# Making the Australian Nuclear SecurityRegime Fit for Purpose

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**Abstract**

This paper outlines the outcomes of reviews and reforms related to licensing elements of Australia’s nuclear security regime. The Nuclear Non-Proliferation (Safeguards) Act 1987 enables the grant of permits to nuclear operators and transporters. Permits specify regulatory requirements and can be tailored to be industry specific. Australia’s application of State level physical protection is consistent with the international nuclear security guidelines for nuclear material and facilities. However, the vast majority of Australian permit holders (licensees) have nuclear material holdings that are below Category III. The elaboration of prudent management practices, applied at State level, led to the expansion of nuclear material categorization to include a ‘Category IV’ nuclear material holdings for source and special fissionable materials and includes a series of categories for locations outside of facilities. This expanded categorization allowed for a structured graded approach to physical protection measures, providing for uniform security requirements across industries with similar nuclear material holdings. Australia originally granted individualized permits to possess or transport nuclear material based on a developing security understanding and best practice at the time of issue. This permit format provided for discrete security performance requirements that was suitable for the limited numbers of Permit Holders at the time. However, as the number of permit holders increased, the need to increase efficiency necessitated the streamlining of permits. Starting in 2015, ASNO embarked on a reform of its permit system relating to physical protection and IAEA safeguards, into industry specific classes. Permits not only include the requirements for the protection of nuclear material and equipment, but also include the protection of associated nuclear technologies and information. Giving preference to a performance-based, as opposed to prescriptive-based, approach to compliance, permit formats allow for, and draw on the security maturity of each industry. The new permit classes accommodate for industry and functional differences including transport, mining, facilities, radiographers and other locations outside of facilities, but also address protection of associated nuclear technologies. Each type of permit includes specific limits on nuclear material holdings. So far, 23 permit classes have been established. The new permit format divides the document into a dedicated Permit section and a Compliance Code common to each class of industry. The Permit section includes all the individual Permit Holder’s company details, total nuclear material holdings and includes any approved locations for the use and storage of nuclear material. This section also provides overarching security principles and detailed requirements for State and IAEA inspections. The Compliance Code holds all the physical protection (and IAEA safeguards) requirements that are common to all the permit holders for each class of permit. The level of detail is industry dependent and reflects the practical application of physical security required. To improve regulatory transparency, ASNO has published template versions of most of the permits and corresponding Compliance Codes on its website. By providing online access to permits, guidance material and glossary information, ASNO supports its newly introduced permit holder’s online access portal. This web based platform is an access controlled database for material accounting and transport of nuclear material by permit holders. Australian industry and regulatory terminology do not always align with Agency terms and historically ASNO permits and forms have had individualized glossaries. ASNO has developed a general glossary of terminology that strives to increase commonality of terms and limiting terminology conflicts across all permit classes. The glossary includes IAEA specific terms for reference. The paper will expand on the reform process, outcomes, lessons learned and planned actions to further improve the permit system and Australia’s national security regime.

## INTRODUCTION

The Australian Safeguards and Non-Proliferation Office (ASNO) is Australia’s regulator (competent authority) for nuclear safeguards and security, enhancing Australian and International security through activities, which contribute to effective regimes against proliferation of nuclear and chemical weapons. *The Nuclear Non-Proliferation (Safeguards) Act 1987* (the Safeguards Act), forms the legislative basis for ASNO’s nuclear safeguards and security activities and gives effect to Australia’s obligations under:

* The Treaty on the Non-Proliferation of Nuclear Weapons (NPT)
* Australia’s Comprehensive Safeguards Agreement (CSA) and Additional Protocol (AP)
* Australian bilateral nuclear cooperation agreements (NCA)
* The Amended Convention on the Physical Protection of Nuclear Material (CPPNM)
* The International Convention for the Suppression of Acts of Nuclear Terrorism (ICSANT)

The Safeguards Act also establishes a system of accountancy and control on nuclear material and associated nuclear equipment and technologies through the issue of permits to possess or transport nuclear material to nuclear operators and transporters. Communication of information contained in sensitive nuclear technology is also controlled through the grant of authorities.

Permits and authorities specify regulatory requirements and can be tailored to be industry specific. These are typically reviewed and revised in five-year cycles. While permits specify both regulatory requirements for nuclear security and IAEA safeguards, the paper will focus on nuclear security.

ASNO historically granted individualised permits with discrete security requirements[[1]](#footnote-2) that was suitable for the limited numbers of Permit Holders at the time. However, as the number of permit holders increased, the need to increase efficiency necessitated the streamlining of the permit system. Starting in 2015, ASNO embarked on a reform grouping permit holders into specific permit classes based on nuclear material, technology or equipment inventory and by industry type.

