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| ONR Technical Inspection Guide (TIG)  Safeguards |



ONR Technical Inspection Guide

Safeguards

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| 1 | Comments incorporated from operator community following sharing of draft versions in March 2020 |
| 2 | Comments incorporated from operator community following sharing of draft versions in September 2020 |
| 3 | Comments incorporated from ONR Safeguards inspector use of the draft version in trial inspection activities throughout the UK SSAC Project |
| 4 | Minor clarifications and consistency improvements based on experience of first two years of ONR Safeguards inspections as safeguards regulator in the UK. |

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# Introduction

1. The Nuclear Safeguards (EU Exit) Regulations 2019 (NSR19) [1] require operators, as defined therein, to make arrangements to comply with obligations under NSR19. ONR inspects compliance with NSR19, and with the arrangements made under them, to judge the suitability of the arrangements made and the adequacy of their implementation.
2. Parts of NSR19 are prescriptive, however there are elements which are goal setting and do not prescribe in detail what the operator’s arrangements should contain, this is the responsibility of the operator. To support inspectors undertaking compliance 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 technical inspection guide (TIG) is part of the suite of documents provided by ONR for this purpose.

# Purpose and Scope

1. This guide has been prepared as an aid to inspection of Nuclear Material Accountancy, Control and Safeguards (NMACS) activities at operator’s sites. It is to be used by ONR predominantly in judging the operator’s compliance with the requirements of NSR19. This guidance provides a framework for these inspection activities, within which the inspector is expected to exercise their discretion and judgement. This framework is provided to facilitate a consistent approach to inspection against NSR19.
2. This guide also contains advice on the activities surrounding, and opportunities presented by, the facilitation of verification by the International Atomic Energy Agency (IAEA) as the international safeguards inspectorate.
3. Note that the requirements of NSR19 relate only to those activities undertaken for civil purposes. Activities for defence purposes are excluded from the UK nuclear safeguards regime.
4. Safeguards inspections undertaken by ONR will fall into one of two basic categories as follows and any of these inspection types may be performed in conjunction with inspections from other ONR purposes.
   1. **Compliance inspections** - Inspection of operator arrangements delivering compliance with NSR19. These inspections can consist of one or more of the areas outlined below;
   * Accountancy focused inspections – refer to Section 5.
   * Physical Inventory Taking (PIT) Evaluation – refer to Appendix 2.
     + Physical Inventory Verification (PIV) may form a subset of this inspection type – refer to Appendix 2.
   * Accountancy and Control Plan (ACP) Inspection – refer to Appendix 4
   * BTC Inspection – refer to Appendix 5
   * ONR inspection and assessment activities alongside the facilitation of verification by the IAEA as the international safeguards inspectorate.
   1. **Safeguards systems-based inspections (SSBIs)** – Inspections which assess the adequacy of systems integral to nuclear material accountancy and control (NMAC) performance both within facilities and across sites – refer to Appendix 3.
5. The guidance is for use by all inspectors in ONR undertaking nuclear safeguards inspections. The guidance does not indicate when or to what extent inspections of the requirements of NSR19 should be carried out as these matters are covered in other ONR guidance [2] and individual inspection plans, which are aligned to safeguards regulatory strategy.
6. It is not anticipated that all the topics recommended for consideration by the inspector will be covered in a single inspection or during their time on site. Some aspects (e.g., operating and accounting records) need not necessarily be inspected on site and some activities can take place remotely.
7. Where relevant, inspectors should note that aspects of compliance with NSR19 can also be delivered by planned inspections with ONR’s other regulatory purposes. For example, nuclear safety licence condition (LC) inspections (e.g., LC 4 – Restrictions on nuclear matter on site) or security arrangements inspections (e.g., those concerned with preventing theft).
8. General ONR inspection guidance for all disciplines on how to plan, prepare, deliver and write-up an inspection should be used in conjunction with this guidance document [3].

# Relationship to Relevant Legislation

1. NSR19 requires operators to have arrangements for accountancy and control of qualifying nuclear material (QNM) in place and to provide specified information on the QNM it holds to ONR.
2. ONR submit the operator’s safeguards information to the IAEA and others in line with the format and detail required by relevant international obligations. Information transmitted to the IAEA is in fulfilment of the obligations of the United Kingdom under the agreement between the United Kingdom (UK) and the IAEA referred to as the Voluntary Offer Agreement (VOA) [4].   
   Additional safeguards information is communicated in line with the obligations of other relevant international agreements as set down in the Nuclear Safeguards (Fissionable Material and Relevant International Agreements) (EU Exit) Regulations 2019 [5].
3. How the operator complies with its requirements under NSR19 is predominantly for them to determine. ONR must judge the adequacy of this compliance and ultimately provide assurance that all operators are compliant with NSR19. ONR carries out this function through both assessment [6] and inspection.

