EDUCATION, SCIENCE AND TRAINING

SENATE LEGISLATION COMMITTEE - QUESTIONS ON NOTICE
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Outcome: ANSTO
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DEST Question No. E720_07

Senator Wong asked on 1 November 2006, EWRE Hansard page 43:

Question:

Senator WONG—Before the break you were telling me that ANSTO had provided various other documentation to the [UMPNER] inquiry. I am asking you to provide copies of that documentation to the committee.

Answer:

UMPNER

ANSTO has provided the following response:

That documentation is attached.

Executive Summary

Information included in this document provides responses to requests for further information from UMPNER secretariat regarding:

- The impact of reversibility and retrievability on repository design
- The effect of partitioning and transmutation on repository design
- Physical Protection and Safeguards of Nuclear Materials and Facilities
- Legislative restrictions on the areas in which ANSTO is allowed to perform research.
- R&D being carried out by uranium mining/milling companies.

What is the impact of reversibility and retrievability on repository design and operation?

The development of high-level waste repositories is well advanced in Finland, Sweden and the US and in other countries, e.g. France, well-defined timeframes for the establishment of disposal facilities have been developed.

These planned disposal facilities are based on step-wise implementation of facility development and generally allow for reversibility[1] of development stages and retrievability[2] of waste. Reversibility aims to facilitate safe emplacement of the waste without removing the option for future generations to modify or reverse the arrangements for its final disposition. Nevertheless, a decision to proceed with reversible and retrievable disposition of waste must be planned and carried out carefully to ensure that there is no undue burden on future generations. In addition to the concern of creating an undue burden on future generations, there are additional requirements for the design of a repository that allows retrievability of waste to ensure that nuclear safeguards requirements are met and irresponsible attempts to recover the waste are prevented.

In Finland[3], spent nuclear fuel (SNF) will be disposed directly into a deep geological repository located in a granitic formation. The disposal plan does not include retrievability but does include a lengthy interim storage period that could allow for continued storage of SNF before disposal or a decision to be made to reprocess the SNF. A decision to reprocess the SNF will not impact on the repository design as the Finish disposal concept is applicable to both SNF and vitrified HLW from reprocessing.

In Sweden[4], plans for the disposition of SNF envisage that the disposal will initially be retrievable and reversible. Under these plans, the repository will be developed in stages with an initial emplacement of 200 to 400 canisters. This initial stage is planned to operate for about three years. After this period, the results arising from studies of the waste package performance during emplacement will be evaluated as part of preparing a licensing application for the routine operation of the repository[5].

In the US[6], the 2001 National Energy Policy recommended that the US

[1] Reversibility denotes the reversing of steps in repository planning or at any stage in the development. This means that the policy for waste disposal includes fall-back positions and to aid the implementation of such a policy the development proceeds in small steps with frequent reviews (NEA, 2001, Reversibility and Retrievability in Geological Disposal of Radioactive Waste – Reflections at the International Level, NEA, Paris, http://www.nea.fr/html/rwm/reports/2001/nea3140.pdf .)

[2] Retrievability refers to the reversing of waste emplacement, i.e. by recovering of the waste packages. *Ibid.*

[3] Report to the Second Review Meeting of the Joint Convention on the Safe Management of Spent Nuclear Fuel and Safe Management of Radioactive Waste, 2005, http://www.stuk.fi/julkaisut/stuk-b/stuk-b-yto243.html .

[4] http://www.skb.se/default2____16778.aspx

[5] Stig Pettersson, Eva Widing, 2003, Development Of The Swedish Deep Repository For Spent Nuclear Fuel In Crystalline Host Rock, WM'03 Conference, February 23-27, 2003, Tucson, AZ, http://www.wmsym.org/abstracts/2003/pdfs/299.pdf

[6] http://web.em.doe.gov/Second_National_Report--Final_Rev_30.pdf

"…develop reprocessing and final treatment technologies that are cleaner, more efficient, less waste intensive, and more proliferation resistant."

This recommendation forms the basis for continuing US research on recycling of SNF without separation of plutonium and uranium.

Any decision to recycle SNF in the US will not impact markedly on the development of the Yucca Mountain repository as vitrified waste is already part of the inventory designated for disposal in this repository. Currently, it is planned that Yucca Mountain will be kept open for at least fifty years after waste emplacement begins[7] which will allow for retrieval of waste emplaced in the repository although ultimately the time that the repository will remain open will be determined through the site licensing process.

Overall, the main advantage of reversibility and retrievability is that they contribute to building stakeholder confidence in the safe performance of the disposition route for SNF and HLW although this results in an increase in the complexity of repository design.

What is the effect of partitioning and transmutation on waste disposal?

The development of partitioning methods for the recovery of minor actinides has been carried out over the last fifteen years in Europe, France[8] and Japan. One major aim of partitioning and transmutation (P&T) is to reduce the long-term radiotoxicity of HLW. To achieve this aim, long-lived radionuclides, i.e. those with half-lives greater than 10,000 years, need to be removed from the waste and then transmuted to shorter-lived radionuclides.

Calculations have shown that the removal of uranium and plutonium reduces the radiotoxicity in HLW by 80% over the first three hundred years and 90% over the first five hundred years. Currently, technology is in place to achieve these levels of reduction in radiotoxicity using reprocessing coupled with a with MOX fuel utilisation. For example, in France, in 2002, there were twenty, 900 MW PWRs using MOX as 30% of their fuel charge with two of these reactors using recycled uranium from SNF reprocessing.

