

Establishing A Regulatory Framework For Nuclear Materials Accountancy, Control And Safeguards: The ONR Approach To Safeguards Assessment, Inspection & Enforcement

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Abstract

The Office for Nuclear Regulation independently regulates nuclear safety, security and safeguards across the UK, our duty is to ensure that the UK nuclear industry controls its hazards effectively, has a culture of continuous improvement and maintains high standards. In order to effectively regulate compliance with the UK's domestic safeguards regulations and meet the UK's international safeguards obligations, the ONR has established an effective and robust regulatory framework that is now being implemented to ensure UK operators demonstrate high standards of nuclear material accountancy, control and safeguards (NMAC&S). ONR has adopted a modern outcome focussed approach to the regulation of Safeguards where inspectors utilise a wide range of regulatory tools to influence improvements in NMAC&S through the implementation of targeted and proportionate safeguards assessment and inspection activities. The safeguards regulatory framework is underpinned by ONR's longstanding regulation of nuclear safety and security, affording safeguards inspectors with regulatory intelligence from ONR's safety and security activities in addition to ONR's well-established enforcement framework, ensuring the appropriate use of enforcement powers to secure sustained compliance with the law and to ensure that those who have duties under it may be held to account for failures to safeguards standards. This paper provides an overview of ONR's Safeguards regulatory framework, focussing on how safeguards assessment and inspection activities are implemented to influence improvements in NMAC&S and make effective regulatory judgements on operator compliance with the law.

1 Introduction

The Office for Nuclear Regulation (ONR) is responsible for the regulation of nuclear safety, security and safeguards across Great Britain. Its mission is to protect society by securing safe nuclear operations. ONR independently regulates nuclear safety, security and safeguards at 36 nuclear licensed sites across the United Kingdom (UK), in addition to more than 100 small holders of nuclear material (SHNM). ONR also regulates transport by road and rail and ensures that UK nuclear safeguards obligations are met. ONR was created in 2011 however, it was preceded by the Nuclear Installations Inspectorate (NII) which was formed in 1959 resulting in over 60 years of expertise of regulating the UK's nuclear estate.

Following the UK's exit from the European Union and the European Atomic Energy Community (Euratom), ONR assumed responsibility as the UK safeguards regulator, responsible for the UK State System of Accounting for, and Control of, Nuclear Materials (UK SSAC).

This paper provides an overview of ONR's regulatory framework for safeguards, focussing on how safeguards assessment and inspection activities are implemented to influence improvements in NMAC&S and make balanced regulatory judgements to effectively regulate compliance with the UK's domestic safeguards regulations.

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2 The UK's Domestic Legal Framework for Safeguards

2.1 Domestic Safeguards Legislation

Following the UK Government decision to exit from the European Union (and consequently Euratom), work was undertaken to establish a domestic legal framework for safeguards within the UK providing unbroken continuation of the application of nuclear safeguards following the UK's withdrawal from the European Atomic Energy Community.

The Nuclear Safeguards Bill was introduced by the UK Government to make provisions for this new legislation. As such, The Nuclear Safeguards Act 2018 [1] was brought into force, which amends the Energy Act 2013 [2] to enable the expansion of ONR's Safeguards purpose to regulate compliance against the UK's domestic safeguards regulations.

The UK's domestic safeguards regulations consist of the Nuclear Safeguards (Fissionable Material and Relevant International Agreements) (EU Exit) Regulations 2019 [3] and the Nuclear Safeguards (EU Exit) Regulations 2019 (NSR19) [4] both of which place duties on the ONR and operators associated with Nuclear Materials Accountancy, Control and Safeguards (NMAC&S).

To facilitate a smooth transition following the UK exit from the EU the NSR19 were drafted to broadly reflect the requirements of European Commission regulation 302/2005 and are aligned to include the equivalent prescriptive nuclear material accounting and reporting requirements. However, in order to enable ONR to transition the regulation of Safeguards to an outcome-focussed regulatory approach, aligned to the approach of ONR's other regulatory purposes, an additional legal requirement requiring operators to produce, maintain and implement an Accountancy and Control Plan (ACP) is included within NSR19. The ACP must set out the accounting and control system for the nuclear material in each facility subject to NSR19 and should be based upon industry good practice as set out in ONR Guidance on Nuclear Material Accountancy, Control and Safeguards (ONMACS) [5] and the ONR Safeguards Technical Assessment Guidance (TAG) [8] (further information can be found in section 5).