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# Purpose of The Nuclear Safeguards (EU Exit) Regulations 2019

1. The operator is required to have arrangements in place to demonstrate compliance with NSR19. With regards to accountancy and control, operators’ arrangements must meet the requirements of Regulation 6.   
   These arrangements should be described in an ACP (Regulation 7), and the ACP should be kept up to date (Regulation 8).
2. There is a requirement in NSR19, Regulation 7, for operators to produce ACPs that describe the specific arrangements and procedures required by Regulation 6 of NSR19.
3. Brief guidance is given below for the requirements on operators in each part of NSR19 and, thus, the features the inspector should target for understanding and compliance during inspections.

## Part 1 (Introduction - Regulations 1 and 2)

1. This part defines the terms used in NSR19.
2. For the purposes of NSR19, a qualifying nuclear facility means a facility (including associated buildings) in which qualifying nuclear material is produced, processed, used, handled, stored, or disposed of. A material balance area (MBA) may be comprised of one or more qualifying nuclear facilities, or one qualifying nuclear facility may comprise of multiple MBAs.   
   The MBA structure should be discussed and agreed with ONR.
3. Qualifying nuclear material is defined as:
   1. Fissionable material specified in regulations under subsection 7 of the Nuclear Safeguards Act 2018; i.e., the “Nuclear Safeguards (Fissionable Material and Relevant International Agreements) (EU Exit) Regulations 2019” ;
   2. Source material in the form of:

Uranium metal, alloy or compound;

Thorium metal, alloy or compound, or;

* 1. Ore containing a substance from which a source material falling within paragraph 2 is capable of being derived.

## Part 2 (Accountancy and control, records, and the provision of information by an operator - Regulations 3 - 20)

1. NSR19:
   1. Requires the operator to declare BTCs for a qualifying nuclear facility, including for those facilities in existence prior to the commencement of NSR19, using the relevant questionnaire shown in Part 1 of Schedule 1 of NSR19 (Regulation 3).
   2. Requires the operator to send an outline programme of activities of a qualifying nuclear facility to ONR using the information described in Part 8 of Schedule 1 of NSR19. The annual outline programme of activities for the following calendar year must be received by ONR by 30 September of each year (Regulation 4).
   3. Allows ONR to impose particular safeguard provisions (PSPs) on an operator in respect of a qualifying nuclear facility. Should PSPs be imposed on an operator, the operator must comply with the requirements of the provisions (Regulation 5). The circumstances in which this is necessary are expected to be rare and ONR will engage with operators to fully understand the implications of any imposed PSPs before applying them.
   4. Requires an operator of a qualifying nuclear facility to maintain a system of accountancy and control of the relevant qualifying nuclear material in each qualifying nuclear facility (Regulation 6).
   5. Requires an operator of a qualifying nuclear facility to produce, implement and comply with an ACP which sets out the accountancy and control system for the qualifying nuclear material in that facility.

An operator must, unless informed in writing by ONR that the matter is, in the ONR’s opinion, unlikely to be prejudicial to the maintenance of the system of safeguards (Regulation 9(2)), implement and comply with the arrangements and procedures described in the ACP. This determination would be made because of inspection and assessment outcomes. As an enabling regulator ONR would communicate this to the operator.

An ACP may, in rare circumstances, be approved by ONR, whereupon any changes to that ACP must thereafter be approved by ONR before implementation.

* 1. An operator must ensure that the operating records and accounting records for each material balance area satisfy the requirements detailed in Regulations 10 and 11.
  2. Regulations 12 – 20 set out the reporting requirements, including the format and timescales, placed upon the operator. The operator should have arrangements to include meeting these requirements.

## Part 3 (Exports and Imports - Regulations 21 - 24)

1. In certain circumstances, NSR19 requires the operator to give advance notification to the ONR if any qualifying nuclear material is exported from or imported into the UK (Regulations 21 and 22).
2. Should there be loss or considerable delay during transfer, then the operator must send a special report to the ONR (as specified in Regulation 16) as soon as the operator becomes aware (Regulation 23). A “considerable delay” should be considered as any delay that impacts on the date of arrival at the receiving plant.
3. Should there be any changes in the dates for packing before transfer, transport or unpacking of qualifying nuclear material, which has been given in the notifications under Regulations 21 and 22, then the operator must inform ONR of this without delay (Regulation 24).

