weakened the identity of Australian uranium held abroad, and thus Australian ability to ensure that our safeguards continued to attach to it.'[52] These reforms were:

- the principle of 'equivalence', by which:

> Australian uranium could in practice be used in all manner of unauthorised ways, provided only that an amount of uranium equivalent to the original shipment from Australia could be seen to be used in approved activities;[53] and

48 ASTEC, *op. cit.*, p. 162. Emphasis added.

49 *ibid.*

50 Professor Richard Broinowski, *Submission no. 72*, p. 2.

51 The Hon Alexander Downer MP, *Submission no. 33.1*, p. 10.

52 Professor Richard Broinowski, *Submission no. 72*, p. 3. See also: People for Nuclear Disarmament (NSW) Inc., *Submission no. 45*, p. 8.

53 *ibid.*

- the concept of 'flag swaps' or 'book transfers', 'by which Australian originating uranium could become American or French or some other nationality to save transport costs.'[54]

8.56 ASNO explained that uranium is a fungible commodity, which means that uranium atoms are indistinguishable from one another, and international nuclear practice is to attribute safeguards obligations to nuclear material on the basis of the principles of equivalence and proportionality, which are defined below.[55]

8.57 For Professor Broinowski, the fungible nature of uranium means that the commodity:

> … is like sugar or wheat or any other bulk commodity. It is very hard to trace once it leaves our country. It is subject now to so many technicalities—so many different forms of working it, enriching it, doing whatever you like with it—that … I have challenged the government to justify or to explain how it is that they keep claiming they can track every single gram of Australian uranium. They cannot. It is not possible. These safeguard modifications—all because of commercial considerations, all to make our own uranium more attractive to clients—have weakened the whole system.[56]

8.58 Likewise, MAPW (Victorian Branch) argued that nuclear materials accountancy cannot guarantee that atoms of Australian uranium have not and will not in the future be used in weapons programs:

> At any stage of enrichment, processing or fabrication, it is impossible to distinguish by any means uranium from one source from uranium from any other source. Accounting is 'virtual'—so-called 'flag-swapping' has been shown to be routine.[57]

8.59 ASNO responded that the principle of equivalence was *not* introduced in 1986 and that the basis of Professor Broinowski's claim is not clear, but presumably was prompted by a statement of that time discussing the equivalence principle.[58]

8.60 It was argued that the principle of equivalence, and the complementary principle of proportionality, have applied from the outset. These principles were apparently not specifically mentioned in the 1977

54 *ibid*. See also: Professor Richard Broinowski, *Transcript of Evidence*, *op. cit*., p. 18.

55 The Hon Alexander Downer MP, *Submission no. 33.3*, p. 1.

56 Professor Richard Broinowski, *Transcript of Evidence, op. cit.,* p. 23.

57 MAPW (Victorian Branch), *op. cit*., p. 3; Associate Professor Tilman Ruff (MAPW Victorian Branch), *Transcript of Evidence*, 19 August 2005, p. 24.

58 The Hon Alexander Downer, *Submission no. 33.1*, p. 10.

announcement because they are matters of technical detail. However, the principles are applied under all of Australia's bilateral agreements, starting with the first agreement, with the ROK, in 1979:

> Australian policy since its inception in the seventies is that uranium is interchangeable. I have seen some of the witness statements … claiming that the policy has changed, but this was always part of the policy and it has always been part of international practice. That is what is called the principle of equivalence. Any batch of uranium of the same quality is the same as any other batch of the same quality. What is described as Australian obligated nuclear material is a way of identifying a batch of uranium as it goes through the fuel cycle and ensuring that that batch is covered at all times by the treaty commitments which ensure that it does not go into non-peaceful use.[59]

8.61 As noted above, the basis of the equivalence and proportionality conventions is that uranium is a fungible commodity, i.e. any particular quantity of uranium is indistinguishable from any other uranium of the same quantity and quality. It is a feature of the nuclear fuel cycle that uranium from different sources is mixed together at the various processing stages, e.g. conversion, enrichment, fuel fabrication, irradiation and reprocessing.

8.62 ASNO explained that this feature of the fuel cycle makes it impossible to track 'national atoms', and no country attempts to do this. Instead, at each stage of the fuel cycle an Australian obligation applies to the proportion of output that corresponds to the proportion of Australian-obligated input. The ASNO *Annual Report 2003–2004* defined the two principles further:

> The equivalence principle provides that where AONM loses its separate identity because of process characteristics (e.g. mixing), an equivalent quantity is designated AONM, based on the fact that atoms or molecules of the same substance are indistinguishable ... the principle of equivalence does not permit substitution by a lower quality of material …
>
> The proportionality principle provides that where AONM is mixed with other nuclear material, and is processed or irradiated, a proportion of the resulting material will be regarded as AONM corresponding to the same proportion as was AONM initially.[60]

8.63 ASNO stressed that because uranium is a fungible commodity tracking individual atoms of Australian uranium is impossible:

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59 Mr John Carlson, *op. cit.*, p. 22.

60 ASNO, *Annual Report 2003–2004*, *op. cit.*, p. 115.

> … anti-nuclear activists feel that we should have a way of controlling atoms—that uranium produced in Australia should somehow be designated as Australian and that the batches of material should then be controlled through their life until they return to Australia or whatever. In fact, the nuclear industry does not attempt to work that way. Uranium is what is described as a fungible material. That means that any atom of uranium is indistinguishable from any other atom of uranium, and quite early in the fuel cycle process uranium from all different sources gets mixed. At the uranium conversion stage, where yellowcake is processed into uranium hexafluoride, which is the feed material for enrichment, the normal commercial process is that uranium from several different producers will be mixed together as it goes through the plant. So trying to track atoms in those circumstances is impossible. The only way we could maintain control over atoms would be to set up the entire fuel cycle in Australia and do what the former Soviet Union used to do—lease fuel elements to countries with reactors and take the fuel elements back.[61]

8.64 While it is theoretically possible that Australian uranium atoms might have gone into weapons:

> … in practice most weapons states operate civil facilities that are quite separate from military ones. The only point where atoms could jump from military to civil would be at the conversion stage—for instance, where there might be military material and civil material going through a conversion plant together and then you have a civil stream and a military stream coming out, and maybe in enrichment a similar situation.[62]

8.65 However, Mr Carlson argued that most of the weapon states never mixed material in this way; either the civil and military facilities were entirely separate, or they operated civil facilities on a campaign basis:

> … where they would run a plant for civil purposes, shut it down, clean everything out, put a batch of military material through and then clean that out and reopen it for civil use.[63]

8.66 Moreover, ASNO explained that:

> Even if at some point AONM is co-mingled with nuclear material that is not covered by safeguards obligations, the presence of the

61 Mr John Carlson, *op. cit.*, pp. 21–22.

62 Mr John Carlson, *op. cit.*, p. 22.

63 *ibid.*

> AONM in no way benefits or contributes to the quantity or quality of the unobligated material.[64]

8.67 In relation to the risk of diversion of AONM in the NWS, ASNO argued that the uranium needs for the civil nuclear programs in each of the countries greatly outweigh the requirements for any military production. Moreover, in the early 1990s four of the NWS (UK, USA, France and the Russian Federation) announced that production of fissile material for nuclear weapons purposes had ceased. ASNO noted that unclassified sources indicate that China also ceased production of fissile material for weapons in the early 1990s. There is no AONM in Russia. Finally, all the NWS provide Australia with detailed reporting on the disposition and use of AONM. These measures are said to provide assurance that the AONM within their jurisdiction remains exclusively in peaceful use.[65]

8.68 The Committee notes that on the issue of supplying uranium to the NWS, the Fox Inquiry report concluded that:

> Selling them uranium would not be likely to increase proliferation, even if they were to use it for military purposes ... It is possible that considerations of our own defence might in any event outweigh any factors adverse to the supply to those countries of our uranium.[66]

8.69 In relation to international 'flag swaps', ASNO explained that the basis of this practice is that, where a physical transfer might take place, in appropriate circumstances the physical transfer can be avoided (with resulting savings in terms of cost and the need to handle nuclear material). Professor Broinowski gives an example that illustrates these arrangements. Suppose:

(a) a US utility owns 100 tonnes of AONM in the form of UF_6 which is located in France awaiting enrichment. In the normal course, once enriched, the AONM will be shipped across the Atlantic for delivery to the US owner;

(b) a German utility owns 100 tonnes of South African uranium as UF_6 which is located in the US awaiting enrichment;

(c) the two companies could arrange to sell and transfer the uranium to each other, i.e. the US company would end up with 100 tonnes of South African uranium and the German company would have 100 tonnes of AONM. There would be no Australian policy issue with such transfers;

64 The Hon Alexander Downer MP, *Submission no. 33.3*, p. 1.

65 *ibid.*, p. 2; The Hon Alexander Downer MP, *Submission no. 33*, p. 14.

66 Mr R W Fox, *op. cit.*, p. 179.

(d) however, the companies can save shipping costs by arranging a 'book transfer', by which the AONM would be re-labelled as South African and the South African uranium would be re-labelled as AONM. The outcome would be the same as if a physical transfer had taken place.[67]

8.70 ASNO argued that there is no detriment to Australian policy from a transfer of this kind. Such transfers are said to be infrequent, are handled carefully by ASNO, and must reflect what could otherwise be done physically.[68]

8.71 ASTEC stated that it was satisfied:

> … overall that [Australia's bilateral] agreements meet the policy requirements and that those requirements are sufficiently comprehensive to provide as much control as can be realistically expected. We consider that Australian uranium and nuclear material derived from it are adequately accounted for and that Australia has the best possible guarantees that such material is being used solely within the civil nuclear programs of Australian customer countries.[69]

8.72 ASTEC also found that 'additional safeguards requirements … would serve only to compound the commercial and administrative burden, without improving safeguards controls or assurances.'[70]

8.73 Moreover, and in contrast to view of submitters who claimed that further uranium mining will contribute to proliferation, ASTEC concluded that 'this is not the case and … the risks of proliferation will be reduced.'[71] It was concluded that imposition of stringent safeguards 'may encourage other suppliers, of nuclear equipment as well as of uranium, to insist on comparable conditions', and that exports of uranium should not be curtailed provided that these stringent conditions of supply are observed.[72]

8.74 The Committee now turns to discuss several other proliferation concerns raised by submitters, namely that:

- Australia's uranium exports could free up indigenous sources of uranium in customer countries for use in their military programs;

67 The Hon Alexander Downer MP, *Submission no. 33.1*, p. 10–11.
68 *ibid.*, p. 11.
69 ASTEC, *Australia's Role in the Nuclear Fuel Cycle*, AGPS, Canberra, 1984, p. 17.
70 *ibid.*
71 *ibid.*, p. 5.
72 *ibid.*

- reprocessing of spent fuel containing AONM and the storage of Australian-obligated plutonium;
- Australian SILEX enrichment technology; and
- issues associated with export of uranium to China and, potentially, to India.

