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Introduction

Referral of the inquiry

1.1 On 15 March 2005 the Minister for Industry, Tourism and Resources, the Hon Ian Macfarlane MP, wrote to the House of Representatives Standing Committee on Industry and Resources (the Committee) asking it to conduct a case study into the strategic importance of Australia's uranium resources, as part of a broader inquiry into the development of Australia's non-fossil fuel energy industry. The terms of reference for the case study are provided on page xxi of the report.

Conduct of the case study

1.2 A media release announcing the inquiry was issued on 17 March 2005. The Committee's terms of reference were advertised and written submissions invited in the *Australian Financial Review* on 1 April 2005, *The Australian* on 20 April 2005, *Australia's Mining Monthly* in May 2005, *The AusIMM Bulletin* in May/June 2005, and on-line through *MiningNews.Net* during April 2005.

1.3 The Committee wrote to 180 organisations, companies and individuals inviting them to make submissions to the inquiry. These included major uranium and coal mining companies, junior uranium exploration companies, industry and professional associations, banking and financial institutions, environmental organisations, unions, Aboriginal organisations, and Government scientific agencies. The Committee invited submissions from all state and territory governments.

1.4 In its letters inviting submissions, the Committee also indicated that it would welcome comments in relation to six additional issues, as follows:

- whole of life cycle waste management assessment of the uranium industry, including radioactive waste management at mine sites in Australia, and nuclear waste management overseas consequent to use of Australian exported uranium;
- the adequacy of social impact assessment, consultation and approval processes with traditional owners and affected Aboriginal people in relation to uranium mining resource projects;
- examination of health risks to workers and to the public from exposure to ionising radiation from uranium mining;
- adequacy of regulation of uranium mining by the Commonwealth;
- assessing the extent of federal subsidies, rebates and other mechanisms used to facilitate uranium mining and resource development; and
- the effectiveness of safeguards regimes in addressing the proliferation of fissile material, the potential diversion of Australian obligate fissile materials, and the potential for Australian obligate radioactive materials to be used in 'dirty bombs'.

1.5 The Committee received 87 written submissions and 19 supplementary submissions, which are listed at Appendix A. The Committee also received 93 exhibits, which included ancillary material provided by witnesses at public hearings and various technical documents. A list of the exhibits is at Appendix B.

1.6 Three petition letters were received from seventeen individuals expressing opposition to further uranium mining. These were received by the Committee as three submissions, with the names of the individuals expressing the views listed under the respective submission in Appendix A.

1.7 Public hearings were conducted by the Committee in Sydney, Melbourne, Perth, Darwin and Canberra from August 2005 to March 2006. In total, 87 witnesses were examined at 13 public hearings. The dates and locations of the hearings, together with the names of witnesses who appeared before the Committee is at Appendix C.

1.8 Inspections were held by the Committee at the three uranium mines that are currently operating—Olympic Dam and Beverley in South Australia and Ranger in the Northern Territory.

1.9 Access to the published submissions to the inquiry, transcripts of evidence taken at public hearings and an electronic copy of the report is available on the internet from the Committee's web site:

http://www.aph.gov.au/house/committee/isr/uranium/index.htm

Structure of the report and principal findings

1.10 In addition to this introductory chapter, the report comprises 11 chapters. The contents and principal findings of the chapters are summarised as follows.

1.11 The Committee's conclusions and recommendations are also summarised in a *key messages* section at the beginning of each chapter and in the *conclusions* section at the end of each chapter.

Chapter two: Uranium: Demand and Supply

1.12 The Committee commences the report by considering the global demand and supply of uranium in the context of world electricity consumption trends and nuclear power's share in the electricity generation mix. The Committee provides a summary of forecasts for world nuclear generating capacity and associated uranium requirements. Competing views on the outlook for new nuclear power plant construction are then considered, followed by an assessment of the role of existing plant performance in influencing the demand for uranium.

1.13 Uranium supply is provided by a combination of primary (mine) production and secondary sources (e.g. inventories held by utilities and ex-military material). The contribution of each part is discussed. The Committee then considers the argument that world uranium resources are insufficient to support an expansion of nuclear power and, hence, represent only a temporary response to the problem of climate change.