## Part 4 and 5 (Carriers, temporary storage agents and ores - Regulations 25 - 28)

1. NSR19 requires that:
   1. any persons / undertakings in the UK engaged, in transporting, or temporarily storing qualifying nuclear material must have records for receipt and handling of the material (Regulation 25).
   2. intermediaries involved in contracts for the supply of qualifying nuclear material must keep all records relating to the transactions performed by them (Regulation 26).
   3. the operator of a qualifying nuclear facility whose principal activity is the extraction of ores must keep accounting records and details of shipments (Regulation 27) and provide an annual report to ONR on ore shipments and exports (Regulation 28).

## Part 6 (Qualifying nuclear material in the form of conditioned and retained waste - Regulations 29 and 30)

1. NSR19:
   1. States that Regulations 10 to 15 do not apply to an operator of a qualifying nuclear facility in respect of qualifying nuclear material which has been transferred to retained or conditioned waste that is stored or treated at the qualifying nuclear facility. Instead, the operator is to keep accounting records for the conditioned and retained waste which satisfy the requirements of Regulation 29. Inspectors should note that this qualifying nuclear material is still subject to safeguards, under a reduced reporting regime, and must be adequately accounted for and controlled.
   2. Sets out the reporting requirements placed on the operator when transferring conditioned waste. The requirements on the operator are outlined in Regulation 30.

## Part 7 (Qualifying nuclear facility with limited operation and exemption - Regulations 31 and 32)

1. A qualifying nuclear facility with limited operation is defined as:
   1. A qualifying nuclear facility in which less than one effective kilogram of qualifying nuclear materials is produced, processed, stored, handled, disposed of or otherwise used, and;
   2. Is not a reactor, a critical facility, a conversion plant, a fabrication plant, a reprocessing plant, an isotope separation plant nor a separate storage installation.
2. If an operator of a qualifying nuclear facility believes that the facility satisfies the definition of a qualifying nuclear facility with limited operation, they can apply to the ONR to request a reporting regime with limited reporting requirements provided for in Regulation 31. The requirements of NSR19 Regulations 4, 12 to 15 and 21 to 24 do not apply to operators for whom the limited reporting regime has been granted.
3. ONR may impose additional requirements concerning the form and frequency of reports under Regulation 31. The operator must supply evidence to show compliance with any additional requirements imposed upon it by ONR.
4. Regulation 32 sets out two exemptions:
   1. NSR19 does not apply to a person who holds only end products which are used for non-nuclear purposes, and which incorporate qualifying nuclear material which is in practice irrecoverable.
   2. NSR19 does not apply to a relevant educational institution which holds an amount equal to 0.01 effective kilograms or less of uranium or thorium where, in the case of uranium, the isotopes 235 and 233 comprise 1% or less of the total mass of uranium.

## Part 8 (Civil activities - Regulations 33 and 34)

1. NSR19 imposes duties on the operator if the operator wishes to remove qualifying nuclear material from civil activities. Before qualifying nuclear material can be removed from civil activities, ONR must provide written consent. The operator must use the form set out in Part 12 of Schedule 1 to provide advanced notification to ONR of the proposed withdrawal. This application must be received by ONR at least 14 days before the day on which the qualifying nuclear material is to be withdrawn (Regulation 33).
2. Regulation 34 clarifies the scope of NSR19 for qualifying nuclear facilities which are partly used for civil activities. NSR19 applies to qualifying nuclear material used in civil activities but they do not apply to anything done for defence purposes within the meaning of section 70 of The Energy Act 2013 (TEA 2013 [7]).

## Part 9 (Communication - Regulation 35)

1. Regulation 35 specifies the ways in which an operator can communicate the information required by NSR19 to the ONR.

## Part 10 (Safeguards equipment - Regulations 36 - 38

1. NSR19 requires the operator to install suitable safeguards equipment in each qualifying nuclear facility if so requested by the ONR. ONR does not envisage routine use of its own safeguards equipment as part of regulating compliance with NSR19. If the requirement ever were to arise, the inspector should note that a PSP may impose requirements on an operator in relation to safeguards equipment (Regulation 36). In any event ONR would engage with the operator throughout the process of installation to ensure the equipment will achieve the desired NMACS outcomes.
2. If safeguards equipment is installed in a qualifying nuclear facility, the operator must permit inspectors to have reasonable access to that equipment. Any maintenance or calibration liabilities for ONR owned equipment would lie with ONR

## Part 11 (The ONR - Regulations 39 - 42)

1. This section of NSR19 outlines potential activities ONR can undertake on site to assess compliance with the requirements by the operator. The ONR may:
   1. Examine records kept by the operator.
   2. Make independent measurements of qualifying nuclear material.
   3. Apply and make use of surveillance and containment measures.
   4. Observe the taking of samples at key measurement points.
   5. Observe the treatment and analysis of samples and obtain duplicates of samples.
   6. Verify the functioning and calibration of an operator’s equipment; and
   7. Make such observations or measurements as necessary to verify the accuracy of BTCs.
2. It should be noted that the above list has been taken from Part 11 of NSR19 and is not exhaustive. The Inspector may use their discretion to determine what is necessary to assess an operator’s compliance.
3. Schedule 8 of TEA 2013 provides further information on the powers that inspectors have been legally authorised with.
4. NSR19 requires the operator, if so instructed by ONR, to send any samples of qualifying nuclear material which have been taken for ONR’s use to a location specified by ONR.