8.75 The chapter concludes with a discussion of nuclear security, including the possible malicious use of radioactive sources in so-called 'dirty bombs' and efforts to prevent nuclear terrorism.

Australian uranium exports could free up indigenous sources of uranium for use in military programs in customer countries

8.76 It was argued by FOE, MAPW (Victorian Branch) and others that, even if Australian uranium is not diverted and used directly in military programs, Australia's uranium exports could potentially free up indigenous sources of uranium for use in military programs in customer countries.[73]

8.77 The Environment Centre of the Northern Territory (ECNT) argued that exports of uranium to China will:

> … simply displace their uranium from being used in nuclear power stations. They will put their uranium in the weapons and our uranium in the reactors. So, directly or indirectly, we are going to contribute—we are already contributing—to the proliferation of nuclear weapons around the world.[74]

8.78 ASNO responded that this argument has no basis and assumes that uranium is a scarce commodity. It was argued that in fact every country has uranium—if cost is no object it can even be recovered from seawater. It was therefore not a question of military and civil programs competing for uranium; historically, in the NWS, the military programs have always had priority and have been separately sourced.[75]

8.79 ASNO made the further point that all the NWS ceased production of fissile material for nuclear weapons purposes in the 1980s or 1990s. It is understood that, in China's case, the country has a sizeable stockpile of weapons-grade fissile material it is able to draw on if required.[76] The choice for a NWS is not, will it use uranium for weapons or for electricity,

73 See: FOE, *Submission no. 52*, p. 20 and *Submission no. 52.2*, p. 11; MAPW (Victorian Branch), *op. cit.*, p. 3; MAPW (WA Branch), *Submission no. 8*, p. 5.

74 Mr Peter Robertson (ECNT), *Transcript of Evidence*, 24 October 2005, p. 10.

75 The Hon Alexander Downer MP, *Submission no. 33.1*, p. 11.

76 The Hon Alexander Downer MP, *Submission no. 33.3*, p. 2

but rather, will it generate baseload electricity with nuclear, coal, gas or hydro:

> … it is useful to put into perspective the suggestion that supply of uranium to a nuclear weapon state frees up indigenous uranium for nuclear weapons programs. The quantities of uranium required for a nuclear weapons program are relatively small, as little as five tonnes of natural uranium to produce one nuclear weapon. Such quantities of uranium are readily available in the nuclear weapon states. By contrast, producing fuel for one 1,000 megawatt power reactor requires around 200 tonnes of natural uranium every year. China's currently announced nuclear power program - 40,000 megawatts by 2020 - will require around 8,000 tonnes of uranium each year.
>
> For a nuclear weapon state considering whether to proceed with nuclear power, therefore, the choice is not between using its uranium for nuclear weapons or for nuclear power – the quantities required for nuclear power are so much larger that the actual choice is whether to generate base load electricity with uranium, or coal, or gas, or hydropower.[77]

8.80 ASTEC also examined this issue and concluded that:

> … while supply of Australian uranium could in theory release other material for weapons use, in practice this does not occur. Indeed we conclude that denial of supply to nuclear weapon states would not affect in any way their weapons programs. There is, therefore, no practical purpose to be served by refusing supply to those states. To do so would be an empty gesture and would certainly not advance the cause of disarmament.[78]

Reprocessing and plutonium stockpiles

8.81 As described in the overview of the nuclear fuel cycle in chapter two, plutonium is formed during fission in the reactor uranium fuel. Used reactor fuel can undergo reprocessing whereby the plutonium is separated out from the unused uranium and waste products. Reprocessing enables the recycling of the plutonium and unused uranium-235 into fresh fuel. The plutonium can be used for the manufacture of mixed oxide (MOX)

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77 *ibid.*; and the Hon Alexander Downer MP, *Submission no. 33.1*, p. 11.

78 ASTEC, *op. cit.*, p. 95.

fuel, which is made from a mixture of plutonium and depleted uranium oxide.[79]

8.82 The FOE alleged that successive Australian Governments have contributed to global and regional proliferation risks and tensions by permitting reprocessing of used fuel containing AONM and the 'stockpiling' of Australian-obligated plutonium. It was also argued that, worldwide, reprocessing currently outstrips the use of plutonium in MOX:

> Reprocessing is difficult to justify even when the plutonium and/or recovered uranium are used as fuel. To be reprocessing well in excess of the demand for extracted plutonium or uranium is indefensible and poses a significant proliferation risk.[80]

8.83 FOE specifically argued that the separation and stockpiling of plutonium in Japan occurs in far greater quantities than can be justified by its limited use in MOX fuel. It was claimed that at the end of 2003, Japan's holdings of unirradiated plutonium amounted to 5.4 tonnes, in addition to 35.2 tonnes held overseas and 105 tonnes of plutonium in spent fuel at reactor sites and processing plants.[81]

8.84 Other evidence claimed that there is currently some 1 250 tonnes of civil plutonium world wide and another 250 tonnes of plutonium that has been produced specifically for use in weapons. The world's nuclear reactors were said to be producing an additional 70 tonnes of plutonium per year.[82]

8.85 FOE argued that it poses a proliferation risk for Japan to possess stockpiles of Australian-obligated plutonium which, given regional tensions, could be used by Japan should it decide to develop nuclear weapons.[83] It was also argued that, even in the absence of a nuclear weapons program, the very existence of plutonium in Japan exacerbates regional tensions in north-east Asia:

> Regardless of the intentions driving Japan's plutonium program, it certainly enhances Japan's capacity to produce nuclear weapons, and to do so in a short space of time. That latent potential is an ongoing source of tension in north-east Asia—it provides both an incentive and an excuse for countries such as North Korea, South Korea and Taiwan to pursue nuclear weapons programs or to steer ostensibly civil nuclear programs in such a way as to reduce the

79 UIC, *Plutonium*, Nuclear Issues Briefing Paper No. 18, viewed 20 July, <http://www.uic.com.au/nip18.htm>.

80 FOE, *Submission no. 52*, p. 17.

81 *ibid*., p. 24.

82 MAPW (Victorian Branch), *Exhibit no. 51, The Proliferation Consequences of Global Stocks of Separated Civil Plutonium*, p. 1.

83 FOE, *Submission no. 52*, p. 23.

> lead-time for weapons production (e.g. the development of reprocessing capabilities). It generates resentment when South Korea and Taiwan are prevented from pursuing similar policies to Japan.[84]

8.86 Professor Richard Broinowski also argued that exporting uranium to North and East Asian countries contributes to regional tensions:

> The Japanese nuclear industry is one of our largest customers. They have admitted that some of their plutonium has gone missing. Right now in north Asia we have a situation where if North Korea does not have nuclear weapons already they surely will. I can assure you that my professional judgment is that if they do, Japan is going to declare that it has them too, South Korea will as well, and Taiwan probably will too. This is not a joke. This is really serious; these are our most important customers for uranium.[85]

8.87 Similarly, AMP Capital Investors Sustainable Funds Team (AMP CISFT) expressed the concern that Japan is able to use Australian uranium in its fast breeder reactor, which produces plutonium, and People for Nuclear Disarmament also expressed opposition to use of fast breeder technology for this reason.[86]

8.88 FOE and the AMP CISFT called for permission for the reprocessing of spent fuel containing Australian-obligated plutonium to be withdrawn, or at least 'in circumstances of plutonium stockpiling' as is said to occur in Japan.[87] The existence of stockpiled Australian-obligated plutonium in Euratom countries was also opposed. MAPW (Victorian Branch) also argued that the non-proliferation regime would be significantly strengthened if reprocessing and the production and use of MOX were stopped.[88]

8.89 In contrast, the UIC pointed out that Japan's national policy is to use plutonium in MOX fuel and the country is currently constructing a MOX fuel fabrication plant (at Rokkasho) in which the plutonium will be used. It was also argued, as will be discussed further below, that the separated

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84 *ibid.*, p. 24.

85 Professor Richard Broinowski, *Transcript of Evidence*, *op. cit.*, p. 18; Professor Richard Broinowski, *Submission no. 72*, p. 3.

86 Dr Ian Woods (AMP CISFT), *Transcript of Evidence*, 16 September 2005, p. 29; People for Nuclear Disarmament (NSW) Inc, *op. cit.*, p. 5.

87 FOE, *Submission no. 52*, pp. 16, 21; AMP CISFT, *loc. cit.*

88 MAPW (Victorian Branch), *Exhibit no. 79, op. cit.*, p. 6.

reactor grade plutonium has an isotopic composition which renders it 'totally unusable for anybody's weapons.'[89]

8.90 Use of MOX fuel was also said to have a number of important benefits, including that it will enable Japan (and other countries that recycle plutonium) to extend by about one-third the amount of energy the country obtains from the uranium they buy. Plutonium recycling offers substantially greater efficiency because energy is produced from the most abundant uranium isotope, U-238, through conversion of U-238 to plutonium and not just from the fissile isotope U-235, which constitutes only 0.7 percent of natural uranium.[90] Use of MOX fuel therefore offers Japan additional energy security by further reducing dependence on imported fuels, it conserves uranium resources, and it also reduces the amount of highly radioactive waste that must be disposed of.[91]

8.91 The UIC also argued that if Australia were to withhold uranium supplies it is likely that some countries 'will seek supplies from places that cannot boast Australia's record of influence to ensure the safety of the nuclear fuel cycle and the control of weapons proliferation.'[92]

8.92 ACF were also critical of Australia's uranium sale conditions and argued that:

> Australia does not have a credible track record on uranium sales in the nuclear trade. There is a range of obvious conditions that … should be added to those conditions of export.[93]

8.93 These additional conditions include a prohibition on the reprocessing of used fuel made from Australian uranium. That is, ACF also oppose the separation and recycling of Australian obligated plutonium. ACF also urged that customer countries should be required to have ratified the Comprehensive Test Ban Treaty (CTBT) prior to receiving Australian uranium, and that the declared NWS further their obligations to disarm under the NPT. These countries should also be required to support a 'credible' fissile material cut-off treaty (FMCT).[94]

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89 Mr Ian Hore-Lacy (UIC), *Transcript of Evidence*, 19 August 2005, p. 95.