## PERMIT CLASSES

The permit classes established by the review are set out in the Table A:

TABLE A. PERMIT CLASSES

|  |  |  |
| --- | --- | --- |
| **Class Series** | **Description** | **% of All Permit Holders** |
| L | Locations Outside Facilities (LOFs) – Includes tertiary education, research, medical industries | 35% |
| R | Industrial radiographers | 32% |
| U | Production, storage and transport of Uranium Ore Concentrate (UOC) | 21% |
| T | Transport of nuclear material (other than UOC), associated equipment and technology  | 3% |
| P | Nuclear technology and equipment | 6% |
| S | Special Series | 3% |

As depicted in Figure A, these permit class series, shown in Table A, are further broken down into groups based on either quantities; facility lifecycle stage; use; conveyance; or industry-type. Currently there are about 150 active permits and authorities. Of these nearly 90% are either LOFs, industrial radiographers, or in the uranium industry.

Section 18
**Authority to Communicate Information**

**P1** – Patent Attorneys

**P2** – Government Archives

Section 13
**Permit to Possess Nuclear Material**

**S1** - Facilities

**S2** – Research
 Associated Technology

**S3** - Research
Nuclear Material

**S4** – Research
Enrichment

**L1** - Very Low Quantity

**L2** - Low Quantity

**L3** - Moderate Quantity

**L4** - Category IV

**U6** - UOC Laboratory

**U5** - UOC Broker / Trader

**R1** - Radiographer Small Quantity

**R2** - Radiographer Medium Quantity

Section 16A
**Permit to Establish Facility**

Section 16B
**Permit to Decommission Facility**

Section 16
**Permit to Transport Nuclear Material**

**T1** - NM General

**T2** – NM Air transport

**T9** - NM Single Transport

**U2** - UOC Transport Road/Rail

**U3** - UOC Transport Sea

**U7** – Establish UOC Plant

**U4** - UOC Stevedores /Ports

**U8** – Decommission UOC Plant

**U1** - UOC Concentration Plant

*FIG. A. Permit Holder Classes in relation to the Safeguards Act*

## Compliance Codes

Each permit class document is divided into a dedicated Permit (proper) section and a Compliance Code. The Permit section includes all the individual Permit Holder’s company details, total nuclear material, technology or equipment holdings and approved locations for the licensed items. The permit section also provides overarching security and safeguards principles (pitched for security managers to understand) and detailed requirements for State and IAEA inspections. The Compliance Code holds all the detailed physical protection (and IAEA safeguards) requirements suitable for all the permit holders in each class of permit.

## Categorisation of Nuclear Material for L, R and U Class Permits

Australia basis its physical protection standards on the recommendations of NSS-13 [1]. All of the L, R and U-Class Permit Holders possess less than Category III nuclear material and hence are within the realm of “prudent [security] management practice”. ASNO decided to establish a grading within these groups to cater for the wide range in material holdings and uses that fall within this group of permit classes.

### Industrial Radiographers

This permit group was split into companies holding less than 500 kg of depleted uranium as shielding and those holding between 500 and 5000 kg, with a grading of timeliness of inventory reporting rather than of physical protection measures.

### Locations Outside Facilities - LOFs

All Australian locations outside facilities (LOFs) that possess special fissionable material (SFM), hold less than 10 grams of 235U and plutonium at any one location. ASNO grouped these permit holders into those holding less than 1 gram SFM (class L1) or 5 grams SFM (L2) or 10 grams SFM (L3).

Standard requirements for L-class permits include:

* restricted access to (trained) authorised persons within an authorised location;
* storage of nuclear material in a locked container or room;
* labelling batches and containers of nuclear material and maintaining an inventory list;
* prior notification of transfer of nuclear material and only to an approved permit holder;
* reporting of new activities, inventory changes and annual physical inventory taking (PIT); and
* detect loss of control within seven days and reporting of incidents within two hours.

The grading of security requirements between L1, 2 & 3 permits is mostly related to the governance of implementing the above requirements

### Uranium Industry

Australia has for long implemented a comprehensive approach to regulating the uranium industry. Previous papers outlining Australia’s approach can be found in [2] and [3]. The most recent permit model review sought to achieve a more functional permit layout and is harmonised between production, storage, pre-transport, during-transport (by road, rail and sea) and incidental storage requirements.