## Part 12 (Offences - Regulation 43)

1. If an operator fails to comply with Regulation 43 then an offence will have been committed.
2. ONR will utilise the Enforcement Management Model (EMM) [8] to determine the response to an operator failing to comply with NSR19, including committing an offence under Regulation 43.

## Part 13 (Notification to the Secretary of State - Regulations 44 - 49)

1. Regulations 44 to 49 govern the provision of information to the Secretary of State concerning qualifying nuclear material, non-nuclear material, equipment, and technology to which a relevant international agreement, as defined in the Nuclear Safeguards (Fissionable Material and Relevant International Agreements) (EU Exit) Regulations 2019, applies.
2. Regulation 44 states that the Secretary of State may provide written advice if operators have relevant items that should be reported on under one or more international agreements.
3. Regulation 45 sets out the requirements on an operator of a qualifying nuclear facility or other person to inform the Secretary of State of the receipt, production or transfer of any relevant non-nuclear material, equipment, or technology.
4. Regulation 46 sets out the time period for the notification and Regulation 47 requires an operator to notify the Secretary of State of any relevant change.
5. Regulation 48 sets out the circumstances in which Regulations 45 to 47 cease to apply and Regulation 49 sets out interpretation provisions for Part 13.
6. Part 13 should be considered in conjunction with the arrangements for implementing Nuclear Co-operation Agreements (NCAs) agreed between ONR and the government department, BEIS.

## Part 14 (General - Regulations 50 - 56)

1. The final part of NSR19 is the general part and brings into effect all that is contained within the Schedules of NSR19.

# Guidance on Inspection of Arrangements and their Implementation

1. For inspections announced in advance, it is good practice for the inspector to provide the operator with as much information about the scope and nature of the inspection as is practicable. The exception would be unannounced inspections. This ensures that the operator is given every opportunity to provide a true and accurate demonstration of compliance.
2. Guidance on the types of activities which may form part of safeguards compliance and safeguards system-based inspections, identified at Section 2, is provided in the remainder of this section and in the associated appendices.
3. Inspections can be performed across several regulations in NSR19.
4. It is for inspectors to apply their experience and discretion to determine the extent and depth of a particular inspection, taking due account of factors such as the current safeguards strategy, regulatory intelligence and the significance, complexity and purpose of the qualifying nuclear material and qualifying nuclear facility.
5. When planning the scope of the inspection, the inspector should consider whether the presence of a nuclear material accountant specialist inspector will be beneficial.
6. Guidance is given here on some of the key requirements. In deciding which arrangements to sample, Inspectors should consider all forms of regulatory intelligence including reported information, events, and previous enforcement action taken on the site or at other sites. This should include the findings of related safety or security compliance inspections.
7. Where site inspection indicates that an operator's arrangements fall significantly short of the requirements of NSR19, i.e., amber or red inspection ratings, and especially where enforcement action appears to be warranted under the EMM, the inspector should seek advice from the ONR Inspection and Assessment Lead in the first instance.
8. Safeguards compliance-based inspections are those activities involving inspection of an operator in relation to their arrangements for compliance with NSR19. It is recognised that for a qualifying nuclear facility with limited operation (QNFLO) operator, compliance inspections would be proportionate to the activities performed and quantity and type of QNM present.
9. Guidance on accountancy-focused compliance inspections, inspections in conjunctions with ONR’s other purposes, and inspection and assessment activities alongside the facilitation of IAEA activities is provided in the paragraphs below. Guidance on inspections associated with an operator’s PIT, ACP and BTC is provided in Appendices 2, 4 and 5 respectively.