Detailed analyses of the effect of P&T on the HLW requiring geological disposal has been carried out by a group of experts for the OECD/NEA[9]. Their study considered a wide range of aspects of the operation of nine fuel cycle schemes with four variants. Results from modelling of these fuel cycle schemes showed that after fifty years of cooling the decay heat in waste resulting from the different schemes does not vary greatly but after two hundred years, the decay heat is up to a factor of thirty lower in all minor actinide P&T schemes compared to the once through PWR reference case.

The vitrification of waste from reprocessing after minor actinide separation results in a waste that is easier to handle and places less restraints on the design of a repository. However, it should be noted that for fuel cycles based on fast reactors and high burn-ups it might not be possible to carry out aqueous recycling and pyro-processing might be required to handle the high thermal output and gamma radiation levels. The use of this latter reprocessing technique could result in HLW contaminated with chlorides and fluorides. These contaminants would need to be removed or immobilised in special waste matrices to limit corrosion of containers and engineered barrier deterioration associated with the release of these salts. As yet, these conditioning routes have not been developed.

Advanced fuel recycling options incorporating minor actinide burning markedly reduce the size of a repository and the length of time that wastes needs to be isolated from the environment. However, until detailed site-specific studies are undertaken, it is not possible to determine if these reductions in waste inventory, radiotoxicity and use of alternative waste forms would allow HLW to be disposed in shallower, less technically complicated geological repositories.

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7 http://web.em.doe.gov/Second_National_Report--Final_Rev_30.pdf

8 French Research and Development on the Partitioning and Transmutation of Long-lived Radionuclides: An International Peer Review of the 2005 CEA Report, Paris, 2006, NEA document number 6210.

9 OECD/NEA, 2006, Advanced Nuclear Fuel Cycles and Radioactive Waste Management, NEA document number 5990.

1. PHYSICAL PROTECTION AND SAFEGUARDS OF NUCLEAR MATERIALS AND FACILITIES

After the events of September 11, 2001, the security and physical protection of nuclear facilities was the subject of intense scrutiny to determine whether existing arrangements could avert perceived terrorist threats. In particular, there was a consensus that security arrangements would need to be able to handle[10]:

- Terrorist acquisition of an intact or crude nuclear device,
- The deployment of radiological dispersal devices (RDDs or dirty bombs) and/or
- Terrorist attack on a nuclear facility.

Examination of scenarios involving acquisition of nuclear devices or deployment of RDDs have focussed attention on the security of nuclear materials. Consequently, enhanced controls over sensitive materials have been implemented to reduce the number of nations, reactors and facilities that produce or use highly enriched uranium (HEU), to accelerate down-blending of HEU, to reduce the number of nuclear outlets, to upgrade security around the world, and to improve procedures for control of sources.

In addition, to the protection of sensitive materials, there has been an increased focus on preventing rogue states from developing capabilities to produce these materials clandestinely for military use. These concerns have been fuelled by revelations that there has been a "black-market" in sensitive technology between some nations to facilitate clandestine weapons development. Further proliferation concerns have been associated with States obtaining technologies for production of sensitive materials legitimately as a party to the NPT before leaving the NPT to pursue a weapon capability. Current proliferation control regimes have been seen to be ineffective in controlling these types of activities.

Consequently, there have been numerous efforts to strengthen the current proliferation regime. Wolfsthal (2004)[11] notes that strategic and tactical approaches to the handling of these issues have been proposed. Strategic proposals include the following:

- States that violate safeguards agreements should have their rights to develop facilities rescinded by the international community
- Withdrawing from the NPT should not relieve States of their responsibilities and failure to honour these responsibilities should be met by dismantling and demolition of illegal facilities by the international community.
- The Additional Protocol should be made universal to all States
- Export bans should be applied to any transgressing States

These proposals are well-formed, however, recent experience has underlined that it is almost impossible to gain international consensus on implementing punitive processes.

Tactical proposals put forward by the IAEA[12] and separately by the US aim to limit the numbers of nations with proliferation sensitive facilities, e.g. reprocessing and enrichment, or to place all existing facilities under international control. However, these approaches remain the centre of international debate without the development of a shared vision of the future. Generally, Wolfsthal (2004) notes that the US proposals would allow States to maintain and enhance existing networks at the expense of the ability of other nations. Whereas, the IAEA would seek to avoid this technological division between States by taking international control of all facilities. This latter approach assumes that a way could be found to hand existing

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[10] http://www.ceip.org/files/projects/npp/resources/2004conference/summary/nuclear.htm

[11] http://www.wmdcommission.org/files/No11.pdf

[12] http://www.iaea.org/Publications/Documents/Infcircs/2005/infcirc640.pdf

facilities over to the international community. It should be noted that, even if this approach could be progressed, there is no guarantee that it would limit the dissemination of sensitive knowledge as, for example, A. B. Khan obtained his knowledge of enrichment while working in a European-controlled facility.

Proliferation controls are also being developed that are more intrinsic to nuclear fuel cycle activities. For example, proliferation resistance of reprocessing circuits is being enhanced by the development and implementation of schemes in which uranium and plutonium are not produced as separated streams. This approach will be aided in advanced fuel cycles by the burning of minor actinides and plutonium in Generation IV reactors.