90 Theoretically, plutonium recycling offers some 150 times as much energy from a given quantity of uranium as using uranium without reprocessing, although practical factors this level of efficiency being attained. See: UIC, *Plutonium*, *loc. cit*.

91 *ibid*.

92 *ibid*., p. 89.

93 Mr David Noonan (ACF), *Transcript of Evidence*, 19 August 2005, p. 85.

94 *ibid*., p. 76.

Weapons useability of reactor grade plutonium

8.94 Opponents of nuclear power, reprocessing and the use of MOX argued that these represent a proliferation risk because the plutonium recovered from reprocessing is said to be useable for nuclear weapons. FOE and others asserted that:

> … the overwhelming weight of expert opinion holds that reactor-grade plutonium can be used in weapons, albeit … that the process may be more dangerous and difficult.[95]

8.95 In support of this argument, it was claimed that a weapons test conducted by the US Government in 1962 used reactor-grade plutonium. It was also argued that the quantity of plutonium produced in power reactors each year 'is sufficient to produce 7,000 weapons.'[96]

8.96 According to the UIC, the plutonium content of spent fuel from the normal operation of a light water reactor (LWR), which is the most common type of nuclear reactor, will be approximately one per cent when the fuel is unloaded. At this point, the isotopic composition of the plutonium will be approximately 55 per cent Pu-239, 23 per cent Pu-240, 12 per cent Pu-241 and lesser quantities of other isotopes.[97]

8.97 The isotopic composition of plutonium is significant because it affects the material's suitability for particular purposes, such as use in a reactor or use in weapons. The plutonium isotope most suitable for weapons use is Pu-239. Weapon-grade plutonium is comprised of at least 92 per cent Pu-239 and no more than seven per cent Pu-240, while reactor-grade plutonium, produced in the normal operation of LWRs and from which MOX is made, is typically comprised of less than 60 per cent Pu-239 and greater than 18 per cent Pu-240. Fuel-grade plutonium is an intermediate category comprised of between seven to 18 per cent Pu-240.[98]

8.98 The longer that reactor fuel is irradiated (the higher the 'burn-up'), a greater quantity of higher plutonium isotopes (Pu-240, Pu-241 and Pu-242) will be formed. In normal operations, uranium fuel remains in a reactor for three to four years, which produces plutonium with a substantial proportion of these higher isotopes, as noted above (approximately 25 per cent Pu-240). Pu-240 and Pu-242 are undesirable for weapons purposes because their rate of spontaneous fission causes premature chain reactions

95 FOE et. al., *Exhibit no. 71*, *op. cit.*, section 3.3; Mr Colin Mitchell, *Submission no. 67*, p. 1.

96 *ibid*.

97 UIC, *Plutonium*, *loc. cit.*

98 See: ASNO, 'Recycling: The Use of MOX Fuel', *Annual Report 1998-1999*, viewed 21 July 2006, <http://www.asno.dfat.gov.au/annual_report_9899/ct_plutonium.html>; GlobalSecurity.org, *Plutonium isotopes*, viewed 21 July 2006, <http://www.globalsecurity.org/wmd/intro/pu-isotope.htm>.

(pre-initiation). In addition, the radiation and heat levels would adversely effect weapon components. Consequently, ASNO observed that because of the need to minimise the Pu-240 content, weapon-grade plutonium has hitherto been produced in dedicated plutonium production reactors (usually natural uranium-fuelled and graphite moderated), specially designed and operated to produce plutonium of weapon quality by removal and reprocessing after short irradiation times.[99]

8.99 ASNO noted that while the isotopic composition of reactor-grade plutonium would create the serious technical difficulties for weapons use mentioned above, these could 'possibly be overcome, to some extent at least, by experienced weapons designers'.[100] Similarly, the UIC observed that:

> An explosive device could be made from plutonium extracted from low burn-up reactor fuel (i.e. if the fuel had only been used for a short time), but any significant proportions of Pu-240 in it would make it hazardous to the bomb makers, as well as unreliable and unpredictable.[101]

8.100 However, while it was noted that the various technical difficulties could be overcome, Mr Carlson stated that 'ASNO is not aware of any successful test explosion using reactor grade plutonium, typical of light water reactor fuel.'[102] This contradicted FOE's assertion that the 1962 weapons test was conducted using reactor grade plutonium and other evidence cited by MAPW (Victorian Branch) that claimed another such a device was exploded by the British Government in 1956.[103] As explained below, before the current plutonium grade definitions were introduced in the 1970s, there were only two terms in use to define plutonium grades: weapon-grade (no more than seven per cent Pu-240) and reactor-grade (greater than seven per cent Pu-240):

> The US conducted a test in 1962 using what they described as reactor grade plutonium. In those days, there were only two grades of plutonium, weapons grade and reactor grade. Also, plutonium did not exist in the very high burn up levels that we have today with normal power reactors. The US say they acquired this particular plutonium from the UK …
>
> At any rate, the US have refused to reveal what the isotopic composition was. There is some evidence that it contained around

99 ASNO, 'Recycling: The Use of MOX Fuel', *loc. cit*.

100 Cited in the Hon Alexander Downer MP, *Submission no. 33.1*, p. 4.

101 UIC, *Plutonium, loc. cit*.

102 Cited in the Hon Alexander Downer MP, *Submission no. 33.1*, p. 5.

103 MAPW (Victorian Branch), *Exhibit no. 51, op. cit*., p. 4.

> 10 per cent plutonium 240. Weapons grade would contain less than seven per cent plutonium 240. What is now known as reactor grade has something like 20 plus per cent plutonium 240. In the 1970s, the definitions of plutonium were changed and a new category of what was called fuel grade was introduced. Now the categories are weapons grade, which goes up to seven per cent plutonium 240, fuel grade, which goes from seven per cent to 19 per cent plutonium 240, and reactor grade, which is 19 per cent plus. What is today reactor grade did not exist in the early 1960s. There are a number of American specialists who have assured me that the 1962 test was not reactor grade as it is now defined.
>
> The antinuclear groups are trying to make too much of this issue. The reason I went into print on this in my annual report was because I was concerned at the assertions being made that Australian uranium is building up plutonium stockpiles around the world which equate to X-thousand weapons, the implication being that this is all weapons quality material which could be readily seized by the country concerned if it ever decided to pursue nuclear weapons. This is extremely misleading.
>
> … I do not believe that reactor grade plutonium has been tested as being capable of producing a nuclear explosion, but theoretically it could produce a nuclear explosion. It certainly could by a weapons state that has substantial experience—the United States, for instance, having conducted some 1,500 or 1,600 tests. If anyone could produce an explosion out of reactor grade plutonium, they could.[104]

8.101 From ASNO's explanation, it seems probable that the 1962 weapon test was conducted with what is currently defined as fuel-grade plutonium, not reactor-grade plutonium. Mr Carlson also speculated that if those countries with major nuclear power programs wanted to pursue nuclear weapons they would not do so using power reactor fuel:

> … it is pointless. They would have something of uncertain performance; they could not be sure whether it would function as intended. They would go for something that is much more certain. You can see that in the way the nuclear weapons states themselves have proceeded. If power reactor fuel is so attractive, why have those countries set up special reactors with very low burn-up fuel to produce high levels of plutonium 239? Why have they done that if they think that ordinary power reactor fuel is just as good?[105]

104 Mr John Carlson, *op. cit.*, pp. 25–26.

105 *ibid.*, p. 26.

8.102 The UIC also submitted that there are profound differences of opinion on whether reactor grade plutonium is useable for nuclear weapons:

> The facts are, first, that normal reactor-grade plutonium has about one-third non-fissile isotopes in it. The second fact is that nothing like that has ever been made to explode. The 1962 test that has been referred to was certainly of plutonium recovered from British spent fuel, from the Magnox reactors and the best intelligence I have is that that was about 15 per cent non-fissile. The third fact—and I think these facts are not disputed—is that for anybody trying to make a weapon using any plutonium, it is a very high-tech operation. It is not a terrorist backyard job. Finally, if that attempt to make a plutonium weapon were attempted with reactor-grade plutonium with a high amount of plutonium-240 in it, it would be a very hazardous and fraught undertaking. I do not think anyone disputes that. It would be almost suicidal, if not definitely suicidal, because plutonium has a high rate of spontaneous neutron emission.[106]

8.103 The UIC and ASNO emphasised that, in any case, plutonium obtained from reprocessing is treated for safeguards purposes as if it *is* weapons useable and the material is subject to strong security. Mr Carlson stated that:

> … all separated plutonium has to be subject to strong security … But that is quite a different proposition to saying that Australian uranium is generating massive quantities that are likely to be turned into nuclear weapons.[107]

8.104 In its *1998–1999 Annual Report*, ASNO insisted that while the IAEA has acted prudently in classifying all plutonium, including reactor-grade plutonium, as 'direct-use' material (that is, nuclear material that can be used for the manufacture of nuclear explosives components without further transmutation or enrichment), the IAEA is *not* thereby saying that all plutonium is suitable for weapons or that nuclear explosives can be made from spent fuel or from MOX.[108]

SILEX enrichment technology

8.105 The MAPW expressed concern about R&D activity into laser enrichment technology being developed in Australia by Silex Systems Ltd (Silex). It was argued that the features of the Separation of Isotopes by Laser

106 Mr Ian Hore-Lacy (UIC), *Transcript of Evidence*, 19 August 2005, p. 94.

107 Mr John Carlson, *op. cit.*, p. 26.

108 ASNO, 'Recycling: The Use of MOX Fuel', *loc. cit.*

Excitation (SILEX) technology that make it commercially attractive also add to its proliferation risk.[109] These commercial advantages were said to be its relatively simple and modular design, versatility in deployment and relatively low capital costs:

> Essentially what this technology would enable, if further developed, would be the enrichment of uranium on a smaller scale, much more cheaply, without the huge industrial infrastructure, high energy demand, large-scale plant facilities, high-level technical sophistication and manufacturing capacity that is required to produce traditional gas centrifugation or other enrichment plants.
>
> One could envisage that if this technology is further developed … it could make it possible for a terrorist group or government, in a space probably a quarter of the size of this room, without huge high-voltage power lines and large industrial scale, visible, detectable infrastructure, to enrich sufficient material for the production of a couple of nuclear weapons per year.
>
> For Australia to be allowing this highly proliferation sensitive research—which is the only privately held research, to public knowledge, that has the highest security classification from the US Department of Energy—to be conducted in a publicly funded facility at Lucas Heights, utilising the facility and presumably the safety waste management and other infrastructure at the plant, is entirely incompatible with Australia's non-proliferation objectives and should be closed forthwith.[110]

8.106 MAPW (Victorian Branch) also argued that:

> If the Silex process is fully developed, its eventual use for the production of fissile materials for use in nuclear weapons is probably inevitable. Thus in addition to Australian uranium exports fuelling weapons proliferation risks by contributing to the global pool of enriched uranium, successive Australian governments have allowed and supported highly proliferation sensitive enrichment R&D to be conducted in a public Australian facility, while publicly supporting non-proliferation. This is an inconsistent, immoral and indefensible position.[111]

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109 MAPW (Victorian Branch), *op. cit.*, pp. 6–9. As discussed in chapter ten, in May 2006 Silex announced that it had entered into a commercialisation and license agreement for SILEX technology with General Electric. A test loop, pilot plant and a full-scale commercial enrichment facility will be constructed in the US.