## Accountancy Focused Inspections

1. Accountancy-focused inspection incorporates ONR examination and inspection of operating and accounting records, associated nuclear material accounting reports and resolving any discrepancies or inconsistencies through site inspections.
2. Operating and accounting records are examined to establish a correct set of data and to provide confidence to ONR that the operator has an adequate nuclear material accountancy and control system established.
3. The basis of an accountancy inspection is the information provided to ONR in the accounting reports (PILs, MBRs, ICRs) and other notifications, and the operating and accounting records. These records are formed of primary data, known as “source data”, examples of which would be a measurement or a calibration result. Together, these records and reports form the starting point for the inspector when planning the scope of accountancy-focussed inspection.
4. As well as inspecting the information in the accounting reports, the inspector may examine the specific arrangements and procedures in place for nuclear material accountancy. This helps build overall confidence in the adequacy of the operator’s nuclear material accountancy arrangements.
5. Those arrangements and procedures should be compliant with NSR19.   
   For instance:
   1. The ACP for the QNF should describe the relevant procedures and arrangements in place for accountancy and control of QNM.
   2. Procedures should be internally consistent with each other, valid, have an up-to-date review or change control history, identifying the appropriate responsible persons.
   3. It should be possible to establish instructions, methods and quality assurance requirements claimed in procedures have been followed and whether any changes made have been correctly incorporated and validated.
   4. The arrangements should be readily available, up to date, approved by an appropriate authority, implemented on site and adequately controlled under a suitable system.
6. The arrangements should show awareness of the reporting requirements placed on the operator as specified in NSR19. These arrangements should reference the requirements for the following, as a minimum:
   1. ICR (Regulation 14)
   2. MBR and PIL (Regulation 15)
   3. Special Reports (Regulation 16)
   4. Exports and Imports (Regulations 21 and 22)
7. The focus of an accountancy focused inspection is on operating records, accounting records, the accounting reports, notifications, and arrangements and procedures for accountancy. The ONMACS provides further clarity on what ONR considers to be good practice for accountancy arrangements [9]. Of relevance are ONMACS Fundamental Safeguards Expectations 6 – 9 which describe ONR expectations regarding QNM measurement, QNM tracking, and data processing respectively.
8. When planning an accountancy focused inspection, the inspector should work closely with the nuclear material accountancy specialist inspector designated to the relevant facility/site. The specialist inspector will inform of any unresolved anomalies, discrepancies, unusual inventory changes, trends or other questions arising from analysis of the operator’s accounting reports and other submissions.
9. Detected discrepancies and inconsistencies within accounting reports will be communicated to the operator as soon as possible after their detection.
10. ONR will utilise accountancy focussed inspections as a method of following-up on discrepancies, inconsistencies and requests for amplification or clarification (Regulation 12), special reports (Regulation 16), and unusual inventory changes that remain unresolved. These inspections allow the inspector to seek clarification where the accounting reports are difficult to understand without viewing the associated operating and accounting records.
11. Any operator reporting practices which have been recorded as regulatory issues within the Well-Informed Regulatory Decisions (WIReD) system should also be considered during the inspection planning phase.
12. The inspector should aim to sample the full breadth of inventory change types at a given MBA with a focus on corrections and unusual or rare inventory changes. All accidental loss, accidental gain, and new measurement transactions should be included in the report sample.
13. Operating records are those used for capturing data at the plant level where the data originates. They should form an auditable trail to the accounting reports. Examples of operating records include movement control documents, weight or volume records, laboratory records and power production records.
14. Ledgers and any subsidiary ledgers summarising inventory changes and providing the book inventory for a given period, inventory change journals, inventory change documents and internal transfer forms are examples of accounting records which can help with verification of accountancy reports. There will be a general ledger for the MBA and each nuclear material category.
15. An operator must ensure that, for each material balance area, the accounting records show all inventory changes and measurement results used to determine the physical inventory. All adjustments and corrections that have been made in respect of inventory changes, book inventories, and physical inventories should be fully auditable with the operating records and accounting reports.
16. The inspector should check that the accounting reports, and any other notifications received, correspond to the actual on-site conditions.   
    Special attention should be paid where unusual inventory changes have occurred; see paragraph 68 above.
17. The information in the accounting reports should be fully auditable and consistent with the operating and accounting records. These records are vital for tracking material flow on site as not all movements will be captured in the operator’s accounting reports to ONR. Movements of QNM within an MBA will not appear in accounting reports but are still an important aspect of nuclear material control arrangements. Similarly, although Part 6 of NSR19 does not require operators to report waste handling in accounting reports to ONR, they must maintain a “stock list and accounting records” for the QNM in such retained and conditioned waste.
18. The operator must make available any operating or accounting records and other relevant supplementary information, upon request by the inspector during an inspection. The inspector should make reasonable time allowances for the operator to retrieve information that may be difficult to access quickly, such as records stored on plant, or in off-site archives.
19. Inspectors should cross-check operator and accounting records with the accounting reports for consistency, completeness, and correctness.   
    The following types of information may be recorded in operating records or accounting records and could be helpful to confirm during an accountancy focused inspection:
    1. Changes to the QNM quantity or category e.g., enrichment or weight;
    2. Changes to QNM material description code (form, container, state);
    3. Date of change;
    4. Type of change;
    5. Information on QNM movement within an MBA;
    6. Batch identity e.g., rebatching;
    7. Number of items in a batch;
    8. Origin of weight information.
    9. Explanations for corrections or modifications (e.g., deletions and /or additions)
20. From the evidence obtained through the on-site inspection, the inspector should assess the appropriateness of the inventory change codes used and discuss the outcome with the operator.
21. If accidental losses, accidental gains, or new measurements have been declared by the operator then the inspector should request any operating or accounting records outlining the magnitude and cause of these changes. The operator must provide this information on request by the inspector.   
    The inspector should make reasonable time allowances for the operator to retrieve information that may be difficult to access quickly, such as records stored on plant, or in off-site archives.

