House of Representatives Standing Committee on Industry and Resources

Inquiry into the development of the non-fossil fuel energy industry in Australia

Case study into the strategic importance of Australia's uranium resources

Supplementary questions to ASNO, following public hearings in November 2005

Responses by Mr John Carlson, Director General, ASNO 31 January 2006

The Committee has requested responses to a number of supplementary questions, set out below. My response follows each point.

Bilateral safeguards agreements with China and other countries

At a recent briefing for the House of Representatives Industry and Resources Committee, the Minister for Industry and Resources was asked to describe progress in the negotiations for the bilateral safeguards agreement with China.

Members also enquired as to whether there were any other negotiations underway, or likely to be commenced in the near future, with any other countries for safeguards agreements.

DG ASNO response The first round of formal negotiations with China on nuclear cooperation and safeguards issues was held in Canberra on 18-19 January 2006. Discussions were conducted in a friendly and constructive atmosphere, and good progress was made. A further round is expected in the next few weeks.

Both sides have agreed that the details should remain confidential to the parties until the negotiations are concluded. The Government has made it clear that Australia's stringent safeguards requirements will not be compromised in this agreement—nor, I might add, has China sought to do so. The agreement will be subject to Parliamentary review through the JSCOT process before it is brought into effect.

Currently there are no proposals under consideration to negotiate safeguards agreements with any other country.

Proposals to reform the non-proliferation regime

The Minister's submission states that it is vital to the future of the non-proliferation regime to limit the spread of enrichment and reprocessing technologies and that the IAEA is considering multi-nation arrangements to limit the expansion and use of these technologies (p. 3).

At least two multilateral proposals have been advanced to better manage the fuel cycle to reduce proliferation risks:

i. **the IAEA itself serve as guarantor of two fuel cycle services: supply of fissile material for fuel, and the reprocessing of spent fuel; and**

ii. **the most sensitive technologies be placed under multi-nation operation and control.**

1. Would you describe the various multilateral proposals that have been mooted or are being considered for the future management of the fuel cycle to reduce proliferation risks?

DG ASNO response The ideas mentioned above—the IAEA as guarantor and multination operation and control of proliferation-sensitive facilities—are two of a number of approaches being considered internationally to limit the spread of proliferation-sensitive technologies. Before discussing these ideas, I will briefly outline the context.

Broadly speaking, the technologies used to produce fissile material for reactor fuel—uranium enrichment and reprocessing (plutonium separation)—can also be used to produce fissile material for nuclear weapons. Accordingly, the importance of ensuring effective control over these proliferation-sensitive technologies—including limiting their spread—has been long recognised.

The NPT itself does not directly address this issue, other than through the commitments undertaken by non-nuclear-weapon states not to seek nuclear weapons, not to divert nuclear energy from peaceful uses to nuclear weapons, and to accept IAEA safeguards to verify fulfilment of these commitments. When the NPT was concluded (1968), it was expected that development of enrichment and reprocessing would be too complex and too expensive to be practicable for most countries. Instead, it was anticipated (as reflected in the wording of Article IV.2 of the NPT) that existing technology holders—principally the nuclear-weapon states—would provide fuel cycle services to other states. In fact the commercial nuclear industry has developed very successfully on this basis. Today most of the world's power reactors are fuelled through enrichment services provided by the US, UK, France and Russia, together with Germany and the Netherlands, and reprocessing services are provided by UK and France.

The main international barrier to the spread of enrichment and reprocessing technologies has been the guidelines on sensitive technology transfers established through the Nuclear Suppliers Group (NSG). However, the development of

indigenous technology by some countries, and especially the emergence of a black market based on stolen enrichment technology, demonstrate the need for additional measures.