### Expanded Categorisation Table

ASNO expanded on the model set by ‘Table 1’ in NSS-13 [1] by adding licence limits associated with the L, R and U-class permits and the newly developed Category IV for special fissionable materials into an expanded categorisation table (see Table B).

TABLE B. AUSTRALIAN CATEGORIZATION OF NUCLEAR MATERIAL

|  |  |  |
| --- | --- | --- |
| IAEA Categorisation According to NSS-13(INFCIRC/225/Rev.5)(CPPNM Annex II) |  | ASNO Categorisation **Prudent Management Practice** |
| Material | **Category** c |  | **Category** f**IV** |  | LOF | UOC g | Radiographers |
|  | Form | **I** | **II** | **III** |  | **L3** | **L2** | **L1** | **U1**  | **U2** | **R2** | **R1** |
| Special Fissionable Material | Unirradiated b | **Pu** a | ≥2kg | >500g<2kg | >15g≤500g | >10g≤15g |  | ≤10g | ≤5g | ≤1g |  |  |  |  |
| **U235** | ≥ 20% U235 | ≥5kg | >1kg<5kg | >15g≤1kg | >10g ≤15gTotal U235 |  | ≤10gTotal U235 | ≤5gTotal U235 | ≤1gTotal U235 |  |  |  |  |
| > 10% U235< 20% U235 |  | ≥10kg | >1kg<10kg | >10g ≤1kg Total U235 |  |  |  |  |  |  |  |  |
| < 10% U235 |  |  | ≥10kg | >10g <10kgTotal U235 |  |  |  |  |  |  |  |  |
| **U233** | ≥2kg | >500g<2kg | >15g≤500g |  | >10g ≤15g |  | ≤ 10g | ≤ 5g | ≤1g |  |  |  |  |
| Irradiated Fuel |  | DU, NU, Th orLEF <10%fissile content d,e |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |
| Source Material | Unirradiated b | NaturalUranium |  | ≤5000kg |  | ≤5000kg | ≤500kg | ≤10kg | Ultd | 1x106kg |  |  |
| DepletedUranium |  | ≤5000kg |  | ≤5000kg | ≤500kg | ≤10kg |  |  | ≤5000kg | ≤500kg |
| Thorium |  | ≤5000kg |  | ≤5000kg | ≤500kg | ≤10kg |  |  |  |  |

|  |  |
| --- | --- |
| a - | All plutonium except that with isotopic concentration exceeding 80% in plutonium-238 |
| b - | Material not irradiated in a reactor or material irradiated in a reactor but with a radiation level ≤ 1 gray/hour (100 rads/hour) at one metre unshielded |
| c - | Quantities not falling in Category III and natural uranium should be protected in accordance with prudent management practice |
| d - | Although this level of protection is recommended, it would be open to States, upon evaluation of the specific  |
| e - | Other fuel which by virtue of its original fissile material content is classified as Category I and II before irradiation may be reduced one category level while the radiation level from the fuel exceeds 1 gray/hour (100 rads/hour) at one metre unshielded |
| f - | **Category IV** - Prudent Management Practice for **small quantities of nuclear material** (Above L3, L2, L1 permits) |
| g- | **Category UOC -** Prudent Management Practice **for large quantities of source material** (U1-U4, U6 permits)Note: 1 TEU Container of UOC is typically 8-16 tonnes contained Uranium |

## Special Class Permits

Special class permits do not fit into any of the aforementioned L, R and U class permit and moreover mostly apply to a single permit holder having significant (e.g. operation of a research reactor, enrichment research), complex or multifaceted nuclear activities.

## Prescriptive versus Performance-based requirements

Giving preference to a performance-based, as opposed to prescriptive-based, approach to compliance, the security requirements set out in the Compliance Codes takes into account the relative security maturity of each industry. Permit Holders dealing with higher risk materials and technologies are typically more security aware and prefer to work with performance based regulation. In comparison, the tertiary education, medical and radiography industries tend to be more safety conscious than security conscious and work better with simpler, more direct prescriptive-based regulation.

Australia has a growing number of research and development companies with relatively lower levels of security culture and experience. For these Permit Holders, ASNO initially prescribes relatively detailed (explanatory) and prescriptive security requirements that helps to guide and support the development of Permit Holder’s security expertise. The ensuing growth in security culture and experience allows for successive permit requirements to progress towards a performance based approach.