## Inspections in Conjunction with ONR’s Other Purposes

1. Inspections may be undertaken in conjunction with inspectors from ONR’s other regulatory purposes. The guidance in this section is aimed at all inspectors who participate in such inspections that are either safeguards-focussed or have a safeguards element. Joint inspections should be considered at the planning stages of ONRs annual safeguards intervention plan.
2. Multi-discipline ONR inspections exploit the synergies between different specialisms. For example, an inspection on the control of nuclear material on site could cover compliance inspections of both NSR19 and site licence condition 4 (Restrictions on nuclear matter on site).
3. Some operators may have limited resource to facilitate inspections covering multiple ONR purposes, and a multi-discipline approach may reduce the burden on the operator by reducing the number of inspections on site.   
   For example, the same operator personnel may be required for both an LC 4 and a safeguards compliance inspection; it may therefore be more efficient to support a single larger inspection than multiple smaller ones.
4. Before undertaking a joint inspection, an inspector should consult ONR guidance [2] to understand the objectives of the different inspection types and specialisms.
5. When planning such inspections, the following points should be followed:
   1. The site safeguards lead inspector will use their knowledge and experience of the site to coordinate the safeguards input to the inspections. Ideally these will be captured in advance in the relevant inspection plan.
   2. The vires for all ONR regulatory purposes should be clearly communicated to those involved at the facility to be inspected.
   3. The technical guidance associated with the aims of the inspection   
      (e.g., LC4) should be reviewed, differing expectations noted, and each purpose’s outcomes embedded within the inspection plan.

## ONR Inspection and Assessment Activities Alongside Facilitation of IAEA Verification Activities

1. As part of meeting the UK’s international safeguards obligations, ONR must facilitate the IAEA’s verification activities under the VOA [4]. This facilitation does not necessarily demand the presence of ONR inspectors on site, but where there is such presence, it may provide opportunities for other regulatory activities.
2. The guidance in this section is aimed at all inspectors involved in facilitation of IAEA verification activities. Inspections during facilitation should be considered for incorporation into each respective ASIP at the planning stage.
3. Prior to the IAEA inspection the inspector should establish or confirm:
   1. the scope and content of the IAEA inspection.
   2. that all IAEA Safeguards inspectors and other officials (e.g., equipment technicians) have approval to access the site and the facility, as well as a clear understanding of where access may be restricted and/or need to be managed (e.g., for safety or security reasons).
   3. the scope of the work of the IAEA under the relevant international agreement, particularly, their rights and obligations.
   4. the previous history of the operator with respect to international safeguards verification and ONR safeguards activities.
4. When facilitating IAEA requests of operators during an IAEA inspection, the ONR inspector should be cognisant that they are on a nuclear facility which is under the control of the operator, and that ultimate responsibility for safety and security of the facility rests with the operator. Where an operator must refuse an IAEA Safeguards inspector’s request on the grounds of safety or security, the ONR inspector should seek to fully understand the reasons and should lead a pragmatic resolution process with both parties.
5. In terms of inspection activity during an IAEA inspection the inspector should use their judgement to:
   1. Attend and facilitate understanding at both opening and closing meetings, which should be led by the IAEA. During those meetings, the ONR inspector should:

Ensure that the scope of the inspection is clear and understood by all parties.

Ensure the roles and responsibilities of all participants are clear and understood, including any access restrictions.

Ensure that the outcomes, actions (assigned and time-bound), and recommendations are clear and understood by all parties.

* 1. Monitor operator activities in support of the IAEA inspection and:

Confirm with the operator that all activities are safe and in line with reasonably acceptable NMACS operations.

Ensure that the operator responds effectively to reasonable requests from the IAEA (e.g., access to certain areas of plant and information) without impacting the safety or security of the facility.

Note and challenge any operations that appear to fall outside safety or security expected good practice.

Challenge any behaviours / activities that would appear to result in clear and present danger.

Where activities appear to be unsafe / represent poor security behaviour report these to the relevant ONR inspector.