1.14 The Committee concludes the chapter with an assessment of the implications of the supply/demand balance for further mine production and the potential for Australia's uranium production to expand to meet requirements.

1.15 The Committee concludes that new nuclear build combined with improved reactor performance and operating life extensions are likely to outweigh reactor retirements in the years ahead, thereby increasing projected uranium requirements. Importantly, secondary supplies (which provide some 35 per cent of the market) are also declining, leading to an increased requirement for uranium mine production. Dramatic increases in the uranium spot price are stimulating new uranium exploration activity.

1.16 The chapter commences with an overview of the nuclear fuel cycle, which establishes a context for the discussion in subsequent chapters of matters including greenhouse gas emissions, waste, safety and proliferation risks associated with nuclear power generation.

Chapter three: Australia's uranium resources, production and exploration

1.17 The chapter provides a detailed overview of Australia's uranium resources, mine production and exploration for uranium.

1.18 Australia possesses 38 per cent of the world's total Identified Resources of uranium recoverable at low cost. According to company reports, Australia's known uranium deposits currently contain a total of over 2 million tonnes of uranium oxide in in-ground resources. The in-situ value of this resource at spot market prices prevailing in June 2006 was over A$270 billion.

1.19 The Committee was pleased to note record uranium production and exports for Australia in calendar year 2005. Production across the three operational mines (Ranger, Olympic Dam and Beverley) was 11 222 tonnes of uranium oxide (t U_3O_8) and exports were 12 360 t U_3O_8. Uranium exports also earned a record $573 million in 2005.

1.20 Some 75 per cent of Australia's total Identified Resources of uranium are located in South Australia, but significant deposits are also located in the Northern Territory, Western Australia and Queensland.

1.21 Olympic Dam in South Australia contains 26 per cent of the world's low cost uranium resources and is the world's largest uranium deposit. A proposal to expand Olympic Dam would see uranium production from the mine treble to 15 000 tonnes of uranium oxide per year, which would make Olympic Dam and its owners, BHP Billiton Ltd, by far the world's largest uranium producer.

1.22 The increase in uranium spot price and the anticipated decline in secondary supplies have stimulated a resurgence in exploration activity and expenditure in Australia.

1.23 While there has been a trend of increasing exploration expenditure since early 2003, there has been relatively little exploration for uranium over the past two decades and Australia's known uranium resources generally reflect exploration efforts that took place 30 years ago. It is likely that the size of Australia's known uranium resources significantly understates the potential resource base and there is great potential for new and significant discoveries.

1.24 In its previous report, which addressed impediments to exploration, the Committee accepted that future world-class uranium deposits are likely to be located at greater depths than those hitherto discovered. It was concluded that this will require large injections of exploration investment capital to overcome the technical challenges of locating bedrock deposits. These observations reinforce the need to ensure that junior companies, which are generally efficient explorers, are appropriately assisted to

discover Australia's future world-class uranium and other mineral deposits. The Committee is convinced of the merits of flow-through share schemes and repeats the recommendation contained in its previous report.

1.25 To assist in the discovery of new world-class uranium deposits the Committee recommends that Geoscience Australia be provided with additional funding to develop and deploy techniques to provide precompetitive geoscience of prospective areas, in order to assist in the discovery of new world-class uranium and other mineral deposits located under cover and at depth.

Chapter four: Greenhouse gas emissions and nuclear power

1.26 The chapter addresses the greenhouse gas emissions avoided by the use of nuclear power, emissions across the whole nuclear fuel cycle, the contribution from renewable energy sources, and the relative economic attractiveness of nuclear power for baseload power generation.

1.27 The Committee concludes that nuclear power unquestionably makes a significant contribution to the mitigation of greenhouse gas (GHG) emissions—nuclear power plants currently save some 10 per cent of total carbon dioxide (CO_2) emissions from world energy use. This represents an immense saving of GHG emissions that would otherwise be contributing to global warming. If the world were not using nuclear power plants, emissions of CO_2 would be some 2.5 billion tonnes higher per year.