2.2 Establishment of a Regulatory Framework for Safeguards

In order to regulate compliance with the NSR19 and meet the UK's international safeguards obligations the ONR has established an effective and robust regulatory framework that is now being implemented to ensure UK operators demonstrate adequate standards of NMAC&S. The ONR safeguards regulatory framework has been structured to enable the implementation of an outcome focussed approach to the regulation of safeguards where inspectors utilise a wide range of regulatory tools to influence improvements in NMAC&S.

The ONR safeguards regulatory framework provides safeguards inspectors with a broad range of measures which can be targeted in a proportionate manner to determine compliance with NSR19. These measures include a combination of regulatory activities which can be broadly categorised into regulatory assessment activities and on-site inspection activities, both of which are expanded upon in the below sections.

To this end, ONR will adopt a proportionate and targeted approach, focussing regulatory attention based on a set of principles which include the proliferation attractiveness of nuclear material, the strategic importance and configuration of a facility, the correctness and completeness of the operators nuclear material accountancy and control (NMAC) system, declared programmes of activities and an operators' regulatory performance record. The

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safeguards regulatory framework is also underpinned by ONR's longstanding regulation of nuclear safety and security, affording safeguards inspectors with regulatory intelligence from ONR's safety and security activities to target safeguards interventions, in addition to carrying out joint interventions where synergies exist.

3. ONR Safeguards Inspection Framework

The ONR's safeguards inspection framework consists of several distinct inspection types which can be split into three categories summarised below:

- Compliance Inspections which are undertaken to provide evidence-based assurance that operators are complying with their statutory obligations under NSR19.
- Safeguards Systems Based Inspections (SSBI) that target the systems, structures and components that directly support NMAC&S across a site or facility to obtain regulatory assurance that equipment delivers the required NMAC&S function.
- ONR safeguards inspection activities alongside the facilitation of IAEA safeguards verification activities under the UK/IAEA voluntary offer agreement [6].

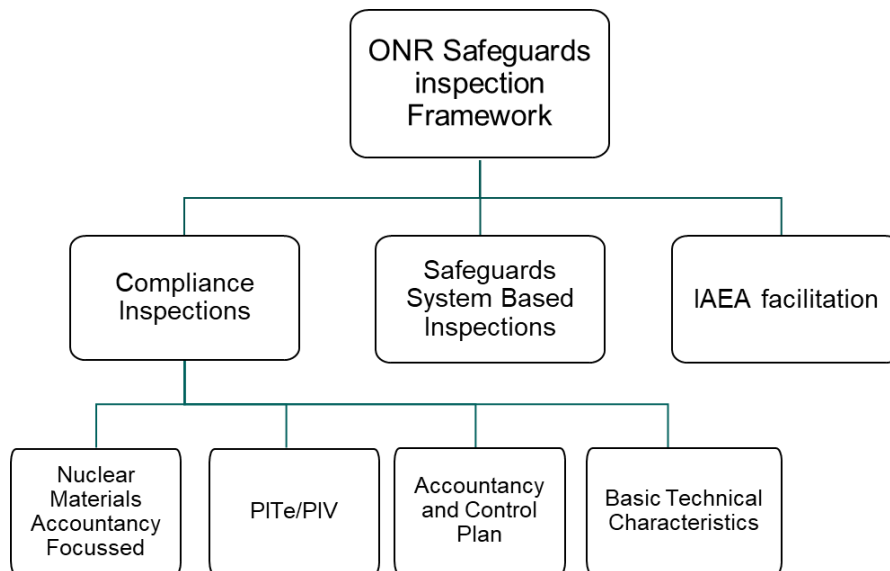


Figure 1: ONR Safeguards Inspection Framework.

All ONR Safeguards inspection activities are conducted against NSR19 and ONR's regulatory expectations encompassed within the ONR Guidance on Nuclear Material Accountancy Control and Safeguards (ONMACs) and the supporting Safeguards Technical Inspection Guide [7]. This guidance is in place to facilitate a consistent approach to ONR safeguards regulatory inspections by providing information to inspectors on ONR's regulatory expectations for NMAC&S and therefore, supporting inspectors in making balanced regulatory judgements and decisions. As an open and transparent regulator, all of ONR's guidance for inspectors is published on the ONR website ensuring this information is accessible to operators to increase awareness of ONR's expectations of the nature and content of their own arrangements for NMAC&S.