Concerns about an attack on a nuclear facility led the US to re-visit the "Design Base Threat" (DBT) used as the basis for developing security arrangements. The underlying assumptions of the DBT were updated, post September 11, to reflect that attackers:

- Would be well-trained and dedicated individuals,
- Receive inside assistance from a knowledgeable person
- Have hand-held automatic weapons, with long-range accuracy,
- Have hand-held equipment to facilitate their mission,
- Have a four-wheel drive vehicle for transport and
- Be able to detonate a vehicle bomb.

These assumptions formed the basis for determining the required physical security upgrades to existing NPPs and led to the formulation of additional NRC regulations for security protection at NPPs in the US that have been emulated elsewhere. As a consequence, these upgrades focussed on vehicle control measures, personnel reliability checks, armed security officers and protected defensive positions, appropriate delay and engagement barriers, and tactical response training[13]. In addition, a number of countries, including the US and Switzerland, carried out studies of the effect of aircraft impact on the safety of NPPs[14]. The US study found that although the NPPs were not designed to withstand a September 11-type attack they were well designed for a number of other scenarios and the high degree of over engineering meant that in the most part the NPPs would resist any impact without any radiation release arising from the impact of heavy aircraft. Similarly, the Swiss study found that the combination of plant location and viable approach speeds resulted in a small impact on their NPPs.

In the next generation of NPPs, physical resistance to attack will be part of the design of the reactor buildings. In addition, design features including a resistance to core melt down and a greater level of inherent safety features that require no active control or operational intervention to avoid accidents coupled with simpler more rugged designs will augment the increased physical protection features currently being used with operating NPPs.

In more detail, within Australia, the physical protection of nuclear materials and nuclear facilities is conducted under an international orientated regime that that is refined to be in concert with from the Australian Governments protective security. In particular, the following physical protection (PP) issues to be considered include:

- Obligation and Compliance
- Legislation
- Regulation
- Implementation of Physical Protection at Facilities

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13 http://www.ceip.org/files/projects/npp/resources/2004conference/speeches/meserve.ppt
14 http://www.world-nuclear.org/info/inf06app.htm

2. OBLIGATIONS AND COMPLIANCE

Physical protection and safeguards of nuclear materials and facilities are subject to the obligations of an international regime and compliance within a national regulatory and legislative framework.

2.1 International obligations

- Convention of Physical Protection of Nuclear Materials (CPPNM)
- Nuclear Non-Proliferation Treaty (NPT)
- Bilateral Agreements
- IAEA Safeguards
  - Nuclear Material Accountancy and Control
  - Integrated Safeguards
  - Additional Protocol

2.2 National compliance

- ASNO PP and Safeguards Permits
- ARPANSA Safety Licences
- Protective Security Manual (PSM)
- National Counter Terrorism Plan (NCTP)

2.3 Convention on Physical Protection of Nuclear Material

Mainly concerned with transport of nuclear materials and is based on a categorisation of the type, enrichment and amount of nuclear materials.

2.4 Bilateral Agreements

Australia has bilateral agreements with – Argentina, Canada, Czech Republic, Egypt, Euratom, Finland, France, Hungary, Japan, Mexico, New Zealand, Philippines, Republic of Korea, Russia, United Kingdom, United States, Sweden and Switzerland.

Australia's bilateral agreements require adherence with the recommendations of the IAEA document INFCIRC/225/Rev.4, *Physical Protection of Nuclear Material and Nuclear Facilities*. The INFCIRC/225 statement of objectives for the IAEA member state's physical protection system are -

(a) To establish conditions which would minimise the possibilities for unauthorised removal of nuclear material and/or for sabotage: and

(b) To provide information and technical assistance in support of rapid and comprehensive measures by the State to locate and recover missing nuclear material and to cooperate with safety authorities in minimising the radiological consequences of sabotage.

The document details minimum standards for PP based on the categorisation of the type, enrichment and amount of nuclear materials as well as consideration of sabotage. The document does not categorise facilities.

2.5 Safeguards

Safeguards compliance comes under the Safeguards Act which relates Australia's treaty commitments under the Nuclear Non-Proliferation Treaty (NPT) and safeguards agreement with the IAEA.

2.6 ASNO Permits

The current ASNO permits for physical protection are performance based which could be applied to other sectors of the nuclear fuel cycle. There is another approach, the prescriptive method, which has been addressed in further sections of this document.

Currently ANSTO is subject to three permits issued by ASNO –

- PN001 – Permit to Possess Nuclear Material
- PA001 – Permit to Possess Associated Items (Equipment and Technology)
- PA002 – Permit to Possess Associated Items (Associated Material)

To facilitate the regulatory process during the construction of the OPAL Replacement Research Reactor (RRR), a transient permit – EF001 "Permit to Establish a Facility" was issued by ASNO. This enabled ANSTO to construct OPAL in a construction and commercial contract environment which did not actually involve nuclear materials until the final stages.

2.7 ARPANSA Licences

ARPANSA is the nuclear safety and radiation protection regulator under the ARPANS Act. Currently the ARPANS Act prohibits ARPANSA from licensing specified nuclear activities i.e. power plants, fuel fabrication, enrichment or reprocessing plants.

2.8 Protective Security Manual (PSM)

The PSM is the Australian commonwealth government's standard for protection of assets, information and personnel. It identifies the risks to an agency's functions and security classified information and the treatments required. The requirements are based on risk management with an intelligence led approach involving threat levels and scalable security arrangements.