110 Associate Professor Tilman Ruff, *op. cit.*, pp. 27–28.

111 MAPW (Victorian Branch), *op. cit.*, p. 9.

8.107 The MAPW also cited a report by the Carnegie Endowment for International Peace which alleges that previous attempts at laser enrichment have been part of nuclear weapons development programs in Iran, South Korea, Brazil, Iraq and South Africa.[112]

8.108 Silex responded to these claims, arguing that laser enrichment technology is far more complex and sophisticated than gas centrifuge enrichment and that proliferators will always opt for gas centrifuge enrichment or extract plutonium from used nuclear fuel to obtain fissile material. While it was conceded that the SILEX technology is economically superior to the alternatives, it was argued that:

> … proliferators are not interested in economics; they are interested in getting the weapons material. This has been proven in the past—proliferators have not bothered with lasers; they have always gone for centrifuges.[113]

8.109 In addition, Silex argued that it is the most heavily regulated company in Australia and cited Australia's non-proliferation track record and safeguards. It was noted that a US-Australia treaty was adopted in 2000 which specifically relates to cooperation on developing SILEX technology, regulation and safeguards procedures that both Silex and any US companies interested in partnering with Silex must be subject to:

> So this is a very comprehensive process to safeguard our technology. I believe that we are the most heavily regulated company in Australia, and so we should be because we have this significant technology. We have been housed inside the secure area of Lucas Heights ever since this project started in 1990 and we have been very effectively safeguarded for 15 years … There has been a very effective process of safeguards. I can assure you that the SILEX technology is not adding to the threat or the risk of nuclear proliferation in the world today or in the future.[114]

8.110 In response to allegations that SILEX technology could conceivably be deployed in small spaces, such as a garage, and therefore be easier to conceal than existing enrichment technologies, Silex displayed confidential schematics for the Committee of a conceptual enrichment plant using the SILEX technology. It was explained that:

> It will not fit in anyone's garage … You can see the scale. This is a smallish commercial plant … and you cannot have equipment of a lesser size than this. You cannot pick up this stuff and carry it

112 MAPW (Victorian Branch), *Submission no. 30.1*, pp. 18–20.

113 Dr Michael Goldsworthy (Silex Systems Ltd), *Transcript of Evidence*, 9 February 2006, pp. 5, 13.

114 *ibid.*, p. 5.

> away. It is still very big machinery. The difference between this and centrifuge and diffusion is that diffusion and centrifuge would have 100 of these, not just one. So it is still a very big plant but it is not, as the critics make out, portable.[115]

8.111 ASNO agreed that enrichment technology and facilities must be very carefully regulated because, as noted above, it is one of the routes to producing fissile material. However, ASNO also argued that Silex's technology does not represent a substantial proliferation danger.[116]

8.112 Mr John Carlson stated that ASNO is actually pleased that Silex is renting premises at Lucas Heights because of the strong security at the site. The SILEX technology has also been designated under the Safeguards Act so that access to the technology is limited to named individuals who have been personally authorised after undergoing security vetting. In relation to its dealings with American companies, as noted above, the Australian and US Governments established a so-called Silex agreement which came into effect in 2000 which allows for technology transfer between the two countries. The US Government have likewise classified the technology as 'restricted data'.

8.113 As to the proliferation sensitivity of the SILEX technology, ASNO disputed claims that the technology could produce very high enrichment levels: 'The company has not sought to find out. We would not authorise it.'[117]

8.114 ASNO also disputed arguments that the technology could be hidden in a 'garage' and produce quantities of fissile material for a weapon. It was also argued that the components required for the SILEX process are extremely complex and therefore not a technology that proliferators would choose:

> The Silex equipment is in fact quite bulky. You can build a small laser application—as you know, lasers are used in all sorts of things. Even for demonstrating isotopic separation it would be possible to build something on a relatively small scale that could separate nanograms. But if you want something that can produce kilogram quantities, for a nuclear weapon you would need a minimum of 15 kilograms of uranium-235. If you want something that can have a throughput and that will give you that level of production, you would need to go into equipment which is much larger and have a plant which is a lot larger. Our assessment is

115 *ibid*., p. 14.

116 Mr John Carlson, *op. cit*., p. 25.

117 Mr John Carlson, *op. cit*., p. 24.

> that if you are looking at a plant—if we look at the Iraqi and Libyan experience we could say that the minimum plant size to produce enough high-enriched uranium for one nuclear weapon in a year would need a plant which has an output of around 10,000 SWU [separative work units] a year, around 2,000 centrifuges.
>
> If we assume that someone is attempting to build a Silex project that would give that kind of throughput, our assessment is that the plant would be larger than a centrifuge plant in fact and would need a small industrial building. It is not something that could be readily hidden. On top of that, the Silex process requires extremely complicated components which are very difficult to manufacture. There are only a handful of countries that are even capable of producing the various components that would be required. It is not really something that a proliferator would pursue. We would regard it as being an extremely difficult route to go down. Our concern is with centrifuge enrichment because the technology is easier, and unfortunately it is now out and about in the marketplace. We do not believe that the Silex process represents a substantial danger.[118]

8.115 ASNO informed the Committee that the main proliferation risk is with centrifuge enrichment technology, which is relatively compact and requires less electricity that older enrichment technology. While centrifuge enrichment is technically complex, the:

> … know-how for designing and operating centrifuges has gradually spread, particularly through the efforts of Pakistani nuclear expert Abdul Qadeer (A Q) Khan, who stole Dutch technology.[119]

8.116 ASNO noted that A Q Khan was responsible for selling stolen centrifuge technology to Iran, Libya and North Korea. There have also been individuals of German, Swiss and British backgrounds, who were involved in the Urenco centrifuge program, who sold technology to aid the Iraqi program.

Uranium exports to China

8.117 As noted above, in April 2006 Australia and China entered into a bilateral safeguards agreement on the transfer of nuclear material, whereby sales of uranium to China will now be permitted.[120] Australian uranium cannot be

118 *ibid.*, pp. 24–25.

119 Mr John Carlson, *op. cit.*, p. 21.

120 ASNO, *Agreement Between the Government of Australia and The Government of the People's Republic of China on the Transfer of Nuclear Material, loc. cit.*

transferred to China until the agreement is in force and administrative arrangements have been concluded between ASNO and the China Atomic Energy Authority.[121]

8.118 The Committee received evidence from FOE and others opposing the sale of uranium to China on the basis of the following claims:

- the IAEA inspections program is 'under resourced' and thus it is 'highly unlikely' that inspections would be sufficiently numerous or rigorous to detect any diversions of AONM;
- Australia's bilateral safeguards agreements are 'meaningless' and have been 'repeatedly weakened' since the framework was established in 1977;
- China maintains an active weapons program and refuses to ratify the CTBT;
- the Chinese regime has a record of military exports;
- Australian uranium could be used in weapons if regional tensions over Taiwan escalate into war;
- Australia's uranium exports will allow China to use more of its indigenous supplies for its weapons programs;
- China does not have civil society safeguards such as whistleblower protection and there are 'examples of persecution of nuclear whistleblowers';
- the Chinese regime tightly controls the media and if diversions were to occur it is 'highly unlikely that the media would be unable to uncover and report on the diversion';
- uranium sales to China would allegedly set a 'poor precedent' for sales to 'repressive, secretive, military states'; and
- China lacks plans for public safety in case of an emergency or for managing spent fuel.[122]

8.119 ACF also opposed sales of uranium to China on the basis that it is not an 'open society' and therefore allegedly cannot be trusted:

> That China is not an open society predicates against reliance on state assurances over proliferation and management of AONM. Apparently the China export arrangements are proposed to allow enrichment of Australian uranium in China. This would further compromise any claimed control over AONM within China.[123]

121 ASNO, Australia-China Nuclear Material Transfer Agreement and Nuclear Cooperation Agreement, *Frequently Asked Questions*, *loc. cit*.

122 FOE, *Submission no.52.4*, pp. 4–6. See also: Mr Colin Mitchell, *Submission no. 67*, p. 1.

123 ACF, *Submission no.* 48, p. 12.

8.120 Exports were also opposed because China was said to be a nuclear weapon state still developing weapons programs, and that supplying uranium to China would in effect be:

> … freeing them up to use their own limited uranium supplies in their nuclear weapons programs. An indirect Australian facilitation of these programs.[124]

8.121 Responses to several of these allegations were presented in the evidence cited in preceding sections and in the previous chapter, notably the claims that: Australia's uranium will simply displace Chinese uranium for use in its weapons programs; resource constraints limit IAEA's inspections; alleged weakening of Australia's bilateral safeguards; and the production of fissile material for weapons programs.[125]

8.122 In its *2004–2005 Annual Report*, ASNO reiterated that the assurance that AONM will not be used in nuclear weapons in China comes from a combination of factors: China's willingness to undertake a legally-binding treaty-level commitment to this effect; the safeguards arrangements that will apply; and the factual circumstances as outlined below.

