Office for Nuclear Regulation

ONR Nuclear Material Accountancy, Control and Safeguards Inspection Principles		
Date Issued:	March 2019	
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Record Reference:	TRIM Folder 1.1.3.947. (2019/79819)	

2019 Edition, Version DRAFT
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1. Introduction

The Office for Nuclear Regulation (ONR) is the independent regulator of nuclear safety, civil nuclear security and nuclear safeguards across the United Kingdom.

The Nuclear Safeguards (EU exit) Regulations 2019 [1] require, that operators should make arrangements to comply with regulatory obligations outlined in the regulations. ONR inspects compliance with the nuclear safeguards (EU exit) regulations 2019, and also with the arrangements made under them, outlined in an accountancy and control plan (ACP) and/or basic technical characteristics (BTC), to judge the suitability of the arrangements made and the adequacy of their implementation. To support inspectors undertaking inspection, ONR produces a suite of guides to assist inspectors to make regulatory judgements and decisions in relation to the adequacy of compliance on the site. This document outlines the principles that ONR will use for the development of an annual site safeguards implementation plan[1].

The annual programme of work outlined in the site safeguards intervention plan will make use of the full range of tools available to the ONR.. The aim of such annual programmes of work is to constitute a specific mix of activities that are expected to provide sound/robust evidence of compliance with the nuclear safeguards regulations and relevant international agreements.

The existence of a site safeguards implementation plan does not prevent the ONR from carrying out ad hoc activities in case of unforeseen events that require additional regulatory attention. In this way, the ONR will be able to rationalise inspection effort and apply a differentiated approach taking into account the perceived risk that an operator of a specific installation represents.

The ONR will record and monitor the total number of Nuclear Material Accountancy, Control and Safeguards (NMAC&S) inspections that the UK nuclear operators are subject to, exploring all opportunities allowed by an integrated approach between ONR Safeguards, Security and Safety to optimise the number of inspections potentially reducing the regulatory burden on UK operators.

The ONRs approach to the enforcement of NMAC&S, and to the management of enforcement activities as a whole will be in line with the principles and approach outlined in the ONR Enforcement Policy Statement [2].

2. ONR Safeguards Inspection Framework

There are three main pillars supporting the ONR in providing assurance of effective nuclear material accountancy, control and safeguards across the UK civil nuclear industry:

- the operator implementing an effective nuclear material accounting and control & safeguards (NMAC&S) system;
- timely, accurate and correct reporting by the operator relating to the installations as well as of the location and quantity of nuclear material; and

[1] For larger sites, the annual safeguards implementation plan may be produced at a facility level.

- independent assessment and inspection by the ONR of those reports and of the effectiveness of the operator's NMAC&S system.

In order to provide independent assurance of effective NMAC&S, safeguards compliance inspections are undertaken by the ONR. ONR safeguards compliance inspections will fall into at least one of four key categories:

1. Accountancy based inspections for verifying operator declarations and resolving anomalies (e.g. ICR verification), including physical inventory verifications;

2. Safeguards systems based inspections of an operator's arrangements for compliance with the Nuclear Safeguards (EU Exit) Regulations 2019, e.g. accountancy and control plan inspections;

3. Integrated inspections in conjunction with ONR's other regulatory regimes, e.g. inspections alongside nuclear safety or security inspectors and;

4. Inspections during facilitation related to the activities and systems necessary to facilitate safeguards inspections by the International Atomic Energy Agency (IAEA).

Detailed information on the framework for the regulatory activities outlined above can be found in the ONR Safeguards Technical Inspection Guide for the Nuclear Safeguards (EU Exit) Regulations 2019.

Based on the above considerations, the following would constitute the general features of an inspection scheme.

- a physical inventory verification (PIV)[2] would normally be made each year at all facilities (excluding small holders);
- the PIV inspection would, in addition, include a verification of the BTCs where this is practicable;
- a systems based inspection of aspects of the NMAC system (outlined in the ACP) could also be carried out during a PIV, where this is practicable;
- further interim inspections could be made[3], based on the inspector's discretion when using the principles outlined in this document.

There is also a need to maintain high standards of NMAC at small facilities and locations outside facilities (LOFs), and the ONR will aim to carry out a proportionate programme of regulatory activities, coupled with analysis/assessment of the safeguards reports provided by the operators concerned.

When there is evidence of poor nuclear materials accountancy or a loss of nuclear material control, the extent and depth of the inspections will be increased as required. Inspections for physical verification and/or compliance purposes, pursuant to an approved site or facility specific safeguards implementation plan, could be announced, short-notice or unannounced as appropriate to their specific objectives.

Where practicable, cost-effective and agreed, a scheme involving a number of announced inspections at regular intervals may be replaced by a scheme involving fewer, randomly selected, short-notice or unannounced inspections, or a mixture of announced and unannounced or short-notice inspections. The number of inspections should be based on a consideration of the principles outlined in this document.

[2] A PIT Evaluation may be carried out in place of a PIV.
[3] Further interim inspections should each contain an element of accountancy data consistency verification in addition to other activities the inspector deems appropriate.