2.9 National Counter Terrorism Plan (NCTP)

The NCTP outlines responsibilities, authorities and the mechanism to prevent, or if they occur, manage acts of terrorism and their consequences within Australia. The plan has a strong intelligence led arrangement that provides response based on detailed preparedness, capabilities and contingencies. It is a threat level methodology that relies on scalability of security arrangements.

NCTP Key Strategies –

- Clear understanding of responsibilities, authorities, roles and jurisdiction
- Strong cooperation, coordination and consultations (state & territories)
- Intelligence-led prevention - collection, sharing, assessment and investigation
- Threat assessment and national counter-terrorism alert levels

- Close cooperation, other IAEA member states
- Appropriate agency links
- Prosecution of criminal acts relating to terrorism
- Public awareness

3. LEGISLATION

Physical protection involves an IAEA member state's internal security and is an area where a state's sovereign authority is most carefully recognised and maintained.

In Australia, the legislative basis for physical protection measures at nuclear sites was established in the *Nuclear Non-Proliferation (Safeguards) Act*, 1987 - nationally referred to as the "Safeguards Act". An integral part of this Act of the Australian Parliament is Schedule 4, the *Convention on the Physical Protection of Nuclear Material*, published by the IAEA as INFCIRC/274. In addition, Australia's bilateral agreements require compliance to the IAEA document INFCIRC/225/Rev.4, *Physical Protection of Nuclear Material and Nuclear Facilities*.

The Safeguards Act establishes the statutory office of *Director of Safeguards* and also the *Australian Safeguards Office (ASNO)*. ASNO reports to Parliament through the Minister for Foreign Affairs and Trade. The Safeguards Act also establishes a system of Permits and Authorities to possess nuclear material and associated items, to transport nuclear material and associated items and to communicate information. Nuclear material is defined as special fissionable material and source material, as those terms are defined in Article XX of the Statue of the IAEA (see Schedule 1 of the Safeguards Act). Associated items are defined as non-nuclear material, like graphite and heavy water, plus equipment and technology; what is often called intellectual property these days.

The Safeguards Act establishes penalties for possession of nuclear material or associated items without a permit, breaches of permit conditions and unauthorised communication of information. In December 2003, the Safeguards Act was amended to declare Protected Areas as "Prohibited Areas" with gaol terms in lieu of fines for trespass and release of confidential information in regard to nuclear facilities. This has a strong deterrent effect and is also effective in addressing the threat of terrorists using the cover of protest.

The Australian Nuclear Science and Technology Organisation (ANSTO) is a Commonwealth Government statutory authority established by the Australian Nuclear Science and Technology Organisation Act 1987. ANSTO reports to parliament through the Minister for Education, Science and Technology. ASNO issues permits for ANSTO to possess nuclear material and associated items, to transport nuclear material and associated items, provided satisfactory physical protection standards are maintained. These standards are based on the current revision of INFCIRC/225/Rev.4.

The Australian Radiation Protection and Safety Agency (ARPANSA) is a Commonwealth Government statutory authority established by the ARPANS Act 1998. ARPANSA reports to Parliament through the Minister for Health and Aging. ARPANSA is charged with responsibility for protecting the health and safety of people, and the environment, from the harmful effects of radiation. ARPANSA performs its regulatory role by issuing licenses to permit Commonwealth radiation and nuclear activities dealing in radioactive materials or apparatus, or any aspect of a nuclear facility. ARPANSA is subject to ASNO regulation in respect of its possession of sensitive information.

In Australia there is a strong demand for transparency on nuclear safety issues. The Australian Radiation Protection and Nuclear Safety Act contains obligations for the publication of information relevant to safety and radiation protection. However, ARPANSA is aware of the need to balance these general reporting obligations with the need for confidentiality regarding detailed physical protection measures.

4. REGULATION

Both ASNO (safeguards and physical protection) and ARPANSA (nuclear safety) have roles as regulatory bodies. ARPANSA's licenses have a component of security and the arrangements listed below were implemented to address the potential for regulatory overlap -

- Memorandum of Understanding for Cooperation in Nuclear Regulatory Affairs between ASNO and ARPANSA was concluded between ASNO and ARPANSA in June 1999 to eliminate the potential for conflict in regulatory requirements.
- Memorandum of Understanding between ASNO, ARPANSA, ANSTO and ASIO on the Evaluation Process to be Applied to the Replacement Research Reactor Physical Protection System (2003)
- ASNO and ARPANSA Joint Acceptance Criteria for ANSTO's Replacement Research Reactor Security Plan. The actual assessment of the plan was conducted by ASNO who were to ensure that both ASNO's and ARPANSA's requirements were met. The 10 points were the same as the existing permits and proposed variations of the permits.

To facilitate the regulatory process during the construction of the OPAL Replacement Research Reactor (RRR), a transient permit – EF001 "Permit to Establish a Facility" was issued by ASNO. This enabled ANSTO to construct OPAL in a construction and commercial contract environment which did not actually involve nuclear materials until the very final stages. The construction period was subject to a RRR Construction Security Plan which was an integral component of the permit compliance. This process was a sensible and reasonable approach which facilitated the project in the construction environment.