The issue has been highlighted by the situation of Iran, which claims it needs to develop enrichment to ensure security of supply of nuclear fuel. Iran's argument about its "right" to develop the full fuel cycle should be seen against the following facts:

- Iran does not actually have a nuclear power program—it has only one power reactor under construction;
- Russia, which is building the reactor in question, has undertaken to supply fuel for 30 years;
- Iran has developed its enrichment program, and undertaken other nuclear activities, in secret over a period of some 20 years. This contravenes its IAEA safeguards agreement and the NPT, both of which require all nuclear activities and nuclear material to be placed under IAEA safeguards. The IAEA Board of Governors has determined that Iran is in non-compliance with its safeguards agreement.

At this time it is not clear how the Iranian situation will be resolved, but changing the fuel supply assurances given by Russia from unilateral to multilateral assurances could well be an important element in any peaceful resolution.

More generally, a number of ideas are being considered for developing an international framework that balances: (i) the right to benefit from nuclear energy; and (ii) the right to protect national and international security through reducing the risk of proliferation. Such a framework could include a combination of measures along the following lines:

(a) criteria for assessing the international acceptability of proposed sensitive projects—e.g. the non-proliferation/safeguards credentials of the country concerned; whether there is a clear economic/energy rationale for the project; whether the country is located in a region of tension; etc;

(b) a more rigorous safeguards regime for countries with sensitive facilities;

(c) internationally guaranteed supply assurances to ensure reliable access to reactor fuel for countries that forgo national enrichment and reprocessing capabilities; and

(d) possibly, establishment and operation of sensitive facilities on a multination basis.

In 2004 the IAEA commissioned a study by a group of international experts on possible multilateral approaches to the nuclear fuel cycle. This study covered the interwoven issues of "assurances of supply" and "restraints for use" together with the concept of "multinational fuel cycle facilities". The study drew extensively from a similar international review coordinated by the IAEA in the 1970s and early 80s—the International Nuclear Fuel Cycle Evaluation (INFCE).

In addition to these institutional ideas, a number of technical measures are under consideration which also address this general issue, specifically, the development of proliferation-resistant technologies, including in the future a nuclear fuel cycle that does not require enrichment and currently-established reprocessing technologies.

2. What is your assessment of the merits and challenges associated with these proposals and what level of international support is there for these proposals?

DG ASNO response The key question with these various proposals is whether they can succeed in persuading countries not to proceed with development of indigenous enrichment and/or reprocessing capabilities. This depends on the motivation for such development.

The situation is complicated by political considerations. For example, Iran, with the support of some members of the Non-Aligned Movement (NAM), makes much of the "right" to develop the nuclear fuel cycle (ignoring the point that rights bring corresponding duties, especially the obligation to comply with NPT and safeguards commitments).

A number of NAM members express concern that limits on the spread of sensitive technology will entrench the "monopoly" position of existing technology holders. This argument overlooks that, far from a monopolistic situation, the current market for fuel cycle services is highly competitive and buyers benefit from low prices. In any event, it is open for a customer to seek to acquire a shareholding in a fuel service provider, as Iran did with the French enrichment operator Eurodif.

Under current circumstances, with established global enrichment and reprocessing capacities exceeding demand, the development of indigenous enrichment/reprocessing is not economic, except possibly in the case of very large power programs. An example of the latter is Japan, which operates some 55 power reactors. Even Japan buys most of its enrichment from others, and the very substantial investment in reprocessing has been influenced not by current economics but by future fuel cycle plans (i.e. the development of fast neutron reactors). By comparison, the example of South Korea (currently operating some 20 reactors) shows that a large and expanding nuclear power program can proceed with great success on the basis of external enrichment services. The majority of the world's nuclear power programs are based on external fuel cycle service suppliers.

If a country's real motivation is to develop fuel cycle technology for military purposes, these proposals in themselves will not dissuade such a country. What the proposals can do, however—and this is important—is to expose the real reasons for a country's actions. If a country insists on proceeding with indigenous enrichment or reprocessing because of concerns about "energy security", despite being given long-term fuel supply guarantees, the international community can draw its own conclusions and act accordingly.

3. What is the status of international deliberations on proposed reforms?

DG ASNO response The IAEA's study on multilateral approaches to the nuclear fuel cycle was released in 2005. It is now up to governments to consider if any of the concepts in the study warrant taking further.