Ensure that the operator responds effectively to any relevant observations made by the IAEA and / or ONR during the inspection.

Ensure that the IAEA does not work outside the scope of the relevant international agreement, including access and information requests.

Challenge requests for any activities that appear to result in unnecessary risk or are outside local rules.

* 1. Act as the UK and ONR representative with respect to outcomes of the IAEA inspection, including receipt of the formal IAEA report on the inspection results and conclusions as specified in the VOA. The ONR inspector should:

Share ONR observations with the operator in the first instance and, if appropriate, with the IAEA.

Discuss the outcomes of the IAEA inspection with the operator and ensure the correct level of understanding.

Post inspection, share the formal report from the IAEA with the operator.

Utilise the outcomes of the inspection to inform future ONR regulatory activities.

Ensure follow up of outcomes of inspection and close out of issues raised.

Ensure relevant learning is shared within ONR and with the operator at the close out meeting and after the inspection.

1. During an IAEA inspection, the ONR inspector should be aware that any observed operator shortfall reflects on ONR and the UK as well as the operator. The ONR inspector should carefully consider whether any such observations should form part of the facilitation inspection or whether they would be better raised and considered separately with the operator.   
   The ONR inspector should consider the different objectives of the ONR and IAEA with regards to safeguards.

## Particular Safeguards Provisions (PSPs)

1. PSPs may be imposed on an operator by ONR, although the circumstances in which this is necessary are expected to be rare. Where requirements have been placed on an operator with a PSP, the ONR inspector may wish to consider PSP compliance as part of another inspection type, to verify that the requirements in the PSP are being fulfilled.
2. The inspector should:
   1. Examine the arrangements and procedures that are in place to demonstrate compliance with the requirements detailed in the PSP and confirm that those arrangements are implemented on site.
   2. Examine the procedures for consistency, including consistency between safeguards reportable information e.g., PSPs, BTCs and ACPs. Review the procedures to establish validity, whether any changes have been made since the last review and whether the identified responsible persons are correct.
   3. Note whether instructions, methods and quality assurance requirements claimed in procedures have been followed and whether any changes that have been made have been correctly incorporated and validated.
3. The arrangements should be readily available, up to date, signed by an appropriate person and adequately controlled under a suitable management system.

## Safeguards Systems Based Inspections (SSBI)

1. SSBIs are inspections of systems that directly support NMACS across a site or within an MBA. The aim of an SSBI is to obtain assurance that the systems in place for NMACS are proportionate to and appropriate for the qualifying nuclear facility and the QNM within it.
2. It is recognised that this would not be an appropriate inspection type for an operator of a qualifying nuclear facility with limited operation (QNFLO).
3. Further guidance on SSBIs can be found in Appendix 3.

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# References

|  |  |
| --- | --- |
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# Glossary and Abbreviations

|  |  |
| --- | --- |
| ACP | Accountancy and Control Plan |
| BEIS | Department for Business, Energy, and Industrial Strategy |
| BoD | Board of Directors |
| BTC | Basic Technical Characteristics |
| C&M | Care and Maintenance |
| DAP | Duly Authorised Person |
| EEL | Essential Equipment List |
| EIMT | Examination, Inspection, Maintenance and Testing |
| EMM | Enforcement Management Model |
| FA | Facility Attachment |
| FSE | Fundamental Safeguards Expectation |
| FsyP | Fundamental Security Principle |
| HOW2 | ONR Management System |
| IAEA | International Atomic Energy Agency |
| ICR | Inventory Change Report |
| ID | Inventory Difference |
| IDAL | Inventory Difference Action Level |
| IR | Intervention Record |
| ITVs | International Target Values |
| KMP | Key Measurement Point |
| LC | Licence Condition |
| LFE | Learning From Experience |
| LII | List of Inventory Items |
| LMfS | Leadership and Management for Safety |
| MACE | Material Accountancy and Control Expectation |
| MBA | Material Balance Area |
| MBR | Material Balance Report |
| MUF | Material Unaccounted For |
| NCA | Nuclear Co-operation Agreement |
| NDA | Non-Destructive Assay |
| NISR 2003 | Nuclear Industries Security Regulations 2003 |
| NMAC | Nuclear Material Accountancy and Control |
| NMACS | Nuclear Material Accountancy, Control, and Safeguards |
| NMAS | Nuclear Material Accountancy System |
| NSR19 | The Nuclear Safeguards (EU Exit) Regulations 2019 |
| ONMACS | ONR Guidance for Nuclear Material Accountancy, Control and Safeguards |
| ONR | Office for Nuclear Regulation |
| OIML | International Organisation of Legal Metrology |
| PIL | Physical Inventory Listing |
| PIT | Physical Inventory Taking |
| PITe | Physical Inventory Taking Evaluation |
| PIV | Physical Inventory Verification |
| PSP | Particular Safeguards Provisions |
| QNF | Qualifying Nuclear Facility |
| QNFLO | Qualifying Nuclear Facility with Limited Operation |
| QNM | Qualifying Nuclear Material |
| RPG | Relevant Good Practice |
| SBI | System Based Inspection |
| SBD | Safeguards By Design |
| SQEP | Suitably Qualified and Experienced Person |
| SSBI | Safeguard System Based Inspection |
| SSC | System, Structure or Component |
| TAG | Technical Assessment Guide |
| TEA 2013 | The Energy Act 2013 |
| TIG | Technical Inspection Guidance |
| VOA | Voluntary Offer Safeguards Agreement |
| WIReD | Well Informed Regulatory Decisions |