The current permit strategy is performance based whereby ANSTO as a facility operator was required to submit a proposal for a physical protection system that would comply with Australia's international obligations and national compliance in line with a "ten point plan" –

1. Security Management
2. Site Security and Threat Assessment
3. System of Physical Protection and Security
4. Access Control
5. Personnel Security
6. Security of Information Management
7. Performance Assessment
8. Record Keeping
9. Reporting
10. Review

5. REGULATORY APPROACH

Currently there are two approaches to regulation of PP and safeguards i.e. prescriptive and performance based. The prescriptive approach is based on uniform PP measures that may not, in fact, be entirely suitable for the particular location or circumstances and may entail higher than necessary intrusiveness and/or high costs. This is the course taken by the US Nuclear Regulatory Commission. In Australia, ASNO requires each operator to propose their own ideas for solving their particular PP problems. These schemes are assessed by ASNO together with the Government's security advisers (ASIO), and the relevant PPS is laid down as part of the Permit issued by ASNO to the Permit holder (the operator). If conditions change at a site, or if an ASNO inspection finds deficiencies, then the Permit requirements may be amended.

The future regulatory body will need to determine whether the future approach will be performance or prescriptive. Currently having only one facility is straightforward but having a number of different types of facilities with different PP arrangements may be cumbersome with a performance approach. Then again, a prescriptive approach is difficult to maintain if there are a number of different types of nuclear facilities, plant designs or sectors of the nuclear fuel cycle.

ANSTO is a commonwealth government research facility. In the case of power plants, enrichment or fabrication, they will most likely be commercial concerns. At this time it is not clear whether these will under commonwealth or state control or private. They will require strict regulation but they will also need to be commercially viable to encourage substantial private sector investment and expected returns. Overlap of regulation would be a very difficult situation.

6. IMPLEMENTATION OF PHYSICAL PROTECTION

The objectives of a Physical Protection System (PPS) are to prevent unauthorised access to or theft of nuclear material and to prevent industrial and radiological sabotage. A PPS is intended to accomplish these objectives against sub-national adversaries such as criminals, terrorists and anti-nuclear extremists.

International PP is based on a minimum standards concept where there are defined PP requirements based on a categorisation of type of NM, enrichment and amount or the facility sabotage risk. However, the Australian national approach to protective security is based on a risk management concept of protective security which relates likelihood to consequence. This is in conjunction with the National Counter Terrorism Plan (NCTP) that defines threat levels and a scalable security system.

An effective PPS includes many diverse types of components and can involve different organisations within a State.

- Prevention
- Minimise possibility for unauthorised removal of NM or sabotage
- Evaluate threat, threat assessment & level, Design Basis Threat
- Graded Approach (Attractiveness, material, consequences)
- Risk Management (Likelihood vs Consequences)
- Defence in Depth - Deterrence, detect, assess, delay, response, contingencies
    - Authorised and limited access, Protected Areas
    - Balance - Policies, procedures, IT, physical, technology, guarding, personnel checking
    - Integrated technology based
- Confidentiality
- Provide assistance to locate and recover

Facilities need to address minimum standards, risk management NCTP and most importantly the business and operations in a balanced manner. This is achieved in an overall security plan approach that addresses all the criteria in a realistic, practical and cost effective way which will be paramount if the private sector is involved as there is a strong need to be commercially viable.

As ANSTO is essentially a research organisation the PP strategy has been to have an effective and efficient PP but at the same time having a perspective of an open facility to research stakeholders that encourages international researchers and collaboration. This is a common practice with nuclear research reactors internationally and in many cases they are on a university campus. With an expanded nuclear program there will be a need to encourage students to pursue a nuclear career which will be an important feeder of engineers, researchers, operators, etc.

Other facilities in the nuclear fuel cycle e.g. nuclear power reactors, enrichment or fuel fabrication plants are more or less “closed” facilities with even more stringent PP arrangements due to different sets of risk assessments and consequence analysis.

Australia currently only has a limited fuel cycle, however, INFCIRC225 Rev 4 would be applicable to other types of facilities as it addresses PP as a categorisation of material and does not categorise facilities.

In general terms the ANSTO security plan adopts a defence-in-depth and vital area strategy in line with current international and national practice utilising Deterrence, Detection, Delay and Response.

One of the primary considerations in the design of a physical protection system is the threat definition and analysis. The designer of the system must take into consideration the intentions and capabilities of the perceived adversaries and their motivation.

The relevant Government body that addresses these items is the Australian Security Intelligence Organisation (ASIO). Their personnel include persons expert in the methods that could be used in penetrating fences, buildings, locked doors and bypassing alarm systems. They also conduct an evaluation program which assesses the relative efficiencies and strengths/weaknesses of perimeters, structures, buildings, locks, seals, filing cabinets, alarm systems and communication devices proposed for use in the Australian Government service.

As a result of these evaluations, ASIO endorses certain products for particular situations, and prescribes how they should be installed. It also indicates how the devices should perform in service. Since Australia is a large country with several climatic zones, this information is very useful. For example, the uranium mining companies find themselves in the middle of desert-like terrain (Olympic Dam) or in a tropical environment (the Ranger mine at Jabiru, N.T.).

Once the design basis threat has been determined, then we can determine what to protect and how to protect it. The system should provide four basic functions - deterrence, detection, delay and response (see below).

<u>Deterrence</u> - Can be achieved by two elements - laws of the state and security measures.