The other ideas outlined in the response to 1. above are likely to be considered further in forums such as the G-8 and the NSG.

At this stage the concept that has progressed furthest is that of providing nuclear fuel supply guarantees for countries that are prepared to forswear national enrichment and reprocessing programs. Two ideas are under development. The IAEA is developing a concept where the Agency would have available reserves of nuclear material in cooperating countries which it could release for supply to qualifying countries. And the US has announced a proposal to reserve an initial quantity of 17 metric tons of surplus US weapons-program high enriched uranium (HEU) for downblending and use as civil power reactor fuel, to be available to countries that forswear the development of enrichment and reprocessing. The US is now discussing the details of this proposal with the IAEA and some countries supplying fuel cycle services.

Another submitter (Mr Lance Joseph, submission no. 71, p. 3) has suggested that Australia should take on a catalytic role in pressing for greater international investigation of the 'IAEA-as-guarantor' proposal.

4. Would there be any merit in greater international investigation of the IAEA-as-guarantor proposal?

DG ASNO response Although Australia is a major supplier of uranium, we are not well placed to take on a "catalytic role" as Mr Joseph suggests. This is because the issue of supply guarantees relates much more to enrichment services, and also fuel fabrication services, than to uranium supply. Uranium is, or could be, supplied by many countries, but enrichment is supplied by a relative handful, and when it comes to supply of fuel for particular reactor models there may be only a single supplier.

As noted in the response to 3. above, the US concept of supply assurances is under discussion with the IAEA. At this stage it is not clear what the IAEA's role would be: whether the Agency would be one of a number of parties to a fuel guarantee arrangement, or would have a more active role, directly commissioning fuel on behalf of the requesting country. In principle, the involvement of the IAEA could help ensure confidence in the integrity/objectivity of any fuel guarantee arrangement.

Vulnerabilities of the NPT regime

At the opening of the 2005 NPT Review Conference, the Director-General of the IAEA described three vulnerabilities in the NPT regime: the acquisition by more and more countries of sensitive technologies; the uneven degree of physical protection of nuclear materials from country to country; and the limitations on the IAEA's verification authority.

5. How are these vulnerabilities being addressed through the IAEA and what action is Australia taking to assist in these endeavours?

DG ASNO response In addition to the vulnerabilities quoted above, another major issue is the need to improve the IAEA's technical capability to detect undeclared nuclear activities.

The issue of the spread of proliferation-sensitive technology has been discussed in the response to questions 1. – 4. above. Physical protection of nuclear material is discussed under question 7. below. The question of limitations on the IAEA's verification authority is discussed under question 6. Here I will outline the issue of detection of undeclared nuclear activities, and refer to Australia's contribution across these issues.

The objective of safeguards can be described as the timely detection of diversion of significant quantities of nuclear material from peaceful nuclear activities to manufacture of nuclear weapons or for purposes unknown, and the deterrence of diversion through the risk of detection. Thus detection capability is of fundamental importance to the effectiveness of the safeguards system.

IAEA safeguards have demonstrated a high level of effectiveness against "acquisition paths" involving declared nuclear facilities—removal of nuclear material from declared facilities, and/or misuse of such facilities. Acquisition paths involving use of undeclared nuclear material and undeclared facilities present a far greater challenge. Detection of undeclared nuclear activities is a major focus of the program to strengthen IAEA safeguards which was initiated after the first Gulf War, following the discovery of the clandestine Iraqi uranium enrichment program, and remains ongoing.

Strengthening safeguards to counter undeclared nuclear activities involves technical and political aspects. At the technical level, as mentioned, is the need to improve detection methods. At the political level, there is the need to extend the IAEA's authority to require information and inspector access, particularly through universalisation of the Additional Protocol (see below).