1.28 An important consideration in assessing nuclear power's viability as a GHG emission mitigation option relates to the economic competitiveness of nuclear power relative to other baseload alternatives. Evidence suggests that nuclear power plants have higher capital/construction costs than either coal or gas plants, which are characterised by mid-range and low capital costs respectively. However, nuclear plants have low fuel, operating and maintenance costs relative to the fossil fuel alternatives.

1.29 A range of recent authoritative studies have concluded that, in many industrialised countries, nuclear power is competitive with gas and coal-fired electricity generation, even without incorporating an additional cost for the carbon emissions from the fossil fuelled plants.

Chapter five: Radioactive waste

1.30 It was alleged in evidence that there remain three unresolved issues associated with the nuclear fuel cycle and its industries that, in the view of some submitters, are such as to justify a winding back of uranium mining and an eventual end to the use of nuclear power worldwide. These issues relate to the:

- generation and management of *radioactive waste* across the nuclear fuel cycle, principally waste from the operation of nuclear reactors, but also waste from uranium mines;
- *safety* of the fuel cycle, particularly the operation of nuclear reactors and the risks to health from fuel cycle industries, including uranium mining; and
- risk of *proliferation* of nuclear materials and technologies, and their diversion for use in weapons programs.

1.31 Chapter five and the following three chapters examine the evidence presented to the Committee in relation to each of these three key issues.

1.32 Chapter five addresses the management of radioactive waste generated across the nuclear fuel cycle, from uranium mining to the decommissioning of nuclear power plants.

1.33 The Committee concludes that the radioactive wastes which are produced at each stage of the nuclear fuel cycle have, since the inception of the civil nuclear power industry 50 years ago, been responsibly managed. There are proven technologies for the management of all types of radioactive waste.

1.34 The Committee finds that nuclear power deals with its waste more explicitly and transparently than many other sources of energy. The Committee notes that high level radioactive waste has several features which lends itself to ease of management: very small volumes (12 000 tonnes per year worldwide); the radioactivity is contained in the spent fuel assemblies; it decays at a predictable rate; and is amenable to separation, encapsulation and isolation. Moreover, the nuclear power industry significantly contributes to the cost of its waste management through levies imposed on utilities.

1.35 This is in sharp contrast to the wastes produced by fossil fuels, which are not contained or managed, involve enormous volumes and a range of toxic pollutants that do not decay. Moreover, the cost of the environmental externalities these energy sources create are generally not factored into the price of the electricity generated.

Chapter six: Safety of the nuclear fuel cycle

1.36 The chapter examines the second 'unresolved' issue associated with the civil nuclear power industry—the safety of nuclear fuel cycle facilities, and particularly the health risks to workers and to the public from exposure to radiation from uranium mining and nuclear power plants.

1.37 The chapter presents evidence in relation to the following themes in turn: the health effects from exposure to ionising radiation and the current

international standards for control of radiation exposure; regulation for radiation protection in Australia; safety and health issues associated with the uranium mining industry in Australia; radiation exposure from the whole nuclear fuel cycle; nuclear safety; and radiation and public perceptions.

1.38 The Committee concludes that the nuclear power industry has by far the best safety record of all major energy industries, including coal, oil, natural gas, liquefied petroleum gas and hydro. Notwithstanding the tragedy of the Chernobyl accident, which has been the only accident to a commercial nuclear power plant that has resulted in loss of life, nuclear power's safety record is unrivalled by any other major energy source.

1.39 The total average effective radiation dose received by the world population from natural sources of radiation (i.e. 'natural background radiation') is 2.4 millisieverts (mSv) per year. In contrast, the total average effective dose to monitored workers across the whole nuclear fuel cycle (including uranium mining and milling) is 1.75 mSv per year. The maximum average annual radiation dose allowed for a uranium miner is currently set at 20 mSv. The actual dose received by workers at Australian uranium mines is well under half this level. The radiation exposure for the public in the vicinity of the mines is a small fraction of the prescribed limit for members of the public.