The principles outlined in Section 4 are provided to facilitate a consistent graded approach to the development of an annual site safeguards implementation plan, all principles should be considered during the development process.

1. ONR Nuclear Material Accountancy, Control & Safeguards Inspection Principles

For the purposes of regulating Nuclear Materials Accountancy and Safeguards, the general principles and approach outlined in the ONR Enforcement Policy Statement are supported by five Nuclear Material Accountancy, Control & Safeguards Inspection Principles, as detailed in this section. It is against these principles that inspectors will develop an annual safeguards implementation plan for each site, this plan will outline the frequency and scope of ONR NMAC&S regulatory activities to be undertaken on the site[4].

ONR Nuclear Material Accountancy, Control & Safeguards Inspection Principles	
I	Sensitivity and Quantity of Nuclear Material
II	Strategic Importance and Configuration of the Facility
III	The Quality of the Operators NMAC&S System
IV	The Operators Programme of Activities
V	NMAC&S Regulatory Performance

Table 1: ONR Nuclear Material Accountancy, Control & Safeguards Inspection Principles.

3.1 NMAC&S Inspection Principle 1: Sensitivity and Quantity of the Nuclear Material.

Nuclear Material Accountancy, Control & Safeguards Inspection Principles	Sensitivity and Quantity of Nuclear Material	NMAC&S Inspection Principle 1
The frequency and duration of inspections and the number of inspectors used will be proportionate to the sensitivity and quantity of nuclear material. Material directly usable in a nuclear explosive device, or easily converted to such a form, will be subject to greater regulatory scrutiny than material which requires further processing, such as enrichment or reprocessing.		

Sensitivity of the Material

Sensitivity is a function of material type/category (eg. Pu, Th, Uranium etc), whether it is irradiated (sufficiently to be self-protecting – as for physical protection categorisation) and its form (eg bulk, or item).

Material Category
Direct Use Nuclear Material
Pu

[4] For larger sites, the annual safeguards implementation plan may be produced at a facility level.

U-233
Highly Enriched Uranium (U-235 >= 20%)
Indirect Use Nuclear Material
Low Enriched Uranium (U-235 < 20%)
Natural Uranium (U-235 = 0.711%)
Depleted Uranium (U-235 < 0.711%)
Thorium

Table 2: Outlining direct and indirect use nuclear material.

Quantity of the Material

Quantity is the inventory of the facility/MBA in effective kilograms. The effective kilogram is a special unit used in the safeguarding of nuclear material, reflecting its strategic value.

A quantity in effective kilograms is obtained by taking:

- for plutonium, its weight in kilograms;
- for uranium with an enrichment of 1% (0.01) and above, its weight in kilograms multiplied by the square of its enrichment;
- for uranium with an enrichment below 1% (0.01) and above 0.5% (0.005), its weight in kilograms multiplied by 0.0001; and
- for depleted uranium with an enrichment of 0.5% (0.005) or below, and for thorium, its weight in kilograms multiplied by 0.00005.

The quantity component relates to the scope of the inspection activities at a facility that are necessary to deliver of assurance regarding compliance with the safeguards regime that provides confidence about the absence of diversion and that facilities are operated as declared. These sensitivity and quantity components are used for establishing the frequency of inspections and other activities at a facility or a LOF during a material balance period (typically one year), in order to verify that no abrupt diversion has occurred.

3.2 NMAC&S Inspection Principle 2: Strategic Importance and Configuration of the Facility.

Nuclear Material Accountancy, Control & Safeguards Inspection Principles	Strategic Importance and Configuration of the Facility	NMAC&S Inspection Principle 2
The frequency and duration of inspections and the number of inspectors used will be proportionate to the strategic importance and configuration of the facility. Facilities for the storage or production of direct-use material (e.g. reprocessing and enrichment installations) will be subject to more stringent inspection activity than those which do not hold this capability.		

The strategic importance of a facility is determined by what it can be used for (eg whether or not it can be used to store or produce unirradiated direct use nuclear material). Table 2, below provides an overview of facilities that are encompassed in the UK civil nuclear fuel cycle and their capabilities of producing direct use nuclear material.

Facility Type
Facilities Capable of Producing/Storing Unirradiated Direct Use Nuclear Material
Plutonium / Highly Enriched Uranium Storage
MOx Fuel Fabrication

Reprocessing Facilities
Enrichment Facilities
Facilities Not Capable of Producing Unirradiated Direct Use Nuclear Material
Conversion and Fuel Fabrication Facilities (excluding MOx)
Spent Fuel and Other Storage Facilities
Reactors
Locations Outside Facilities

Table 3: Providing an overview of the capabilities of each facility type.

The facility configuration should be outlined in the basic technical characteristics of the installation, declared by the operator. The frequency and duration of inspections should be advised by the configuration of the facility e.g. a facility within a post operational clean out or decommissioning phase, where essential equipment[5] has been rendered inoperable should be subject to less stringent inspection activity than a fully operational facility. Further relevant considerations can be found in NMAC&S Inspection Principle 4.