8.123 These circumstances include that Australia's uranium will be bought by Chinese power utilities for electricity generation. The Nuclear Material Transfer Agreement ensures that AONM will be used or processed only within a jointly agreed list of facilities, which will be subject to China's safeguards agreement with the IAEA. While China has the right to choose which facilities are eligible for IAEA inspections, Australia and China must jointly agree on which facilities will be eligible to use AONM under the Agreement. AONM is not eligible for use in military facilities. Monitoring of AONM in China will be based on safeguards procedures applied at facilities where AONM is handled in accordance with China's safeguards agreement with the IAEA and the Administrative Arrangements concluded with Australia. ASNO explained that it will cross check reports on AONM provided by China for consistency with information from the IAEA and other sources.[126]

8.124 ASNO repeated its belief that China has no reason to divert civil material for its military program. In the first place, the quantities of uranium required for nuclear power are so much larger than that required for weapons and, second, while China has not stated officially that it has

124 *ibid*. See also: Mr David Noonan (ACF), *Transcript of Evidence*, 19 August 2005, p. 76.

125 See also: The Hon Alexander Downer MP, *Submission no. 33.3*, pp. 1–2.

126 ASNO, *Annual Report 2004–2005, op. cit.*, p. 18. See also: ASNO, Australia-China Nuclear Material Transfer Agreement and Nuclear Cooperation Agreement, *Frequently Asked Questions, loc. cit.*

ceased production of fissile material for weapons, unofficial statements indicate such production ended in 1991.[127]

The US-India Nuclear Agreement and possible exports of Australian uranium

8.125 As a non-NPT Party, India has hitherto not been eligible for nuclear cooperation under current internationally established export control arrangements, particularly those guidelines established by the Nuclear Suppliers Group (NSG). However, on 18 July 2005 the US President and the Indian Prime Minister issued a joint statement announcing a civil nuclear energy cooperation agreement.[128] Under the agreement, the US undertook to:

- seek agreement from Congress to adjust US laws and policies to achieve full civil nuclear energy cooperation;
- work with allies to adjust international regimes to enable full civil nuclear energy cooperation and trade with India, including early consideration of fuel supplies for safeguarded nuclear reactors (at Tarapur);
- in the meantime, encourage its partners to consider fuel supply (to Tarapur) expeditiously;
- consult with its partners to consider India's participation in the International Thermonuclear Experimental Reactor (ITER) project; and
- consult with other participants in the Generation-IV International Forum with a view towards India's inclusion.[129]

8.126 For its part, India undertook to:

- identify and separate civil and military nuclear facilities and programs in a phased manner;
- file a declaration regarding its civil nuclear facilities with the IAEA;
- voluntarily place its civil nuclear facilities under IAEA safeguards 'in perpetuity';
- sign and adhere to an Additional Protocol with the IAEA with respect to civil facilities;

127 *ibid.*, pp. 18–19.

128 Joint Statement Between President George W. Bush and Prime Minister Manmohan Singh, 18 July 2005, , viewed 28 July 2006, <http://www.whitehouse.gov/news/releases/2005/07/20050718-6.html>.

129 *ibid.*

- harmonise its export controls with the NSG and Missile Technology Control Regime (MTCR) Guidelines, although India is not a member of either group;
- upgrade its non-proliferation regulations and export controls (which has taken place in part as a result of a *Weapons of Mass Destruction Act* of May 2005);
- refrain from transfer of enrichment and reprocessing technologies to states that do not have them, and to support international efforts to limit the spread of these technologies;
- continue a unilateral moratorium on nuclear testing; and
- work with the US for the conclusion of a multilateral FMCT.[130]

8.127 ASNO explained that under the agreement, the US has committed to broaden the level of co-operation that is possible, including for the supply of nuclear fuel to safeguarded reactors, and will seek to persuade other members of the international community to adopt that policy.[131] In particular, the US will seek to have the NSG adjust its practices so that India can obtain full access to the international nuclear fuel market, including 'reliable, uninterrupted and continual access to fuel supplies from firms in several nations.'[132]

8.128 India currently has 22 thermal reactors in operation or currently under construction. Under its nuclear separation plan, which was announced in March 2006, India has committed to place 14 of its thermal reactors under IAEA safeguards between 2006 and 2014 (including four reactors that are already under safeguards). India will also place under safeguards all future civil reactors, both thermal and breeder reactors.[133]

8.129 Steps necessary for the implementation of the agreement include: amendment of US legislation to allow the nuclear supply to India; conclusion of a nuclear cooperation agreement between the US and India; conclusion of a safeguards agreement and Additional Protocol between India and the IAEA; and agreement within the NSG, either to make an exception to its conditions to allow nuclear supply to India, or to change its conditions (which ASNO believes is unlikely). ASNO noted that as of 1 June 2006, negotiations and consultations had commenced on each of these steps. On 26 July 2006, the US House of Representatives voted, by a

130 *ibid*. ASNO, *Exhibit no. 92, Informal brief on US-India Nuclear Agreement*, pp. 1–2.
131 Mr John Carlson, *op. cit.*, p. 18.
132 ASNO, *Exhibit no. 92, op. cit.*, p. 2.
133 *ibid.*, pp. 5–6.

large majority, to approve amendments to relevant US laws to give effect to the agreement.[134]

8.130 The US Government has argued that the agreement will have important non-proliferation benefits:

> … this initiative brings India into the global nuclear non-proliferation mainstream. For the first time, India has committed to take the significant steps described above that will end its 30 year isolation from the global regime and will increase the transparency of its civilian nuclear program, improve the safety and the effectiveness of that program, and provide oversight—again for the first time—over a large majority of Indian civilian nuclear reactors and the associated upstream and downstream facilities that support those reactors.[135]

8.131 Several countries have expressed support for the agreement, including Russia, France, Japan and the UK. The Director General of the IAEA also welcomed the agreement, noting India's intention to identify and place all its civilian nuclear facilities under IAEA safeguards and sign and adhere to an Additional Protocol with respect to its civilian nuclear facilities:

> This agreement is an important step towards satisfying India's growing need for energy, including nuclear technology and fuel, as an engine for development. It would also bring India closer as an important partner in the non-proliferation regime … It would be a milestone, timely for ongoing efforts to consolidate the non-proliferation regime, combat nuclear terrorism and strengthen nuclear safety.
>
> The agreement would assure India of reliable access to nuclear technology and nuclear fuel. It would also be a step forward towards universalisation of the international safeguards regime … This agreement would serve the interests of both India and the international community.[136]

8.132 The Australian Government has also welcomed the agreement as a very positive development, noting that it has paved the way for the expanded application of IAEA safeguards which will allow the IAEA enhanced access rights in India. The Government also noted that the agreement

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134 *ibid.*, p. 4.

135 US Department of State, Bureau of Public Affairs, *U.S.- India Civil Nuclear Cooperation Initiative*, Fact Sheet, issued 9 March 2006, viewed 28 July 2006, <http://www.state.gov/documents/organization/63007.pdf>.

136 Dr Mohamed ElBaradei, *IAEA Director General Welcomes U.S. and India Nuclear Deal*, Press Releases, 2 March 2006, viewed 28 July 2006, <http://www.iaea.org/NewsCenter/PressReleases/2006/prn200605.html>.

would help meet India's economic development and energy needs in an environmentally clean manner. However, ASNO indicated that the Australian Government would like to see India ratify the CTBT and to cease production of fissile material for nuclear weapons immediately.[137]

8.133 It was noted in chapter two that India is currently constructing eight reactors and intends to triple nuclear generating capacity to 20 gigawatts electrical by 2020. India also plans that by 2050 nuclear power will contribute 25 per cent of the country's electricity generation—a hundredfold increase on 2002 nuclear generating capacity.[138] ASNO observed that 'it is essential that this program is based on high safety standards—but this would not be helped by continued denial of modern technology and cooperation.'[139] It was also observed that if India's electricity demand, which is predicted to increase by as much as ten-fold by 2050, is met instead by fossil fuels then 'there would be significant environmental and greenhouse emission consequences.'[140]

8.134 In October 2005 ASNO informed the Committee that the Australian Government's policy, which excludes the possibility of uranium supply to India because it is not an NPT party, was not under review and that the Indian Government had not asked Australia to supply uranium.[141] However, such a request was made to the Prime Minister during his visit to India in March 2006. It was subsequently announced that the Australian Government would send a delegation to India and the US to study the civil nuclear energy cooperation agreement.

8.135 ASNO observed that while the Indian Government has consistently supported the objective of non-proliferation and nuclear disarmament, it regards the NPT as discriminatory:

> … because the non-proliferation treaty recognises the five nuclear weapons states that existed at the time the treaty was concluded and makes no provision for any further nuclear weapons states. India felt that this was discriminatory—that the treaty should apply equally to every state—and has refused to join …[142]

8.136 An important issue is that, currently, the NSG—countries that export nuclear material and technology, which includes Australia—have adopted the full scope safeguard standard; that is, suppliers will not supply to

137 ASNO, *Annual Report 2004–2005, op. cit.*, p. 17; Mr John Carlson, *loc. cit.*

138 UIC, *Nuclear Power in India and Pakistan*, Nuclear Issues Briefing Paper No. 45, viewed 1 June 2006, <http://www.uic.com.au/nip45.htm>.

139 ASNO, *Annual Report 2004–2005, loc. cit.*

140 *ibid.*

141 Mr John Carlson, *loc. cit.*

142 *ibid.*, p. 17.