It is prudent to have some PP measures of an overt nature to give the perception of a hardened target which would be the case with some of the types of facilities proposed in an expanded nuclear fuel cycle as opposed to a research facility. Overwhelming experience has shown that the general public has expectations that the commonwealth government has a responsibility to have substantial security in place at a nuclear facility.

<u>Detection</u> - If deterrence fails, then physical protection depends upon the detection function.

<u>Delay</u> - Delay functions of the physical protection system somewhat overlap the detection function. The objective of the delay function is to prohibit the adversary from completing their task before detection and response functions are initiated.

<u>Response</u> - Response consists of the actions taken by the protective forces to prevent the adversary's success.

Cabinet Decision 11496 dated 26th July 1988 determines that the Australian Federal Police (AFP) provides proactive and reactive guarding, an on-site and off-site counter terrorism Advanced First Response (AFR) and incident coordination pursuant to the *Australian Federal Police Act 1979.*

AFP Officers are empowered under this Act to arrest or unarrest, without warrant, people contravening specified Commonwealth Acts relating to the protection of Commonwealth establishments, Commonwealth employees, Internationally Protected Persons and Commonwealth assets and in particular the Nuclear Non-Proliferation (Safeguards) Act.

The AFP is the only commonwealth government agency that provides an AFR capability. There are no other police or guarding providers/contractors in Australia that provide this type of service. In the event of an expanded nuclear fuel cycle there would be a need to address this issue from both the resources and legislative perspectives.

6.1 Personnel

Security vetting is conducted in accordance with the PSM to ensure the trustworthiness of relevant staff, authorised officers, area supervisors, contractor supervisors and contractors, etc. Security clearances are the main element in protection against insider threat.

7. SINCE 11 SEPTEMBER 2001

In many ways these attacks redefined the threats in a number of ways – motivation, aim, tactics, methods and resources which resulted in a wholesale review of PP at nuclear facilities. Some examples –

- Initially temporary PP measures were put in place in line with these attacks and other subsequent related threats. PP facilities have been making permanent these measures in the last few years
- With additional technical measures and systems implement their was a immediate need to integrate the systems
- Realisation that the threats do not consider international borders
- Review Design Basis Threat
- Place a higher emphasis on personnel checking
- PP arrangements needed to be scalable to cope with variable threat levels
- Strengthened intelligence capabilities and coordination and links in government
- Reviewed legislation and introduced new anti-terrorism legislation

8. DESIGN BASIS THREAT (DBT)

One of the primary considerations in the design of a physical protection system is the threat definition and analysis. The designer of the system must take into consideration the intentions and capabilities of the perceived adversaries and their motivation.

A DBT is described as attributes and characteristics of an adversary who might attempt theft or sabotage. The definition in INFCIRC/225/Rev.4 - “The attributes and characteristics of potential insider and/or external adversaries who might attempt unauthorized removal of nuclear material or sabotage, against which a physical protection system is designed and evaluated.”

A DBT for a nuclear facility is determined as the most credible threat for the facility for the medium term (10 years). Other threats would be described as Beyond DBT and would be addressed as a national responsibility under the National Counter Terrorism Plan.

Currently the DBT is determined by ASNO as the competent authority in consultation with ASIO based on the threats -

- Outsiders
  - Terrorists
  - Criminals
  - Extremists
  - Protestors (IMGs)
- Insiders
  - Hostile employees
  - Psychotics
  - Blackmailed or threaten employees
  - Criminals
- Outsiders in collusion with insiders

9. NPP vs REACTORS PP

Essentially research facilities have a PP strategy that is a deterrent but at the same time having a perspective of an open facility to research stakeholders that encourages international researchers and collaboration. This is a common practice with nuclear research reactors internationally and in many cases they are on a university campus.

Other facilities in the nuclear fuel cycle e.g. nuclear power reactors, enrichment or fuel fabrication plants are more or less “closed” facilities with even more stringent PP arrangements due to different sets of risk assessments and consequence analysis.

However, NPPs tend to have substantial containment structures which although are mainly for safety reasons, provide effective physical protection. There has been extensive work to determine what these structure can actually handle in the event of an attack with an obviously concentration on aircraft impact.

10. SAFEGUARDS

The current safeguards regime would most likely handle nuclear material accountancy and control for any further nuclear fuel cycle options in Australia.

Firstly, the principles of physical protection are realised through administrative and technical measures, including physical barriers. The level of physical protection provided to nuclear materials is ultimately the responsibility of the IAEA member state in which the material is located. Secondly, the state's assessment of the threat should take into account the state's emergency response capabilities and the existing and relevant measures of the State System of Accounting for and Control of nuclear material. There is recognition that safeguards and physical protection measures can usefully reinforce each other in an integral manner.

11. CONCLUSION

IAEA member states provide physical protection to nuclear materials and nuclear facilities at the levels recommended by INFCIRC/225/Rev.4 and the Categorisation of Nuclear Material Table therein. These are minimum standards as compared to risk management.

Although physical protection must be maintained at all times, it is important for designers and operators to take into consideration the daily business, operations and functions of the facility.

PP can be achieved by systems that provide deterrence, detection, delay and response. These can be achieved by a cost effective balance of many elements – legislation, regulation, design basis threat, physical barriers and buildings, technology, procedures, administration, personnel security, guarding and response forces. It is a matter of adopting the appropriate elements best suited to the state and the facility to implement an overall PP system.

