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Conduct of the Inquiry

1.1 The proposed *Agreement between the Government of Australia and the Government of India on Cooperation in the Peaceful Uses of Nuclear Energy* (the proposed Agreement) was tabled in the Australian Parliament on 28 October 2014.

1.2 It has taken the Committee considerably longer than the allotted 20 sitting days to complete the inquiry. There are compelling reasons for this.

1.3 The most obvious of these is the basic intent of the proposed Agreement – the sale of Australian nuclear material to India, a state that is not a party to the Nuclear Non-Proliferation Treaty and that is armed with nuclear weapons.

1.4 Another reason for the time taken to complete this inquiry has been the participation of some of the most experienced and incisive minds in the non-proliferation and strategic issues communities, both in Australia and abroad.

1.5 Attracting such a wealth of knowledge has resulted in the consideration of a number of very complex issues, many of which needed careful examination.

1.6 The Committee would like to take this opportunity to thank all participants to the inquiry for their conscientious, patient and valuable assistance with the inquiry.

1.7 The issues that have emerged from the evidence are examined in the six following Chapters:

- Chapter two examines the potential benefits for Australia and India should the proposed Agreement be ratified;
- Chapter three provides an overview of the proposed Agreement and its provisions;
- Chapter four examines the strategic and non-proliferation issues arising out of the proposed Agreement;

- Chapter five deals with nuclear safety in India;
- Chapter six works through issues related to the specific provisions of the proposed Agreement; and
- Chapter seven makes some concluding remarks.

Nuclear power

1.8 The Report discusses some complex matters relating to nuclear power. To assist with these discussions, it is worth providing a brief overview of the mechanics of nuclear power electricity generation.

1.9 Nuclear reactors used to generate electricity use a process called nuclear fission.

1.10 Nuclear fission involves the destruction of radioactive uranium and plutonium atoms, which generates heat and the formation of other radioactive elements, such as caesium, strontium and iodine. The heat from the process, which constitutes about a third of the energy generated by fission, is used to heat water to steam, which is then used to drive an electricity generator turbine.[1]

1.11 Uranium in its natural form is uranium oxide, often called 'yellowcake'. In this form it is mined in order to produce nuclear fuel. The uranium in uranium oxide is generally of two types: the more common, stable, uranium 238 and the less common, radioactive, uranium 235. Uranium 238 usually comprises 99.3 per cent of naturally occurring uranium.[2]

1.12 The numbers 238 and 235 refer to the atomic weight of the element. In simple terms, this refers to the number of subatomic particles (protons and neutrons) that make up the nucleus of the element. The higher the atomic weight of the element, the larger and heavier it is.[3]

1.13 There are a number of steps involved in turning uranium oxide into nuclear fuel. The first is to refine the fuel to increase the concentration of uranium 235 to between three and five percent of the uranium. At this

1 US Department of Energy, *Nuclear Fuel Cycle*, < http://www.energy.gov/ne/nuclear-fuel-cycle >, viewed on 14 April 2015.

2 US Department of Energy, *Nuclear Fuel Cycle*, < http://www.energy.gov/ne/nuclear-fuel-cycle >, viewed on 14 April 2015.

3 US Department of Energy, *Nuclear Fuel Cycle*, < http://www.energy.gov/ne/nuclear-fuel-cycle >, viewed on 14 April 2015.

concentration, there is sufficient uranium 235 to commence a fission reaction.[4]

1.14 Refining the nuclear fuel involves first removing the oxide from the uranium, then concentrating (called 'enriching') the uranium 235.[5]

1.15 Enrichment is undertaken by making use of the difference in weight between uranium 235 and uranium 238. The most common technique involves spinning the uranium in a centrifuge. The heavier uranium 238 will migrate to the outer edge of the centrifuge while the lighter uranium 235 will remain in the centre, separating the radioactive and the stable uranium. The excess uranium 238 is called depleted uranium and has a number of uses unrelated to nuclear power generation based on its weight.[6]

1.16 The enriched uranium is then manufactured into fuel pellets, which are combined into rods. Fuel rods are then combined into fuel assemblies. Most nuclear reactors use between 150 – 200 assemblies.[7]

1.17 The Committee has already heard evidence from the Australian Safeguards and Non-Proliferation Office that, should India purchase uranium ore from Australia, the uranium will be exported to the United States to be processed into fuel assemblies before being exported to India for use.[8]

1.18 Nuclear fuel that has undergone fission is called 'spent fuel'. The spent fuel assemblies are first stored in water to contain any residual heat and radioactivity.[9]

1.19 Following storage, spent fuel assemblies can be reprocessed to extract plutonium created during fission, and any uranium that has not been consumed. The extracted uranium and plutonium, both which can be

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4 US Department of Energy, *Nuclear Fuel Cycle*, < http://www.energy.gov/ne/nuclear-fuel-cycle >, viewed on 14 April 2015.