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3.1 ONR Safeguards Compliance Inspections

The NSR19 requires operators to develop and implement arrangements for accountancy and control of nuclear material and to provide specified information on the nuclear material it holds to ONR. ONR Safeguards inspectors undertake compliance inspections to gain evidence in support of operator compliance with NSR19, making regulatory judgements on the suitability of the arrangements made for NMAC&S and the adequacy of their implementation. Safeguards compliance inspections are undertaken on a planned or reactive basis according to the information derived from operator declarations and other regulatory information.

Safeguards inspections undertaken by ONR to assess compliance with NSR19 can be broadly described as follows:

- Nuclear Materials Accountancy-Focussed Inspection – is undertaken by ONR to seek evidence, on a sampling basis, of traceability and alignment from facility records/source documentation through to the accounting reports submitted to ONR under NSR19, to gain evidence that declarations are consistent with source documentation and reflect facility conditions.
- Accountancy and Control Plan (ACP) Inspection – is undertaken by ONR to seek evidence in support of adequate implementation of operator arrangements for NMAC&S, as described in an ACP ¹submission to ONR under NSR19. The inspector will examine a sample of the specific arrangements and procedures in place for NMAC&S to gain regulatory confidence in the adequacy of the implementation of the operator’s nuclear material accountancy arrangements.
- Basic Technical Characteristics (BTC) Inspection - BTC inspection involves a set of activities carried out by inspectors, on a sampling basis, at a facility to seek evidence in support of the correctness and completeness of the design information declared by the operator in a BTC submission to ONR under NSR19.
- Physical Inventory Taking Evaluation (PITe) – is undertaken by ONR to seek evidence on a sampling basis of the adequacy of implementation of appropriate and proportionate arrangements by an operator to prepare for and undertake a physical inventory take (PIT).
- Physical Inventory Verification (PIV) – is undertaken by ONR to seek evidence in support of the correctness and completeness of the list of inventory items (LII) generated during a PIT. The inspector will seek evidence that the LII is consistent with source documentation and reflects facility conditions.

During inspection activities, inspectors use their inspection findings to derive an inspection rating and an appropriate ONR response (e.g. no formal action, seek improvement or demand improvement). The ONR Inspection Rating Guide [11] is utilised by inspectors to guide them in assigning appropriate inspection ratings and determining an appropriate response, this is discussed with the operator at a ‘hot-feedback’ meeting which is held at the site following inspections. ONR’s response to any shortfalls in compliance will be proportionate to the

¹ The NSR19 requires all UK operators to maintain and implement an Accountancy and Control Plan which sets out the accounting and control system for the nuclear material in each facility. This is broadly similar to the concept of a security plan and facilitates ONR’s implementation of outcome-focussed regulation for NMAC&S.

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seriousness of a failure to comply with a legal obligation; ONR's approach to enforcement is explored further in section 5.

The effective and targeted implementation of ONR safeguards regulatory inspection activities at civil nuclear facilities are a fundamental enabler to ONR safeguards inspectors forming balanced and evidence-based regulatory judgements on operator compliance with NSR19, ensuring that UK operators are effectively accounting for, and controlling nuclear material.

3.2 ONR Safeguards Systems Based Inspections

Although regulatory judgements on the suitability of the arrangements made for NMAC&S and the adequacy of their implementation are made to a degree through the implementation of compliance inspections, safeguards systems-based inspections (SSBI's) involve a more in depth examination of an operators arrangements and procedures in place for NMAC&S. The purpose of a SSBI is to obtain assurance that the systems in place for NMAC&S are proportionate to and appropriate for the qualifying nuclear facility, in order to make this judgement, ONR inspectors will seek evidence to judge the adequacy of implementation of the operators arrangements against five of ONR's regulatory expectations for NMAC&S, as outlined below.

In order to enable the effective planning and targeting of SSBI's, ONR has developed a database which captures each operators' systems, structures and components (SSC's) that deliver a key NMAC&S function; the SSC's have been categorised as follows:

- **Identification Equipment** – Systems which allow for the unique identification of batches of nuclear material, and the ability to process those identities.
- **Computerised tracking** – Computer systems which track material inventories but do not compile accountancy reports.
- **Tracking and data processing systems** – Similar to the previous category, with the addition that these systems are responsible for compiling the xml data files that hold the operator's accountancy reports (ICR/MBR/PIL) and are submitted to ONR.
- **Measurement systems** – Primary and secondary measurement systems which are responsible for providing the flow and inventory data within operator reports, i.e. material assay equipment such as gamma spectrometers and weigh scales.