NNWS that do not accept full scope safeguards, which are IAEA safeguards on *all* existing and future nuclear activities. The majority of the Indian nuclear program is currently outside of safeguards and the nuclear suppliers' guidelines do not currently permit nuclear cooperation with India, except in the area of nuclear safety. This has effectively meant that India is isolated from world nuclear trade. The NSG is unlikely to decide whether it will grant an exception to its guidelines until the relevant legislation has passed through the US Congress, although the US Administration anticipates a favourable decision from the NSG.[143]

8.137 During the Committee's public hearings the uranium industry in Australia had not formed a position in relation to the question of uranium supply to India, but reiterated its support for the Government's current exports policy. When specifically asked by the Committee, the UIC doubted whether the industry would want to see a change in policy:

> … all of our main members would want to go along with Australian government policy in this regard and would see that as rather important, with the two requirements [NPT membership and a bilateral agreement] … and also the third about the additional safeguard; the additional protocol.[144]

8.138 The MCA supported current policy that customer countries must be parties to the NPT, as did the Australian Nuclear Association (ANA).[145]

8.139 The World Nuclear Association's position is that there is some injustice in the current restriction on exports to India, because 'India has been very scrupulous in its non-proliferation intentions and practices.'[146] In addition, and similar to China, India's weapons program preceded its civil program, although the two are now mixed together to a greater extent than in China. China is a recognised weapons state because it conducted its first nuclear explosion in 1967, prior to the NPT coming into force in 1970, while India's first explosion was conducted in 1974 'so it was left out in the cold.'[147]

8.140 In contrast, the ACF argued that India is a 'rogue nuclear weapon state outside of international conventions' and is still developing nuclear weapons.[148] FOE argued that:

143 ASNO, *Exhibit no. 92, op. cit.*, p. 4.

144 Mr Ian Hore-Lacy, *op. cit.*, p. 90.

145 Mr Mitch Hooke (MCA), *Transcript of Evidence*, 5 September 2005, p. 31; Dr Clarence Hardy (ANA), *op. cit.*, p. 55.

146 Mr Ian Hore-Lacy, *op. cit.*, p. 90.

147 *ibid.*, p. 91.

148 ACF, *op. cit.*, p. 11.

> Allowing nuclear co-operation and uranium sales to India would clearly weaken the NPT. Potential nuclear weapons states - in northeast Asia or the Middle East, for example - would be all the more likely to 'go nuclear' if civil nuclear co-operation and trade with non-NPT states were to become the norm.[149]

8.141 On this issue, ASNO has questioned whether adherence to the full scope safeguard can be effective in drawing those states outside the NPT into the Treaty, but emphasised that the agreement with India should not encourage states within the NPT to withdraw in the mistaken belief that they would receive similar treatment:

> Now that only three states—India, Israel and Pakistan—remain outside the NPT, and given that none of these appears likely to change its position on joining the NPT in the foreseeable future, it might be asked whether the full scope safeguards requirement can be effective in drawing these three into the Treaty. In treating India as a special case, however, it is essential that states within the NPT should not be encouraged to withdraw in the belief that a relaxation of the full scope safeguards standard for India would also be available to them. It has to be clearly established that the case of a state that has remained outside the NPT from the beginning, but otherwise supports non-proliferation principles, would be treated very differently from that of a state that has accepted the NPT's commitments and subsequently seeks to renounce them.[150]

Nuclear terrorism — nuclear weapons, 'dirty bombs' and security measures

8.142 The IAEA has identified four potential nuclear security risks: the theft of a nuclear weapon; the acquisition of nuclear materials for the construction of nuclear explosive devices; the malicious use of radioactive sources including in so-called 'dirty bombs'; and the radiological hazards caused by an attack on, or sabotage of, a facility or a transport vehicle.[151]

8.143 The fourth of these risks was addressed in chapter six. The Committee received some evidence in relation to the risk of terrorist groups acquiring nuclear materials for the construction of nuclear weapons and the potential for AONM and other radioactive material to be diverted for use

149 FOE, *Submission no. 52.1*, p. 5.

150 ASNO, *Annual Report 2004–2005, loc. cit.*

151 Dr Mohamed ElBaradei, *Nuclear Terrorism: Identifying and Combating the Risks*, Statement of the Director General, IAEA, Vienna, 16 March 2005, viewed 14 July 2006, <http://www.iaea.org/NewsCenter/Statements/2005/ebsp2005n003.html>.

in 'dirty bombs'. Information on Australian and international activities to prevent terrorist attacks was also provided.

8.144 The MAPW (Victorian Branch) argued that if nuclear power were expanded on a significant scale, for example to displace carbon based energy sources, this would inevitably increase:

> … the volume of material, the number of facilities and the amount of material that is in transit, where it is much more susceptible to being hijacked, sabotaged or stolen than a much smaller program.[152]

8.145 The MAPW were convinced of the inevitability of a terrorist attack on a nuclear facility and argued that an expansion in exports of uranium would increase the risk:

> The risk of nuclear terrorism via a dirty bomb, a primitive nuclear explosion—one or more—or attacks on nuclear facilities is inevitable. There is really no question, to us, about that. They are an extremely attractive terrorist target. Again, increasing the range of possibilities, the number of facilities, the volume of materials, the number of places in which it is dispersed, increases the potential for that risk. Any such risk clearly can be catastrophic in a major urban area—particularly if a multiplicity of events simultaneously timed were planned—but also it could be very difficult to interpret, particularly for nuclear weapon states that have a high proportion of their weapons on hair-trigger alert … For us, these two risks alone really make this technology far more trouble and risk than it is worth.[153]

8.146 It was submitted that some terrorist groups have been trying to obtain nuclear materials, primarily from the stockpiles of the former Soviet Union, and that the international community urgently needs to expand its efforts to secure existing stockpiles of nuclear weapons and materials.[154] MAPW cited evidence which claims that plutonium from civil nuclear programs is becoming more available worldwide and that it is becoming 'increasingly possible for a terrorist group to steal, or otherwise illegally acquire, civil plutonium that could be used to fabricate a nuclear explosive device.'[155] Moreover, this evidence claimed that terrorists would be able to design and fabricate a 'relatively unsophisticated device' with some ease:

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152 Associate Professor Tilman Ruff (MAPW–Victorian Branch), *Transcript of Evidence*, 19 August 2005, p. 32.

153 *ibid.*, p. 25.

154 MAPW (Victorian Branch), *Exhibit no. 53, Nuclear terrorism*, p. 1.

155 MAPW (Victorian Branch), *Exhibit no. 55, Dirty Bombs and Primitive Nuclear Weapons*, pp. 2, 7.

> … if it acquired enough MOX fuel by diversion or theft, a sophisticated terrorist group would have little difficulty in making a crude nuclear explosive. The necessary steps of separating the plutonium from the uranium in MOX, converting it into plutonium dioxide, converting the dioxide into plutonium metal, and assembling the metal or plutonium dioxide … to fabricate a primitive nuclear weapon are not technically demanding and do not require materials form specialist suppliers.[156]

8.147 FOE argued that smuggling of nuclear materials presents a significant challenge and that the IAEA's Illicit Trafficking Database records over 650 confirmed incidents of trafficking in nuclear or other radioactive materials since 1993, at least 17 of which involved small quantities of fissile material. It was argued that: 'Smuggling can potentially provide fissile material for nuclear weapons or a wider range of radioactive materials for potential use in "dirty bombs".'[157]

8.148 In outlining the IAEA's nuclear security plan of activities to combat the four security risks listed above, the Director General of the IAEA, Dr Mohamed ElBaradei, has commented that:

> While the majority of trafficking incidents do not involve nuclear material, and while most of the radioactive materials involved are of limited radiological concern, the number of incidents shows that the measures to control and secure nuclear and other radioactive materials need to be improved.[158]

8.149 ASNO explained that the requirements to construct a nuclear weapon are a sufficient quantity of fissile material of suitable quality and very substantial technical capability. As mentioned in the previous chapter, the fissile material required to construct a nuclear weapon would need to be either very highly enriched uranium (HEU) or plutonium—HEU would need to be enriched to 70 per cent or more U-235, with weapons grade uranium normally enriched to more than 90 per cent U-235, and separated plutonium, with weapons grade plutonium being at least 93 per cent of the isotope Pu-239.[159]

8.150 While constructing a uranium-based weapon could, in principle, be relatively simple, ASNO argued that constructing a plutonium weapon is difficult. However, a uranium-based weapon would also be very bulky, therefore not deliverable by missile, and require a large amount of uranium which would also impede illicit development of such a weapon.

156 *ibid.*, pp. 8, 12.

157 FOE, *Submission no. 52*, p. 16.

158 Dr Mohamed ElBaradei, *Nuclear Terrorism: Identifying and Combating the Risks*, *loc. cit.*

159 ASNO, *Annual Report 2003–2004*, *op. cit.*, p. 107.

On the other hand, a plutonium-based weapon involves complex technology:

> … a country or a group that want to pursue nuclear weapons not only have to do a substantial amount of research in weapon design because it is not simple but also have to have a way of acquiring fissile material of the right quality. Essentially that means, if they are not able to steal it, that they would need to have enrichment or suitable reactors. The conventional light-water reactor is not a good plutonium producer for weapons and they would need to have a reprocessing plant. If they are parties to the non-proliferation treaty, they would need to be able to run these activities while evading detection by IAEA safeguards, which is a challenge. It is a challenge for IAEA safeguards to find undeclared activities, but it is also a substantial challenge for countries to hide activities.[160]

8.151 Mr Keith Alder, a former Commissioner and General Manager of the Australian Atomic Energy Commission who worked on the British nuclear weapons program, concurred with ASNO and disputed MAPW's assertion that fabricating a plutonium weapon would be straightforward. Mr Alder argued emphatically that it would be virtually impossible for a terrorist group to manufacture a nuclear weapon from the plutonium produced in civil reactors:

> The Americans, very unwisely at one stage of the game … did actually make an explosion with civil plutonium. It is very difficult, but they did it, and I think it was a stupid thing to do because it made people feel that if a terrorist got hold of that stuff he could do that. Don't you believe it. The enormous sophistication that goes into a bomb is far beyond the capability of a terrorist organisation … the sophistication of that device is not just the nuclear side but how to implode it, to make it hold together to burn for long enough to make a significant bang. To try and do that with commercial plutonium, without all the resources, all the instrumentation and so on of a major national laboratory—the mind boggles. How could that happen? The idea of a terrorist snooping in with a suitcase with a bomb he has made in his cellar is crazy.[161]

8.152 ASNO explained that terrorist groups have indeed shown interest in obtaining fissile material for nuclear weapons, but the biggest barrier for such groups is obtaining a sufficient quantity of material:

160 Mr John Carlson, *op. cit.*, p. 20.

161 Mr Keith Alder, *Transcript of Evidence*, 16 September 2005, p. 86.

> Our assessment is that it would be beyond the resources of a subnational group to set up an enrichment plant or reactors and a reprocessing plant, or they could be detected. The fairly persistent worry has always been whether it would be possible for them to get hold of existing fissile material. The example that is usually brought out is from the former Soviet Union where, at the time when the Soviet Union collapsed, the controls over fissile material were fairly rudimentary. Basically, the Russian system relied on security over nuclear material—having nuclear material in remote areas with guards—without the development of an effective accounting system.[162]

8.153 ASNO stated that there has now been a substantial program to upgrade Russian capacities in relation to control of fissile material but, in any case:

> … the known cases of trafficking in nuclear materials have never shown that substantial amounts of material are leaving Russia, and certainly nothing remotely like the quantities required for a weapon.[163]

8.154 Furthermore, evidence cited by MAPW itself, which was published in 2002, stated that the US Government was then spending approximately US$900 million annually to secure weapons grade nuclear materials in Russia.[164]

8.155 ASNO explained that dirty bombs are distinguished from nuclear weapons in that the latter derive their explosive force from a nuclear chain reaction, while dirty bombs use conventional explosives to disperse radioactive material (not necessarily nuclear material—uranium, thorium or plutonium). These bombs are also known as radiological dispersal devices (RDD). The objective of a dirty bomb is contamination rather than destruction by explosive force.[165]

8.156 MAPW submitted that:

> There are literally millions of radioactive sources used worldwide in medicine, industry and agriculture; many of them could be used to fabricate a dirty bomb. They are often not kept securely. Terrorists should be able to acquire radioactive material.
>
> Deaths and injuries caused by the blast effects of the conventional explosives and long-term cancers from radiation exposure would

162 *ibid*., p. 20

163 *ibid*.