3.3 NMAC&S Inspection Principle 3: The Quality of the Operators NMAC&S System.

Nuclear Material Accountancy, Control & Safeguards Inspection Principles	Quality of the Operators NMAC&S System	NMAC&S Inspection Principle 3
The frequency, extent and depth of inspections will be proportionate to the quality of the operators NMAC&S system. A robust, comprehensive and well implemented ACP and up to date BTC submissions should be the basis for more effective and therefore efficient inspections by ONR.		

The frequency, extent and depth of inspections should be advised by the output of assessment of NMAC&S arrangements defined in accountancy and control plan for the site/facility (ACP) and/or basic technical characteristics, as well as the implementation of those arrangements (informed from previous inspection) to ensure that qualifying nuclear material is accounted for and controlled in an effective and robust manner and, where appropriate, to those arrangements required to facilitate IAEA safeguards activities on UK Sites.

3.4 NMAC&S Inspection Principle 4: The Operators Programme of Activities.

Nuclear Material Accountancy, Control & Safeguards Inspection Principles	The Operators Programme of Activities	NMAC&S Inspection Principle 4
The frequency and duration of inspections and the number of inspectors will be proportionate to the annual outline programme of activities declared by the operator. Facilities with a high throughput of qualifying nuclear material will generally require greater inspection activity than facilities with a lower throughput of the same qualifying nuclear material.		

The frequency and duration of inspections and the number of inspectors should be advised by information outlined in the operator's annual programme of activities. Key considerations will be the operational status of the facility, facility throughput (e.g. receipts/shipments to/from the facility and/or processing flows within a facility) and type of operations carried out at the facility.

[5] Essential Equipment is outlined in the Department of Trade and Industry document 'Definition of Essential Equipment for Facility Operation – An Operator's Perspective [3].

3.5 NMAC&S Inspection Principle 5: Nuclear Material Accountancy, Control & Safeguards Regulatory Performance.

Nuclear Material Accountancy, Control & Safeguards Inspection Principles	Nuclear Material Accountancy, Control & Safeguards Regulatory Performance.	NMAC&S Inspection Principle 5
The frequency and duration, breadth and depth of inspections will be proportionate to the operator's regulatory performance in nuclear materials accountancy, control & safeguards.		

The frequency and duration, extent and depth of inspections should be advised by the NMAC&S performance of the operator/facility, and observations made during assessment and inspection activities – all of which will be used by the operator as the basis for a system of performance indicators. These indicators, together with the adequacy and the timeliness of the operator's reaction to observations, will be considered by the ONR when establishing an annual programme of work that, on the basis of professional judgement, is considered to be the most effective for the concerned facilities and that uses the available resources in the most efficient way. Relevant performance indicators from other ONR's Safety and Security regulatory activities should also be considered.

Anomalies are defined as *'an NMAC discrepancy or series of discrepancies that are consistent with the absence or gain of a significant amount of nuclear material. An NMAC anomaly can be detected during an investigation of NMAC discrepancies of whatever kind'*, or which frustrates or restricts the ability of ONR (or any other authority i.e. IAEA) to draw conclusions about safeguards compliance. Possible anomalies would be:

- Denial or restriction of inspector access for inspection (including IAEA activities).
- Unreported changes to the nuclear material inventory and/or significant changes to facility design or operating conditions.
- A discrepancy involving significant amount(s) of nuclear material. Discrepancies that cannot be resolved (i.e. ascribed to innocent causes or otherwise satisfactorily explained) may lead to determination that nuclear material is unaccountably missing. Where a discrepancy involves a significant amount of nuclear material it becomes a possible anomaly. A discrepancy is defined for the purposes of this document as 'any discrepancy between two or more pieces of NMAC information (e.g. records) where this discrepancy cannot be justified after taking account of legitimate measurement variation or legitimate uncertainty estimation. NMAC discrepancies include measurement discrepancies, material balance discrepancies and nuclear material control discrepancies.'
- A significant departure from the agreed recording and reporting system.
- Failure of the facility operator to comply with agreed measurement standards or sampling methods.
- For bulk handling facilities (e.g. enrichment, reprocessing or fuel fabrication plants), a negative conclusion resulting from material balance evaluation, shipper-receiver differences or other statistics (e.g. values that are larger than can be explained by known uncertainties in measurements or estimates for material quantities).
- Equipment or items belonging to the IAEA being detached or showing evidence of tampering.

4.0. CONCLUSION:

ONR has established this guidance in order to assist inspectors in making judgements and decisions on the annual programme of regulatory activities on qualifying nuclear facilities that are proportionate and adequate and provide sound/robust evidence of compliance with the nuclear safeguards regulations and relevant international agreements. As with all guidance, inspectors should use their discretion in the depth and scope to which they apply this guidance in the exercise of their professional judgement in reaching regulatory decisions.

5.0. REFERENCES:

1. Nuclear Safeguards (EU Exit) Regulations 2019

   http://www.legislation.gov.uk/ukdsi/2018/9780111175545/pdfs/ukdsi_9780111175545_en.pdf

2. ONR Enforcement Policy Statement http://www.onr.org.uk/documents/enforcement-policy-statement.pdf
3. Department of Trade and Industry 'Definition of Essential Equipment for Facility Operation – An Operator's Perspective', March 2002,, SRDP-R260.