## Nuclear Technology and Equipment

Nuclear material is subject to two broad security risks, namely theft and sabotage. Associated nuclear technology and equipment is subject to proliferation risks, including theft, unauthorised use and unauthorised communication. ASNO not only issues permits for the protection of nuclear material, but also for associated nuclear technology (information) and equipment (see Figure B). Classification is a well-recognised scheme to specify the level of information security required. ASNO in consultation with relevant permit holders develop and enforce the application of individual industry classification guides tailored to the technology being protected. ASNO requires protective security measures consistent with the Australian Government’s Protective Security Policy Framework[[2]](#footnote-3) (PSPF).

## Patent Attorneys and Archiving of Associated Technology

Some companies and individuals developing novel nuclear technologies apply for patents to protect their intellectual property. Submitted applications are referred to ASNO for determination whether they contain information that is deemed associated nuclear technology. ASNO also issues industry specific permits to patent attorneys to provide adequate and ongoing physical protection of the technology and constraints on dissemination and communication of such information. Likewise, historical nuclear programs that retains associated technology requires secure archiving. ASNO issues permits for the long term secure storage of associated technology that requires annual verification and reporting.

**ASSOCIATED TECHNOLOGY (AT)**

Information applicable primarily for enrichment,
reprocessing or heavy water production

**ASSOCIATED ITEMS**

**ASSOCIATED MATERIAL (AM)**

Material specially suited for use in nuclear activities

Nuclear Grade Graphite

Heavy Water

**ASSOCIATED EQUIPMENT (AE)**

Equipment or plant specially for use in nuclear activities

Reactors

Heavy Water Plant

Reactor internals, pressure vessels etc.

Electronic Media (e.g. CDs, USB, Hard-drive, Smart Device, Networks)

Equipment or plant (AE) from which information (AT) can be obtained or deduced

Centrifuge Design

Enrichment, reprocessing or heavy water plant & equipment

Computer or physical model

Document containing information

Photograph, model or other **thing** from which such information may be obtained or deduced

*FIG. B. Depiction of Associated Items as described in the Safeguards Act*

## Cyber Security

Aside from associated technology itself having a security classification, information related to the physical security applied to nuclear material and associated technology may also require protection. Here ASNO specifies cyber security requirements consistent with national standards set out in the PSPF.

## Regulatory Transparency

To improve transparency, ASNO has published template versions of most of the permits and corresponding Compliance Codes on its website[[3]](#footnote-4). These templates provide prospective operators with insight into the required physical security and safeguards measures. Current permit holders that wish to increase their nuclear material limits, can evaluate the additional security measures required for a succeeding class of permit.

## Domestic Security Regime vs International Nuclear Security - terminology

Australian industry and regulatory terminology do not always align with Agency terms [4][5] and historically ASNO’s permits and forms have had individualised lists of definitions. ASNO has developed a general glossary covering all permits and authorities that strives to increase commonality of terms and limiting terminology conflicts across all permit classes. The glossary includes IAEA - sourced terms for reference.

## Future Development

ASNO is developing various guidance material and a glossary to provide additional information on security principles and permit terminology. New permit classes will need to be established for the future construction and operation of Australia’s planned National Radioactive Waste and Management Facility[[4]](#footnote-5). Other permit classes will be establish on a as needs basis.

REFERENCES

[1] INTERNATIONAL ATOMIC ENERGY AGENCY, Nuclear Security Recommendations on Physical Protection of Nuclear Material and Nuclear Facilities (INFCIRC/225/Revision 5), IAEA Nuclear Security Series No. 13, Vienna (2011).

[2] R. Floyd, S. Bayer, C. Everton, Risk Based Approaches to Security and Safeguards at Uranium Mines, Paper submitted to Institute of Nuclear Material Management annual meeting, Atlanta, US, 24–28 July 2016

[3] M. Botha, Regulating the transport of UOC in Australia, International Conference on Physical Protection of Nuclear Material, CN-254-088, 13-17 November 2017, Vienna

[4] INTERNATIONAL ATOMIC ENERGY AGENCY, IAEA Safeguards Glossary, (INVS3) 2001

[5] INTERNATIONAL ATOMIC ENERGY AGENCY, Nuclear Security Series Glossary Version 1.3, November 2015.

1. Although the Safeguards Act provides for the issue of regulations, it has been ASNO’s long-standing practice to promulgate all safeguards and security requirements through the permit system. [↑](#footnote-ref-2)
2. https://www.protectivesecurity.gov.au/ [↑](#footnote-ref-3)
3. https://dfat.gov.au/international-relations/security/asno/Pages/template-permits-and-compliance-codes.aspx [↑](#footnote-ref-4)
4. https://www.industry.gov.au/strategies-for-the-future/managing-radioactive-waste [↑](#footnote-ref-5)