164 MAPW (Victorian Branch), *Exhibit no. 53, op. cit*., p. 2.

165 Mr John Carlson, *op. cit*., p. 18. Further information on RDDs available from the US Nuclear Regulatory Commission, *Backgrounder on Dirty Bombs*, viewed 26 July 2006, <http://www.nrc.gov/reading-rm/doc-collections/fact-sheets/dirty-bombs-bg.html>.

> likely be minimal. The true impact of a dirty bomb would be the enormous social, psychological and economic disruption caused by radioactive contamination.[166]

8.157 ASNO and the UIC argued that in light of the IAEA and bilateral safeguards discussed above, 'the probability of AONM being used in a dirty bomb is miniscule.'[167] In particular, ASNO stressed that Australia's conditions for supply of AONM include an assurance that internationally agreed standards of physical security will be applied to nuclear material in the country concerned.

8.158 Under the *Convention on the Physical Protection of Nuclear Materials (1979)* (CPPNM), the IAEA has issued detailed guidance on the physical protection of nuclear materials and nuclear facilities. This guidance aims 'To establish conditions which would minimize the possibilities for unauthorised removal of nuclear material and/or for sabotage.'[168] ASNO explained that Australia applies these requirements domestically and, through its bilateral safeguards agreements, requires customer countries to do the same. It was argued that the requirements adequately address the possible diversion of AONM to dirty bombs.

8.159 ASNO noted in a supplementary submission that in July 2005 major amendments to the CPPNM were agreed that will strengthen the Convention and these amendments are now with governments for ratification. Whereas the original CPPNM applied only to nuclear material in international transport:

> The amended CPPNM makes it legally binding for States Parties to protect nuclear facilities and material in peaceful domestic use, storage as well as transport. It will also provide for expanded cooperation between and among States regarding rapid measures to locate and recover stolen or smuggled nuclear material, mitigate any radiological consequences of sabotage, and prevent and combat related offences.[169]

8.160 In 2003 the IAEA General Conference also endorsed a revised Code of Conduct on the Safety and Security of Radioactive Sources, which is now

166 MAPW (Victorian Branch), *Exhibit no. 55, op. cit.*, p. 1. MAPW cited several radioisotopes that would be suitable for the purpose of fabricating a dirty bomb.

167 UIC, *op. cit.*, p. 35.

168 Cited in the Hon Alexander Downer MP, *Submission no. 33*, p. 9. In addition, with IAEA support, Russia, the US and other countries and now taking steps to convert their research reactors from HEU to LEU fuel and to return the HEU to the country of origin. The IAEA comments that these and other projects are helping to reduce the risks posed by existing nuclear material.

169 IAEA, *States Agree on Stronger Physical Protection Regime*, Press Release, 8 July 2005, viewed 26 July 2006, <http://www.iaea.org/NewsCenter/PressReleases/2005/prn200503.html>.

with governments for implementation.[170] ASNO noted that Australia has been at the forefront of efforts to strengthen the CPPNM and to develop the Code of Conduct. The Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) is coordinating Australia's implementation of the Code of Conduct.[171]

8.161 The Australian Nuclear Science and Technology Organisation (ANSTO) also submitted that the IAEA has made significant progress in developing detailed standards for the regulation of radioactive sources, including security standards. ANSTO noted that development of the Code of Conduct and supplementary Guidance on the Import and Export of Radioactive Sources took place under its chairmanship. It was argued that: 'Implementation of these standards should significantly reduce the risk of employment of highly active radioactive sources in such devices.'[172]

8.162 ANSTO also submitted that it is playing a significant regional role in this regard by initiating a project on the security of radioactive sources. The project intends to:

- improve and maintain the security of radioactive sources in regional countries, (and concomitantly, to improve and maintain the associated occupational and public radiation safety, and environmental protection);
- identify and secure uncontrolled or poorly controlled radioactive sources in regional countries; and
- reduce the security threat to regional countries potentially arising from malevolent use of radioactive sources.[173]

8.163 In his book, *Fact or Fission*, Professor Richard Broinowski argued that before the events of 11 September 2001, Australian officials could not accurately quantify how much radioactive material (such as discarded caesium, strontium, cobalt and americium used to treat patients, monitor oil wells and so on) was missing in Australia.[174]

8.164 When questioned on the management of radioactive sources in Australia and particularly on the location of so-called 'orphan' sources, which are

170 See: IAEA, *Code of Conduct on the Safety and Security of Radioactive Sources*, IAEA, Vienna, 2004, viewed 26 July 2006, <http://www-pub.iaea.org/MTCD/publications/PDF/Code-2004_web.pdf>. Further information on the IAEA's activities to control radioactive sources is available in the IAEA *Annual Report 2004*, IAEA, Vienna, 2005, pp. 49–50, viewed 27 July 2006, <http://www.iaea.org/Publications/Reports/Anrep2004/radiation_safety.pdf>.

171 The Hon Alexander Downer MP, *Submission no. 33.2*, p. 9.

172 ANSTO, *Submission no. 29*, p. 20.

173 *ibid*.

174 Professor Richard Broinowski, *Fact or Fission*, *op. cit.*, p. 276.

radioactive sources outside regulatory control, the Chief Executive Officer of ARPANSA, Dr John Loy, responded that:

> All the states have good regulatory systems and good knowledge of the location of the sources in their states, as does ARPANSA for the Commonwealth. I would not ever say that it is perfect. Certainly, as part of our current review of security issues, we are looking at how we might pursue a systematic way of looking for what is called in the trade 'orphan sources' that have come out of control in some way. My gut feeling, and I think it is shared by the state regulators, is that it is not a big problem, but that is not to say that it does not exist and that it should not be given attention.[175]

8.165 In relation to the potential for natural uranium to be used in a dirty bomb in Australia, ARPANSA and ANSTO argued that because of the low levels of radioactivity in uranium oxide, use of natural uranium would not present any hazard to human health:

> … it is considered that the use of natural uranium, such as is processed and transported by the uranium mining industry, would not present any hazard to persons or the environment if used by terrorists with malicious intent.[176]

8.166 The UIC emphasised that while dirty bombs are a distinct possibility, it is highly unlikely that terrorists would attempt to construct these from nuclear material:

> … the possibility of them doing [so] with spent nuclear fuel from the civil nuclear cycle or even a research reactor is infinitesimally small because that fuel is self-protecting by virtue of its high radioactivity … even if you were suicidal, I do not think you would do very much with it. I have not seen any suggested scenario from anybody knowledgeable that this is likely.[177]

8.167 Mr Ian Hore-Lacy, General Manager of the UIC, speculated that if dirty bombs were to be used, they are far more likely to be constructed from radioactive medical waste which can be shielded and manipulated, then blown apart, rather than from nuclear material.

8.168 MAPW conceded that: 'Spent nuclear-power reactor fuel elements are so radioactive that they are self-protecting. Any human that went near them would die very quickly.'[178] However, MAPW again called for an end to reprocessing and the use of MOX fuel, arguing that separated plutonium

175 Dr John Loy (ARPANSA), *Transcript of Evidence*, 16 September 2005, p. 73.

176 ARPANSA, *Submission no. 32*, p. 11; ANSTO, *loc. cit.*

177 Mr Ian Hore-Lacy, *op. cit.*, p. 94.

178 MAPW (Victorian Branch), *Exhibit no. 55, op. cit.*, p. 12.

would be easier for terrorists to handle and to use in fabricating either a dirty bomb or a primitive nuclear explosive: 'The safest thing is, therefore, to leave permanently the plutonium in spent reactor fuel elements.'[179]

8.169 In relation to nuclear terrorism more generally, ASNO drew the Committee's attention to the nuclear security activities of the IAEA, as described in its annual reports.[180]

8.170 The IAEA's nuclear security plan is founded on measures to guard against thefts of nuclear and other radioactive material, and to protect related facilities against malicious acts. IAEA activities directed at enhancing nuclear security and protection against nuclear terrorism have three main points of focus: prevention, detection and response. Preventative measures are said to require: effective physical protection of nuclear or other radioactive materials in use, storage and transport; protection of related nuclear facilities; and strong state systems of accounting for and control of nuclear material. The IAEA assists states in implementing these preventative measures through activities such as International Nuclear Security Advisory Service missions (INSServ) to member states, training workshops and technical guidance documents.[181]

8.171 Among its various activities, ASNO highlighted an IAEA program to:

> … increase countries' awareness and ability to control and protect nuclear and other radioactive materials, nuclear installations and transport systems, from terrorist and other illegal activities; and to detect and respond to such events.[182]

8.172 Within this program the IAEA provides monitoring equipment, security and safety upgrades including major structural changes at nuclear facilities. Through the program, the IAEA provides International Physical Protection Assessment Service (IPPAS) missions to assess and assist Member States with physical protection systems related to nuclear material. Australia provides experts to assist in this program.[183]

8.173 In a speech on *Nuclear Terrorism: Identifying and Combating the Risks,* given in March 2005, Dr ElBaradei noted that:

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179 *ibid.*

180 IAEA, *Annual Report 2004*, *op. cit.*, pp. 54–57. See: Dr Mohamed ElBaradei, *Nuclear Terrorism: Identifying and Combating the Risks, loc. cit.*
The nuclear security section of the IAEA *Annual Report 2004* is available at: <http://www.iaea.org/Publications/Reports/Anrep2004/nuclear_security.pdf>. See also: IAEA, *Promoting Nuclear Security: What the IAEA is doing*, IAEA, Vienna, 2003, viewed 27 July 2006, <http://www.iaea.org/Publications/Factsheets/English/nuclsecurity.pdf>.