ANSTO OPAL is a Commonwealth Government research facility. In the case of power plants, and enrichment or fabrication facilities, they will most likely be commercial concerns. At this time, it is not clear whether these will under commonwealth or state control. They will require strict regulation but also need to be commercially viable to encourage substantial private sector investment and their expected returns. Consequently, any overlap of regulatory responsibilities would create a difficult situation.

It is fundamental and very cost effective to integrate the PP into the early design phase of any facilities.

There needs to be a process developed for establishing and approving a facility taking into consideration the commercial and contractual environment.

The AFP is the only commonwealth government agency that provides an AFR capability. There are no other police or guarding providers/contractors in Australia that provide this type of service. In the event of an expanded nuclear fuel cycle there would be a need to address this issue from both resources and legislative perspectives.

There would be a need to examine the direction of regulation framework/regime of a proposed expanded fuel cycle to ensure there is balanced process and to whether it should be performance or prescriptive based. Instead of attempting to re-invent the wheel, it would be prudent to examine this issue in contact with Australia’s bilateral partners in the light of current international practices, experiences and lessons learnt.

What legislative restrictions are there on the areas in which ANSTO is allowed to perform research? How would current legislation need to be changed to lift the restrictions?

The powers under the ANSTO Act in relation to research are sufficiently wide. Section 5(1)(a) of the Act provides:

(1) The functions of the Organisation are:

(a) to undertake research and development in relation to:

(i) nuclear science and nuclear technology; and

(ia) the application and use of nuclear science and nuclear technology; and

(ii) the production and use of radioisotopes, and the use of isotopic techniques and nuclear radiation, for medicine, science, industry, commerce and agriculture; and

(iii) such other matters as the Minister directs

Research into the areas the subject of the UMPNER review would be covered by subparagraph (i). If there were ever any doubt as to whether a particular area of research was covered by that subparagraph, a Ministerial direction under subparagraph (iii) would remove that doubt.

The only prohibition on areas of research contained within the Act is subsection 5(2):

> The Organisation shall not undertake research or development into the design or production of nuclear weapons or other nuclear explosive devices.

ANSTO sees no need to consider any amendment to that subsection.

7. The Task Force identified the time required to set up a regulatory structure for licensing NPPs as a likely major impediment to nuclear power in Australia. This was not addressed in the draft chapter and we would like ANSTO ideas on what the extension to ARPANSA might look like to enable smooth issue of a licence to a constructor. Note that the ARPANSA submission may comment on this but has not yet been received.

The regulatory structure for radiation protection within Australia is extremely and unnecessarily complex. Not only are there regulators in each of the states and territories, but there are three regulators at federal level:

- ARPANSA, an agency located within the Health and Ageing portfolio. Their primary responsibilities are in the area of radiation protection and nuclear safety;
- ASNO, part of the Department of Foreign Affairs and Trade, charged with implementation of safeguards and physical protection of nuclear material and facilities; and
- The Supervising Scientist Division of the Department of the Environment and Heritage, which plays a role in relation to the regulation of uranium mines located in the Alligator Rivers region of the Northern Territory.

As flagged in section 4.4.1 of our submission, there are also requirements for approvals of "nuclear actions" under the *Environment Protection and Biodiversity Conservation Act 1999*, thus effectively creating a fourth regulator.

As noted in our submission, in practice both ARPANSA and ASNO assert some degree of jurisdiction over security matters. ANSTO's view is that it would be preferable to have a single regulatory body in the field.

Clearly, the new regulatory body would require significantly greater resources than are presently possessed by any of the current regulatory bodies. This issue has been addressed in some depth in ARPANSA's submission. Whilst the acquisition of sufficient expertise would be a challenge, it is an exercise which every country commencing a nuclear power program has gone through. There is a wealth of overseas (including IAEA) expertise on which they could draw. In our view, a body of that nature would best be modelled upon the Canadian Nuclear Safety Commission. The CNSC has jurisdiction over all aspects of nuclear regulation – safety, radiation protection, safeguards, security and environmental impact. The CNSC website describes its structure in the following manner:

> The task of the CNSC is to regulate the use of nuclear energy and materials and to respect Canada's international commitments on the peaceful use of nuclear energy. This is accomplished by the work of a Commission of up to seven members and a staff of approximately 550 employees.
>
> One member of the Commission is designated as both President of the Commission and Chief Executive Officer of the organization…
>
> The Commission functions as a tribunal, making independent decisions on the licensing of nuclear-related activities in Canada; establishes legally-binding regulations; and sets regulatory policy direction on matters relating to health, safety, security and environmental issues affecting the Canadian nuclear industry. The Commission takes into account the views, concerns and opinions of interested

parties and intervenors when establishing regulatory policy, making licensing decisions and implementing programs.

Staff prepare recommendations on licensing decisions, present them to the Commission for consideration during public hearings and subsequently administer these decisions once they are made by the Commission.

A commission structure is, in our view, more suited to the needs of a significant nuclear industry than is the single decision–maker model currently in place under the ARPANS Act.

There is a perception that R&D by mining companies has moved offshore from Australia – does that fit with ANSTO observations?

ANSTO is the leading process development facility in Australia for expertise in the processing of uranium ores.

ANSTO has carried out R&D for all of Australia's uranium mining operations since the mid 1970's, eg MKU, Nabarlek, Ranger, Olympic Dam and Beverley. This work has included studies for potential developments, including Westmoreland, Redtree, Yeelirie, Kintyre, Jabiluka and Honeymoon.