1.40 To provide greater assurance to uranium industry workers and the public at large, and also to definitively answer claims—which the Committee is confident are entirely mistaken—that current radiation exposures are harming workers, the Committee recommends the establishment of:

- a national radiation dose register for occupationally exposed workers; and
- a system of long-term monitoring of the health outcomes for workers occupationally exposed to radiation in uranium mining, associated industries and nuclear facilities.

Chapter seven: The global non-proliferation regime

1.41 In this and the following chapter the Committee addresses the third objection to the use of nuclear power—nuclear proliferation and the effectiveness of safeguards regimes.

1.42 The chapter first introduces the concept of proliferation and explains how some technologies required in the civil nuclear fuel cycle also have military uses. The Committee describes the current global non-proliferation regime, the key elements of which are the Treaty on the Non-Proliferation of Nuclear Weapons (NPT) and the safeguards activities of the International Atomic Energy Agency (IAEA).

1.43 The Committee concludes that the global safeguards regime has indeed been remarkably successful in limiting the proliferation of nuclear weapons. While the Committee believes that most alleged deficiencies in the regime are without substance, it notes that the regime is now facing several challenges which must be met.

1.44 The Committee welcomes the commendable range of efforts the Australian Government is undertaking to advance non-proliferation objectives but recommends that further action be taken, including, inter alia: redoubling efforts to encourage adoption by other countries of the Additional Protocol to the NPT; seeking the development of criteria for assessing the international acceptability of proposed sensitive projects; and examining the resourcing of the IAEA's safeguards program.

Chapter eight: Australia's bilateral safeguards

1.45 The chapter 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.

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

1.47 The chapter then considers several other proliferation concerns and allegations raised by submitters, and 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.

1.48 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.

1.49 The Committee supports the Australian Government's decision to permit exports of uranium to China.

1.50 The Committee belives that 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. However, 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 and the Committee hopes that a bipartisan position on this issue can be developed.

Chapter nine: Strategic importance of Australia's uranium resources

1.51 In addition to its greenhouse gas emission benefits, which were discussed in chapter four, evidence presented to the Committee suggested that the strategic importance of Australia's uranium resources derives from the:

- significance of the resource as one of Australia's major energy exports;
- energy security benefits that uranium can provide those countries that choose to adopt nuclear power;
- potential for Australia's uranium exports to assist in addressing the global energy imbalance;
- economic benefits that may be obtained from uranium mining, particularly for state economies and regional communities;
- economic significance of Australia's undeveloped uranium resources; and
- Australia's role as a major uranium exporter in the global nuclear fuel cycle.

The chapter considers each of these points in turn.

1.52 Among other findings, the Committee notes that uranium is Australia's second largest energy export in terms of contained energy content. Uranium is an immensely concentrated source of energy—one tonne of uranium oxide generates the same amount of energy as 20 000 tonnes of black coal. The uranium produced from just one of Australia's mines each year—Ranger, in the Northern Territory—contains sufficient energy to provide for 80 per cent of Australia's total annual electricity requirements, or all of Taiwan's electricity needs for a year.

1.53 In addition, the Committee concludes that while Australia is well endowed with energy resources for its own needs, other countries are not so fortunate. These include developing countries such as China. As a matter of energy justice, the Committee believes that Australia should not deny countries who wish to use nuclear power in a responsible manner the benefits from doing so. Neither should Australia refuse to export its uranium to assist in addressing the global energy imbalance and the disparity in living standards associated with this global inequity.

1.54 Moreover, expanded mining and exports of uranium will have economic and other benefits for the nation, the states that permit uranium resources to be developed and the regional communities supporting the mines.

Chapter ten: Uranium industry regulation and impacts on Aboriginal communities

1.55 The chapter examines the current structure and regulatory environment of the uranium mining sector (noting the work that has been undertaken by other inquiries and reviews on these issues). The chapter commences with a description of the current regulatory environment, focussing on the Australian Government's role. This is followed by sections detailing the industry's assessment of the current regulatory regime, criticisms of the regulatory environment and consultation with Traditional Owners and the social impacts of uranium mining on Aboriginal communities.