181 *ibid.*, pp. 7, 54.

182 The Hon Alexander Downer MP, *Submission no. 33.2*, p. 8.

183 *ibid*. See also: IAEA, *Annual Report 2004, op. cit.*, p. 54.

> The bulk of this nuclear security activity has occurred in the past three years. Since September 2001, working in Africa, Asia, Europe and Latin America, we have conducted more than 125 security advisory and evaluation missions, and convened over 100 training courses, workshops and seminars.[184]

8.174 ASNO noted that in 2002 the IAEA established a Nuclear Security Fund (NSF) specifically to handle voluntary contributions from IAEA members to fund the Agency's nuclear security program. As of July 2005, this extra-budgetary fund had received a total of US$36.7 million from 26 member states and one NGO, and in-kind contributions from 18 member states. Australia has contributed to the NSF and has furnished in-kind assistance. As noted by ANSTO, Australia also provides regional training and assistance on the security and physical protection of nuclear and other radioactive material.[185]

Conclusions

8.175 In addition to IAEA safeguards described in the previous chapter, Australia superimposes additional safeguards requirements through a network of bilateral safeguards agreements. The objectives of Australia's safeguards policy are to ensure that AONM is: appropriately accounted for as it moves through the fuel cycle; is used only for peaceful purposes; and in no way contributes to any military purpose.

8.176 Australia's policy also establishes criteria for the selection of countries eligible to receive AONM. The Committee notes that of the five cases where the IAEA has found countries in non-compliance with their safeguards agreements and reported the non-compliance to the UN Security Council, none of these cases involved countries eligible to use Australian uranium. Furthermore, as the previous chapter noted, from May 2005, NNWS must also make an Additional Protocol with the IAEA as a pre-condition for the supply of Australian uranium.

8.177 While the Committee notes that it simply cannot be absolutely guaranteed that diversion of AONM for use in weapons could never occur at some point in the future, nevertheless the Committee is satisfied that Australia's safeguards policy has been effective to date. The Committee concludes that the requirements in safeguards agreements are adequate and can see no reason for imposing additional requirements at this time.

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184 Dr Mohamed ElBaradei, *Nuclear Terrorism: Identifying and Combating the Risks, loc. cit.*

185 The Hon Alexander Downer MP, *Submission no. 33.2*, pp. 8–9.

8.178 The Committee rejects arguments that Australia's safeguards policy has been eroded and stripped of its potency over time. In particular, the Committee believes that the principles of equivalence and proportionality, which underlie nuclear fuel trade, simply reflect that, other than by establishing the entire nuclear fuel cycle in Australia and leasing fuel elements, it is impossible to track 'national atoms' once uranium from different sources is mixed together (e.g. in enrichment and fuel fabrication processes). It is for this reason that international practice is to designate an equivalent quantity as (Australian) obligated nuclear material. In this way, even if at some point AONM is co-mingled with unsafeguarded material, a proportion of the resulting material will be regarded as AONM corresponding to the same proportion of AONM initially. Thus, even if a stream of material is taken from a process for military purposes (e.g. from a conversion facility), the presence of the AONM will in no way benefit or contribute to the quantity or quality of the unobligated material. In any case, the facilities where AONM can be processed, including in the NWS, must be safeguarded and are eligible for IAEA monitoring and inspections.

8.179 The Committee notes the strong objection by some submitters to the reprocessing of spent fuel containing Australian-obligated plutonium. While the Committee agrees that the existence of stocks of separated plutonium does represent a possible proliferation danger, it notes that reprocessing used fuel has a number of important advantages that must also be considered. Specifically, reprocessing and plutonium recycling enables a far more efficient use of the uranium fuel, extending by about one third the amount of energy a country can obtain from the uranium they purchase. Furthermore, reprocessing and use of MOX fuel significantly reduces the amount of waste that must be disposed of. It strikes the Committee as somewhat curious that groups normally so in favour of energy efficiency and recycling will not countenace these same benefits when associated with the use of uranium.

8.180 Further to the discussion in the previous chapter, the Committee also notes that reprocessing technologies are now being developed in which plutonium is not fully separated, but remains mixed with uranium and highly radioactive materials, thus eliminating this proliferation danger while enabling plutonium recycling. The Committee notes that Australia is free to revoke consents for reprocessing at any time, if necessary. The Committee suggests that the issue of so-called plutonium stockpiling continue to be monitored by the Australian Government and that permission for reprocessing should be kept under review.

8.181 The Committee concludes that there is little or no potential for the diversion of AONM for use by terrorists, or for AONM and other

Australian radioactive materials to be used in 'dirty bombs'. In particular, the Committee notes that Australia's conditions for supply of AONM include an assurance that internationally agreed standards of physical security will be applied to nuclear materials in the country concerned.

8.182 The Committee was informed of the recent strengthening, under the IAEA's auspices, of several conventions and guidelines to protect against acts of nuclear terrorism, including significant amendments to the CPPNM and the Code of Conduct for Safety and Security of Radioactive Sources.

8.183 The Committee is pleased to note that Australia has again been at the forefront in negotiating these outcomes, as well as contributing to nuclear security initiatives in the region, such as leading a project to ensure the security of radioactive sources.

8.184 The Committee welcomes the assistance being provided by the IAEA in implementing measures to guard against thefts of nuclear and other radioactive material and to protect related facilities. This assistance has included its INSServ and IPPAS missions to member states.

Exports of uranium to China

8.185 While the Committee understands the concerns expressed by some submitters about the added risks for export of uranium attendant upon the absence of a fully 'open society' in China and its allegedly poor proliferation record, the Committee nonetheless concludes that such concerns should not prevent sales of Australian uranium to China.

8.186 The Committee is confident that sales of uranium will not, either directly or indirectly, contribute to any military purpose in China. Assurance that AONM will not be used in weapons programs is underpinned by China's preparedness to enter into a treaty-level commitment with Australia to this effect and the safeguards arrangements that will apply to AONM. The Committee notes that the facilities in which AONM is to be processed in China will be subject to IAEA monitoring. It is also the case that while Australian uranium attracts extensive safeguards, some of China's alternative sources of uranium supply may not attract such stringent safeguards.

8.187 While China has not officially confirmed the report, ASNO states that China ended production of fissile material for nuclear weapons around 1991. The Committee notes that, as with Australia's other bilateral safeguards agreements, Australia retains the right (in Article XII) of the Agreement to 'suspend or cancel further transfers of nuclear material' should any of the provisions of the Agreement not be complied with.[186] Naturally, the Committee concludes that if Australian uranium is ever diverted for weapons programs in China then the Australian Government should immediately terminate sales of uranium. Furthermore, while it is difficult to see how the provision could be enforced, the Agreement also states that Australia may 'require the return of nuclear material' if corrective measures are not taken within a reasonable time.[187]

8.188 As discussed in chapters four and nine, the Committee's support for sales of uranium to China is underpinned by the fact that use of nuclear power will aid in China's development and help to address the global energy imbalance, while also earning export income for Australia. Use of Australia's uranium will fuel the generation of base-load electricity in China in a manner that is far less carbon intensive than the alternatives and this will be of unquestionable global environmental benefit.

Possibility of uranium exports to India

8.189 The Committee notes that the proposed US-India nuclear cooperation agreement will have a number of important non-proliferation benefits, including that it will:

- expand the application of IAEA safeguards in India;
- allow the IAEA enhanced access rights;
- the majority of India's nuclear activities will be under safeguards; and
- India's very significant civil nuclear expansion will now be undertaken with heightened safety as it will be able to purchase more advanced nuclear technology.

8.190 The Committee notes that, in addition to the support the agreement has received from the Australian and other governments, the Director General of the IAEA has also welcomed the agreement, noting that it will 'bring India closer as an important partner in non-proliferation' and that it will represent a 'step forward towards universalistion of the international safeguards regime.'[188] The Committee also believes that the agreement is a positive development and particularly welcomes the increased transparency of India's civil nuclear program that will result.

8.191 The Australian Government has been asked to consider permitting sales of uranium to India. As India is not a signatory to the NPT, a decision to permit sales would require a departure from Australia's uranium exports

186 ASNO, *Agreement Between the Government of Australia and The Government of the People's Republic of China on the Transfer of Nuclear Material*, *op. cit.*, p. 7.

187 *ibid*.

188 Dr Mohamed ElBaradei, *IAEA Director General Welcomes U.S. and India Nuclear Deal, loc. cit.*

policy of almost 30 years standing—not to permit sales of uranium to states that are not party to the NPT.

8.192 The Committee notes that there are sound reasons to allow an exception to Australia's exports policy in order to permit uranium sales to India. Among these is the widely held view that India has consistently supported the objective of non-proliferation—unlike some other states that *are* NPT parties. It is conceivable that uranium could be supplied to India, for use in safeguarded reactors, in a way that does not undermine the non-proliferation regime. However, the Committee appreciates that this is a complex issue and does not wish to make a recommendation on the matter.

8.193 While the Committee believes that the issue should be subject to further examination, maintaining the integrity of the non-proliferation regime must remain the top priority and guiding principle for Australia's uranium exports policy. The Committee's view is that Australia's actions must not undermine the non-proliferation regime and the fundamental importance of the NPT. Accordingly, there would need to be compelling arguments to grant an exception to India.

8.194 Australia's position on this matter may have added significance in that, as potentially the world's largest uranium producer, it could carry a power of example to other suppliers. Furthermore, for the long-term stability and reputation of the Australian uranium industry, the Committee believes that—if at all possible—a bipartisan position on the India question should be developed.

8.195 The question of whether Australia should or should not supply uranium may of course become somewhat academic if the NSG decides to grant India an exception to its Guidelines and other countries begin to supply, as Russia apparently already has.

8.196 In the following chapter, the Committee turns to consider the strategic importance of Australia's uranium resources.