To further assist inspectors in effectively targeting SSBI's, ONR has categorised the SSC's according to their importance in delivering a NMAC&S function (fundamental, significant and support), inspectors primarily consider those systems of fundamental and significant importance to NMAC&S when planning a SSBI, to ensure there is a regulatory focus on those SSC's which are of the most importance to NMAC&S both within facilities and across a site.

SSBI's are focussed on seeking evidence that the NMAC&S systems subject to inspection are available, suitably maintained and operated by suitably qualified and experienced persons, in line with operator arrangements. To support inspectors in making regulatory judgements and decisions during SSBI's, each SSC is nominally inspected against the following five regulatory expectations, where appropriate. These expectations are captured in ONR's ONMACS guidance and summarised below:

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- **Competence Management** – Operators should implement and maintain effective arrangements to manage the competence of those with assigned NMAC&S roles and responsibilities.
- **Reliability, Resilience & Sustainability** - Operators should design and support their NMAC&S regime to ensure it is reliable, resilient, sustained and remains relevant and proportionate throughout the entire lifecycle of the facility.
- **Measurement Programme and Control** - Where measurements are performed, operators must implement and maintain robust arrangements to ensure the appropriate performance of measurement systems that provide data for the purposes of NMAC&S.
- **Nuclear Material Tracking** - Operators must implement and maintain an NMAC&S system that is able to provide identification, quantity, characteristics and track any nuclear material in their facilities at any time.
- **Data Processing and Control** - Operators must implement and maintain data processing systems that are capable of producing the NMAC&S reports and records required under NSR19 that incorporate technical and procedural controls to protect the confidentiality, integrity and availability of sensitive nuclear information.

4. ONR Safeguards Assessment

In addition to the statutory accounting reports and the requirement to submit basic technical characteristics (BTC's) for each nuclear facility, the NSR19 requires operators to have arrangements for accountancy and control of nuclear material in place and to submit an accountancy and control plan (ACP) to ONR which sets out the accounting and control system for the nuclear material in each facility.

ONR carries out regulatory assessment activities on a sampling basis, to reach independent and informed regulatory judgements on the adequacy of regulatory submissions made by UK operators under NSR19. ONR has established its ONMACS which encompass ONR's regulatory expectations for an effective and robust NMAC&S system. The principles presented in the ONMACS are supported by a Safeguards Technical Assessment Guide (TAG) to further assist inspectors in their technical assessment work in support of making balanced regulatory judgements. The ONMACs provide the essential foundation for the introduction of outcome-focussed regulation for NMAC&S, where operators have the flexibility to develop optimised solutions that meet their operational needs. This regulatory philosophy is aligned with our mature non-prescriptive nuclear safety and nuclear security regimes and provides UK operators with a coherent regulatory approach across the civil nuclear industry in the UK.

In line with ONR's Enforcement Policy Statement [9], a proportionate and targeted approach to assessment is implemented, on a sampling basis. The factors used to support judgements around sampling are aligned with those described in section 2.2.

The safeguards assessment activities undertaken by ONR in order to assess compliance with NSR19 can be broadly defined as follows:

- **Accountancy and Control Plan Assessment:** is the process ONR applies to reach an independent and informed regulatory judgement on the adequacy and implementation of the arrangements and procedures that make up the system for accountancy and control at each nuclear facility that are described in writing in the Accountancy & Control Plan submission. Assessment may also be focussed on whether the ACP

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adequately sets out the NMAC&S system in compliance with the requirements of NSR19 and ONR's regulatory expectations.

- **Basic Technical Characteristics Assessment:** is the process ONR applies to reach and independent and informed regulatory judgement on the completeness, correctness and adequacy of the BTC declaration to comply with NSR19 and meet, where necessary, international obligations.
- **Accountancy Assessment:** is the process ONR applies to reach and independent and informed regulatory judgement on the completeness, correctness and adequacy of the accountancy declarations received from operators to comply with NSR19.