1.56 Criticisms of perceived failings of the current regulatory regime by those opposed to uranium mining generally relate to the adequacy of environmental protection from the impacts of uranium mining. However, the Committee concludes that while deficient regulation and poor mining practices in past decades have led to ongoing rehabilitation problems at former uranium mine sites and recommends that further funding be provided to complete this rehabilitation, it concludes that current regulation is entirely adequate.

1.57 The Committee notes, for example, that the Ranger operation in the Northern Territory is required to meet among the most rigorous reporting regimes in the country. Ranger is monitored and regulated by a range of independent bodies. The Committee notes that there has been no harm to the Kakadu National Park from the mining operations at Ranger.

1.58 The Committee concludes that while there are a number of impediments to increasing Aboriginal engagement in uranium mining, industry, governments and Indigenous communities themselves should seek to emulate the examples of mining operations, both in Australia and abroad, that have succeeded in achieving employment, business and training benefits for Indigenous communities.

Chapter eleven: Impediments to the uranium industry's development

1.59 The chapter summarises the impediments to the uranium industry's growth in Australia.

1.60 The Committee finds that the principal impediment to the growth of the uranium industry in Australia remains the prohibition on uranium mining in some states and the lack of alignment between federal and state policy. The Committee urges state governments to reconsider their opposition to

uranium mining and to abolish legislative restrictions where these exist. The Committee also recommends that governments address the range of other impediments to the development of the industry.

1.61 In addition, and as described in preceding chapters of the report, the Committee believes that there are widespread misconceptions associated with uranium mining and nuclear power. While these misconceptions persist, the industry's growth is likely to be impeded. The Committee concludes that it is vital that the concerns of the public be responded to. Information should be communicated both to the general public and opinion leaders that eases concerns and addresses areas of poor understanding.

Chapter twelve: Value adding — fuel cycle services industries, nuclear power, skills and training in Australia

1.62 The chapter provides an overview of evidence presented in relation to the possible domestic use of nuclear power and the question of establishing domestic fuel cycle services industries. The Committee also addresses itself to the skills base and research and development (R&D) activity to support Australia's current and possible future participation in the nuclear fuel cycle.

1.63 The Committee regrets that Australia has missed several opportunities to develop industries based on upgrading Australia's uranium resources for export. In addition to the foregone export earnings and the missed opportunities to develop sophisticated technologies and an associated domestic expertise, the failure to press ahead with the development of fuel cycle services industries in Australia has wasted a significant public R&D investment.

1.64 Australia possesses some 40 per cent of the world's uranium, perhaps more. By virtue of this immense resource endowment, Australia has a very strong economic interest in, and justification for, seeking to add value to its uranium resources prior to export. The Committee concludes that such a development would allow Australia the opportunity to extract greater returns from its resource endowment, to develop sophisticated technologies and to expand its national skills base.

1.65 Although the Committee acknowledges that nuclear power may not be immediately competitive in the Australian context, due to the quantity and quality of coal resources (and that carbon emissions are currently not priced), the Committee has no in-principle objection to the use of nuclear power in Australia and believes that, subject to appropriate regulatory oversight, utilities that choose to construct nuclear power plants in Australia should be permitted to do so.

1.66 To facilitate the possible eventual development of domestic fuel cycle facilities, the Committee recommends that steps should now be taken to develop a licensing and regulatory framework to support the possible eventual establishment of such facilities in Australia. The Committee also urges that Government seek to progressively rebuild Australia's nuclear skills base which has been dissipated.

1.67 The chapter concludes with some supplementary remarks from the Opposition members of the Committee in relation to the domestic use of nuclear power and uranium enrichment.

Appreciation

1.68 The Committee wishes to thank those who contributed to the uranium case study, particularly the witnesses who were prepared to travel in order to appear before the Committee. The Committee also thanks the companies that facilitated its inspections of the currently operating uranium mines—BHP Billiton Ltd, Energy Resources of Australia Ltd and Heathgate Resources Pty Ltd. The Committee appreciated the willingness of the Northern Territory Government to have its officials appear before the Committee at its public hearing in Darwin.