Central to the effort to strengthen safeguards is the effective use of **information**—involving collection and analysis of information that can enhance the IAEA's knowledge and understanding of nuclear programs—and providing more extensive rights of **access** to nuclear and nuclear-related locations, including for the resolution of questions arising from information analysis. Major areas of safeguards development include:

- detection methods for undeclared activities—including environmental sampling/analysis, satellite imagery and new sensing technologies;
- safeguards procedures—particularly greater use of unpredictability in inspections (e.g. through unannounced or short-notice inspections);
- the state-level approach—tailoring safeguards implementation to state-specific circumstances—moving from the uniform approach taken by safeguards in the past, and basing safeguards intensity on expert judgment taking account of all relevant circumstances.

Underpinning the program to strengthen safeguards is the **Additional Protocol**—a legal instrument complementary to safeguards agreements, which widens the IAEA's rights to information and inspector access. The IAEA Board of Governors agreed the text of the model Additional Protocol in 1997, and each country is asked to conclude an Additional Protocol to complement its existing safeguards agreement with the IAEA. While the uptake of Additional Protocols remains disappointing—to date, not quite 60% of NPT Parties have ratified or signed a Protocol—in terms of actual safeguards implementation, the situation is much more positive. Additional Protocols have now been ratified or signed by over 85%—55 out of 63—of those non-nuclear-weapon states that are party to the NPT and have significant nuclear activities.

Australia is playing a major role in the effort to strengthen the non-proliferation regime and IAEA safeguards. Some areas where we are active include the following:

- diplomatic efforts through the IAEA Board of Governors and through our extensive bilateral/multilateral contacts. Australia's significant nuclear science program, and our position as a major uranium exporter, gives Australia a permanent seat on the IAEA Board of Governors and substantial influence in international nuclear issues;
- a major contribution to safeguards development through SAGSI—the IAEA's Standing Advisory Group on Safeguards Implementation—of which I am the current chair. SAGSI has been at the forefront in developing new safeguards approaches and methods;
- Australia played a prominent role in the negotiation of the Additional Protocol, and we were the first country to sign and ratify an Additional Protocol (in 1997). We have played a key role in promoting the recognition of this instrument as the contemporary safeguards standard. Last year Mr Downer announced Australia would take the lead in making the Additional Protocol a pre-condition for the supply of uranium to non-nuclear-weapon states;
- we are actively engaged in outreach to other countries, providing training and other assistance on safeguards issues to countries in our region and elsewhere, and supporting IAEA efforts in this regard;
- we provide technical support to the IAEA through trialling of new safeguards approaches and methods in Australia, through a formal Safeguards Support Program covering safeguards R&D projects, and through making analytical and other capabilities of ANSTO available to the IAEA.

6. What is the nature of the limitation on the IAEA's verification authority?

DG ASNO response The IAEA's verification authority is defined by the terms of treaties and related legal instruments—principally the safeguards agreement between the IAEA and each country, and the IAEA's own Statute.

The principal limitation in safeguards agreements relates to rights of access for IAEA inspectors. Under "traditional" safeguards, access for routine inspections is limited to "strategic points" at facilities. This limitation was exploited by Iraq, which was able to conduct undeclared activities at safeguarded sites, at locations which inspectors

were not entitled to access. This limitation is largely addressed by the Additional Protocol, which introduces the concept of "complementary access", substantially extending the locations to which inspectors are able to go.

Another form of limitation, receiving international attention at the moment, concerns the IAEA's verification rights with respect to "weaponisation" activities. Current safeguards agreements are expressed in terms of verification of nuclear material. Certain weaponisation activities do not involve nuclear material, and are "dual-use" in nature, i.e. are not irrefutably limited to nuclear applications. Examples include experiments with high-explosive lenses, acquisition of particular types of high-energy electrical circuits, and certain types of high-speed cameras. Also there are certain non-nuclear materials, such as beryllium, polonium and tritium, which may evidence nuclear weapon intent but also could have other explanations.

The conventional view is that for the IAEA to have a right of access to investigate such activities there must be a clear "nexus" with nuclear material. For example, high-explosive testing with a uranium target would be a sufficient nexus, high-explosive testing with a target of non-nuclear material might not be.