ANSTO has very strong relationships with the three current uranium producers and has experienced an increase in project R&D work over the last 2 years, all of this work has been carried out on a commercial basis by the ANSTO Minerals Business Unit. ANSTO Minerals is also currently undertaking R&D related to the Honeymoon project, the owners of which have just announced their intention to proceed with the development of this deposit. The Honeymoon project is controlled by South African interests. The expertise of ANSTO Minerals in the uranium area has been recognised by BHP Billiton, who have recently signed a five-year agreement to commit expenditure for commercial projects undertaken by the Business Unit.

Now that Ranger and Olympic Dam are owned by the global companies, Rio Tinto and BHPB Billiton, respectively, there is potential for these companies to direct R&D to off-shore Technology Groups. To our knowledge, this has not occurred to any great extent, but both companies are making efforts to enhance their in-house capabilities in Australia.

Over the last 12 months, there has been increased interest in developing other uranium deposits in Australia. ANSTO Minerals has been approached by several companies regarding possible R&D.

Our perception is that uranium R&D by mining companies has <u>not</u> moved offshore from Australia. In fact, ANSTO Minerals is undertaking uranium projects related to two offshore uranium deposits. We are also aware of some limited work on uranium being undertaken by other Australian commercial laboratories.

Work in the uranium area at ANSTO is now carried out by ANSTO Minerals, a Business Unit consisting of about thirty persons, but we are seeking to expand by two to four persons over the next six months. One driver is to earn revenue from our knowledge and experience in the uranium processing area, and other mineral industries where radioactivity is present. We also have a mandate to conduct our own R&D to underpin or commercial work, which is mainly R&D for clients, and to develop new technologies/processes, which will improve the economic and environmental performance of the industry.

Prior to becoming a Business Unit, the Group has operated in a similar fashion for the last ~ 20 years, doing a mix of industry-funded and ANSTO-funded R&D. The creation of the Business Unit has increased the focus on client work, but also improved our focus and efficiency in all areas. In addition to our R&D, we also undertake work to maintain our core capability, provide advice to Government and contribute to international for a such as IAEA technical committees and consultant meetings.

Would it be possible to get an indication of the level of funding provided by mining firms for such research and how that compares with funding levels twelve months ago (and longer if you have the information to hand)?

The best gauge of the level of funding is the revenue generated by uranium related projects. For the ten years ending in 2001/2002, the average revenue was $270,000/year. Note that for most of this period there were only two uranium mining operations, (Ranger and Olympic Dam), and very little activity in the uranium industry.

Revenue received from uranium related projects over the last three years is shown below, together with a projection for the current year. It should be noted that while most of the revenue is for R&D related projects, a very small proportion would be generated by simple analytical work etc.

Year	Revenue ($)	No. of Clients
2003/04	670,000	4
2004/05	680,000	5
2005/06	1,020,000	8
2006/07	1,600,00#	8#

estimate

Do you have any information on private sector expenditure on uranium mining related R&D in general?

Sorry, we do not have any information. But, up this point in time, the three uranium mining companies spend very little on R&D internally, and with other companies. This will probably change, with BHPB and Rio Tinto undertaking more projects in their own laboratories.

To what extent is the R&D done by ANSTO alone, or in collaboration with external groups?

Apart from collaboration with our clients, which can be quite extensive on certain projects, most of the work is done by ANSTO alone. As we have a long history in the area, the need to collaborate has not arisen, and there has not been too much interest in uranium. That said, we are setting up a collaborative project with CSIRO and GeoScience Australia to assess uranium deposits in terms of ore types and mineralogy, with the aim of identifying generic processing issues.

Is the above R&D totally funded by the private sector? If not, what is the level of public funding?

As mentioned above, ANSTO funds our internal R&D and the effort to maintain/enhance our core capability. The total funding in this area is about $1 million/year, but we are about to increase this effort.

How many ANSTO staff are doing this type of R&D (now compared with 12 months ago)?

This answer is not straightforward as we undertake non-uranium industry R&D. Over the last 12 months we have re-focussed our internal R&D to place more emphasis on uranium topics. The best answer I can give is that I expect that the total Unit staffing level to increase from about 28 to 33 over the 2006 calendar year.

Could you provide some illustrative examples of the kinds of R&D that is being commissioned?

Work for external clients include:

- Investigation of resins for recovery of U from saline waters
- Development of resin-in-pulp processes for uranium recovery
- Optimisation of uranium IX exchange circuit performance
- Optimisation of uranium product precipitation circuit performance
- Investigation of improved/alternative leaching strategies to improve uranium leaching recovery and reduce reagent requirements
- Study of conditions required for dissolution of specific uranium minerals
- Recovery of uranium from waste waters
- Application of heap leaching to uranium recovery
- Determine impacts of recycling of acidic and neutralised process liquors on uranium circuit performance
- Investigation of impacts of using alternative water sources in uranium processing
- Uranium processing flowsheet development for new ores
- Processes for recovery of by-product uranium from "non-uranium" ores

Any information you might have on the ease or otherwise of attracting suitably qualified staff to your organisation would be interesting to hear (even if it was anecdotal in nature).

There is a general shortage of experienced chemical engineers/hydrometallurgists, and it is therefore difficult to match salaries being offered by industry for suitably qualified staff. We have recently advertised for graduates with one to five years experience, and the response has been fair, noting that many applicants did not have the required background.