5 US Department of Energy, *Nuclear Fuel Cycle*, < http://www.energy.gov/ne/nuclear-fuel-cycle >, viewed on 14 April 2015.

6 US Department of Energy, *Nuclear Fuel Cycle*, < http://www.energy.gov/ne/nuclear-fuel-cycle >, viewed on 14 April 2015. The most common use for depleted uranium is shielding on radiographic medical equipment.

7 US Department of Energy, *Nuclear Fuel Cycle*, < http://www.energy.gov/ne/nuclear-fuel-cycle >, viewed on 14 April 2015.

8 Dr Robert Floyd, Director General, Australian Safeguards and Non-Proliferation Office (ASNO), Department of Foreign Affairs and Trade, *Committee Hansard*, Canberra, 12 February 2015, p. 3.

9 US Department of Energy, *Nuclear Fuel Cycle*, < http://www.energy.gov/ne/nuclear-fuel-cycle >, viewed on 14 April 2015.

used as nuclear fuel, are fed back into the fuel production process to be included in new fuel assemblies.[10]

1.20 The waste products from reprocessing are highly radioactive, and require special treatment. In general these waste products are sealed into glass and then into steel canisters. At present the steel canisters are stored behind shielding pending final disposal, which, according the Australian Nuclear Science and Technology Organisation, will need to involve burial in stable geological formations deep underground.[11]

The inquiry process

1.21 The Committee's resolution of appointment empowers it to inquire into any treaty to which Australia has become signatory, on the treaty being tabled in Parliament.

1.22 The treaties, and matters arising from them, are evaluated to ensure that ratification is in the national interest, and that unintended or negative effects on Australians will not arise.

1.23 Prior to tabling, major treaty actions are subject to a National Interest Analysis (NIA), prepared by Government. This document considers arguments for and against the treaty, outlines the treaty obligations and any regulatory or financial implications, and reports the results of consultations undertaken with State and Territory Governments, Federal and State and Territory agencies, and with industry or non-government organisations.

1.24 The Committee takes account of these documents in its examination of the treaty text, in addition to other evidence taken during the inquiry program.

1.25 Copies of this treaty and its associated documentation may be obtained from the Committee Secretariat or accessed through the Committee's website at:

- http://www.aph.gov.au/Parliamentary_Business/Committees/Joint/Treaties/28_October_2014

10 Australian Nuclear Science and Technology Organisation (ANSTO), *The Nuclear Fuel Cycle*, <http://www.ansto.gov.au/NuclearFacts/ManagingRadioActiveWaste/Thenuclearfuelcycle/index.htm >, viewed on 14 April 2015.

11 ANSTO, *The Nuclear Fuel Cycle*, <http://www.ansto.gov.au/NuclearFacts/ManagingRadioActiveWaste/Thenuclearfuelcycle/index.htm >, viewed on 14 April 2015.

Conduct of the Committee's review

1.26 The treaty action reviewed in this report was advertised on the Committee's website from the date of tabling. Submissions for the treaty were requested by 28 November 2014.

1.27 Invitations were made to all State Premiers, Territory Chief Ministers and to the Presiding Officers of each Parliament to lodge submissions. The Committee also invited submissions from individuals and organisations with an interest in the particular treaty under review.

1.28 The Committee held four public hearing as part of this inquiry:

- 9 February 2015 in Canberra;
- 12 February 2015 in Canberra;
- 18 May 2015 in Melbourne; and
- 15 June 2015 in Canberra.

1.29 The transcripts of evidence from the public hearing may be obtained from the Committee Secretariat or accessed through the Committee's website under the treaty's tabling date, 28 October 2014.

1.30 A list of submissions received and their authors is at Appendix A.

1.31 A list of witnesses who appeared at the public hearing is at Appendix B.