This issue requires more deliberation by governments and the IAEA itself. Australia is active in pursuing analysis and debate on these issues by governments and the IAEA itself, with the object of further strengthening the non-proliferation regime.

Nuclear terrorism

7. Given the threat posed by the rise in terrorism and the implications for the security of nuclear facilities and materials, would you summarise what responses have been undertaken to address this matter through the IAEA?

DG ASNO response The IAEA has a number of activities, including production of detailed recommendations on international standards for protection of nuclear materials. One major activity is the conduct of a 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.

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. These missions have been well received and their number and scope continues to expand. Australia provides experts to assist in this program.

The annual report on the IAEA's nuclear security activities can be found at:

www.iaea.org/Publications/Reports/Anrep2004/nuclear_security.pdf

In 2002 the IAEA established the Nuclear Security Fund (NSF) specifically to handle voluntary contributions from IAEA Members to fund the Agency's nuclear security programme. As of 31 July 2005, this extra-budgetary fund had received a total $US36.7 million (from a pledged total of $US42.4 million by 26 Member States and

one non-governmental organisation), and "in-kind" contributions (from 18 Member States) in the form of cost free experts, offers of services, equipment and/or the use of facilities.

On request the Agency assists countries to implement their obligations under the Convention on the Physical Protection of Nuclear Material (CPPNM) and the Code of Conduct on the Safety and Security of Radioactive Sources, thereby contributing further to the security of nuclear and other radioactive material against terrorism, theft or sabotage.

Australia is a strong advocate of the Agency's nuclear security program. Australia supports efforts in the IAEA Board of Governors to strengthen the Agency's ability to counter the nuclear terrorism threat, has contributed to the Nuclear Security Fund and has furnished assistance in-kind. We have provided regional training and assistance on the security and physical protection of nuclear and radioactive materials and facilities.

Australia has been at the leading edge of efforts to strengthen the CPPNM and to develop the Code of Conduct on the Safety and Security of Radioactive Sources, mentioned above. Major amendments to the CPPNM were agreed by Convention Parties in July 2005, and are now with governments for ratification. The Code of Conduct was endorsed by the IAEA General Conference in 2003, and is also with governments for implementation. ARPANSA is coordinating Australia's implementation of the Code of Conduct, which is well advanced.

8. What implications, if any, do terrorist threats pose for Australia as potentially the world's largest supplier of uranium?

DG ASNO response In terms of the specific question asked, terrorist threats do not present a direct risk to Australia as a supplier of uranium. Australia produces and exports uranium ore concentrates (yellowcake), which has low levels of radioactivity and requires substantial upgrading before it is suitable for any nuclear use. Security measures applied at Australia's mines, in road and rail transport and at shipping facilities are considered appropriate to counter potential threats.

More generally, however, Australia takes a close interest in international action to counter the risk of terrorist actions against nuclear materials and facilities, given the potential of such actions to affect public health and safety and confidence in nuclear energy. Our interest is reflected in the actions outlined under question 7. above.

<u>Possible development of nuclear power in Indonesia, Thailand and Vietnam</u>

The Minister's submission states that Indonesia, Thailand and Vietnam are also considering the possibility of nuclear power (p. 6).

9. What is the status of plans for use of nuclear power in these countries?

DG ASNO response Indonesian officials are planning on the basis that construction of the country's first reactor could start in 2010 and be completed by 2016. The proposed site is the Muria Peninsula in Central Java. Plans include a further three nuclear power plants to be constructed by 2025. At this stage, however, it is

understood the Indonesian government has not taken a final decision to proceed with this program. A critical issue is how the very substantial capital requirements would be funded.

The Vietnamese government is currently considering a "National Strategy on Development and Uses of Nuclear Energy for Peaceful Purposes". This sets out a plan for completion of the first nuclear power plant by 2020 and a preparatory plan for a long-term multi-unit nuclear power development program. It is not known when a decision might be taken on these plans.

Although there has been some debate within Thailand about nuclear power, it is understood the Thai government is only in the preliminary stages of considering the possibility of nuclear power. There are no firm plans for the use of nuclear energy in Thailand.