Following formal assessment activities, ONR inspectors will apply an assessment rating against the operators formal submission under NSR19 in order to inform the level of response that should be sought against any identified shortfalls. The ONR Assessment Rating Guide [12] is utilised by inspectors to guide them in assigning the assessment rating and determining an appropriate response. ONR's response to any shortfalls in compliance will be proportionate to the seriousness of a failure to comply with a legal obligation or established standards; ONR's approach to enforcement is explored further in section 5.

ONR utilises a Regulatory Issues Database (RID) to record, influence and monitor operator actions to ensure that compliance gaps are addressed in a timely manner. This is supported by a systematic regulatory issues management process, that is adhered to consistently by all ONR inspectors, irrespective of function or specialism.

5. Enforcement

As the independent regulator for nuclear safeguards in the UK, ONR must take enforcement action when operators are found to be failing to meet the safeguards standards required by UK law. The term 'enforcement' has a wide meaning and applies to all dealings between enforcing authorities (such as ONR) and those on whom the law places duties; ONR has a range of enforcement powers, from providing regulatory advice to carrying out prosecution through court proceedings. The appropriate use of these enforcement powers is important, both to secure compliance with the law and to ensure that those who have duties under it may be held to account for failures to meet safeguards standards. ONR's enforcement policy statement sets out how ONR will utilise these powers to ensure that operators comply with the legislation for which ONR is the enforcing authority.

Where compliance shortfalls exist, ONR inspectors will formally apply the ONR Enforcement Management Model (EMM) [10] in order to ensure consistent, proportionate and transparent enforcement decision making. ONR's EMM and supporting guidance provides a clear, logical process for inspectors to make and record enforcement decisions that are aligned to the intent of ONR's EPS. The EMM guides inspectors in considering the key aspects of an operators shortfall in compliance with the law, to arrive at the most appropriate enforcement decision for the circumstances. All enforcement decisions are subjected to ONR's internal governance which includes consideration of wider duty-holder and strategic factors. This enables ONR to determine appropriate enforcement action which includes, where relevant, prosecution for the most serious breaches of the law.

6. Conclusions

The ONR is now implementing an effective and robust regulatory framework to ensure UK operators demonstrate high standards of nuclear material accountancy, control and safeguards. ONR has adopted an outcome-focussed approach to the regulation of safeguards where inspectors utilise a wide range of regulatory tools to influence improvements in NMAC&S through the implementation of targeted and proportionate safeguards assessment and inspection activities. The safeguards regulatory framework is underpinned by ONR's longstanding regulation of nuclear safety and security, affording safeguards inspectors with regulatory information from ONR's safety and security activities to enhance the targeting of safeguards interventions. This is substantiated by ONR's well-established enforcement framework, ensuring the appropriate use of enforcement powers to secure sustained compliance with the law and to ensure that those who have duties under it may be held to account for failures to safeguards standards.

6 References

- [1] Nuclear Safeguards Act 2018, UK Public General Acts, Chapter 15, June 2018
- [2] The Energy Act 2013, UK Public General Acts, Chapter 32, December 2013
- [3] The Nuclear Safeguards (Fissionable Material and Relevant International Agreements)(EU Exit) Regulations 2019, UK Statutory Instruments, No. 195, February 2019
- [4] The Nuclear Safeguards (Fissionable Material and Relevant International Agreements)(EU Exit) Regulations 2019, UK Statutory Instruments, No. 195, February 2019
- [5] Office for Nuclear Regulation, ONR Guidance for Nuclear Material Accountancy, Control and Safeguards (ONMACS), Version 1.1, March 2020
- [6] Agreement Between the United Kingdom of Great Britain and Northern Ireland and the International Atomic Energy Agency for the Application of Safeguards in the United Kingdom of Great Britain and Northern Ireland in Connection with the Treaty in the Non-Proliferation of Nuclear Weapons, Miscellaneous Series No. 13, June 2018
- [7] Office for Nuclear Regulation, Safeguards Technical Inspection Guidance, Revision 3, January 2021.
- [8] Office for Nuclear Regulation, Safeguards Technical Assessment Guidance, Revision 3, January 2021.
- [9] Office for Nuclear Regulation, Enforcement Policy Statement, December 2020.
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- [11] Office for Nuclear Regulation, ONR Inspection Rating Guide, <https://www.onr.org.uk/intervention-records/onr-inspection-rating-guide.pdf>.
- [12] Office for Nuclear Regulation, Guidance on Mechanics of Assessment, Revision 0, April 2020.