# **Appendix 1: Standard Definitions**

The following definitions are provided from the IAEA Safeguards Glossary 2022 Edition [10].

**1. International Standard of Accountancy**

1. Values of the measurement uncertainty σE expected for closing a material balance. These values, which were established in the 1970s on the basis of operating experience at the various types of bulk handing facility, are considered to be achievable under the condition of normal operation.   
   For calculating the international standard for the uncertainty of a material balance for a given facility type, the measurement uncertainty from (Table 2) (expressed as a relative standard deviation) is multiplied by the facility throughput.
2. The σE values should be used as a guide as to what can be typically expected for the measurement uncertainty of a specific facility type. However, good practice is to use the International Target Values [11] to determine whether a facility’s actual measurement system meets current international standards, and that any associated facility inventory difference can be explained by its measurement performance.

Table 2: Expected measurement uncertainty σE associated with closing a material balance

| Bulk handling facility type | σE | % Uncertainty |
| --- | --- | --- |
| Uranium enrichment | 0.002 | 0.2 |
| Uranium fabrication | 0.003 | 0.3 |
| Plutonium fabrication | 0.005 | 0.5 |
| Uranium reprocessing | 0.008 | 0.8 |
| Plutonium reprocessing | 0.010 | 1 |
| Separate scrap storage | 0.040 | 4 |
| Separate waste storage | 0.250 | 25 |

**2. International Target Values (ITVs)**

1. Values of random and systematic measurement uncertainty components which should be achievable under regular conditions for typical industrial laboratories and safeguards verification measurements for destructive analysis (DA), non-destructive assay (NDA) and bulk measurements (weight, volume) performed on nuclear material. The values are expressed as relative standard deviations (RSDs) and are values for uncertainties associated with a single determination result. For example, this may be the result reported by one laboratory on one sample (independent of the analytical scheme applied internally in the laboratory), or the result of an NDA measurement performed on a single item.
2. The values are based on actual practical measurement experiences and are intended to be used as a reference for routinely achievable measurement quality by facility operators, State (or regional) systems for accounting for and control of nuclear material (SSAC/RSACs) and the IAEA. The values are regularly updated to address changes in measurement capabilities, methods and techniques and their application to nuclear material. The currently used set of values [11] can be found on the IAEA website.

# Appendix 2: Operator Physical Inventory Take (PIT): PITe, PIV and/or Accountancy Compliance

**1. Purpose and Scope**

1. This Appendix sets out additional guidance on the scope and purpose of ONR inspections associated with an operator’s Physical Inventory Take (PIT).
2. The purpose of a PIT is for the operator to establish the physical inventory within an MBA at a given date and involves the operator identifying, counting, and measuring, or deriving quantity estimates of all qualifying nuclear material (QNM).
3. This guidance will be used by ONR to judge the operator’s compliance with the requirements of NSR19, particularly the adequacy and implementation of the arrangements made by the operator, to gain assurance of the accuracy of the operator’s physical inventory.
4. When applying this guidance inspectors should be proportionate.   
   The attention applied to a facility should reflect the consequences of safeguards non-compliance (hazard and risk in safeguards terms) posed by the facility, along with other factors such as the operators regulatory performance. The factors that inform ONR’s judgement of the level of safeguard related regulatory attention are set out in the regulatory strategy for the Safeguards sub-Division.
5. Inspectors may wish to conduct an inspection relating to PIT alongside other appropriate inspection types (e.g., an accountancy- focussed inspection) to provide additional value to both inspection activities. A PITe is best timed a short period after an operator has conducted a PIT to inspect the implementation of those arrangements without hindering the actual taking of a physical inventory.
6. The guidance provided is split into three main elements:
   1. Section 2 – NSR19 requirements associated with a PIT
   2. Section 3 - Purpose of a PIT and related inspections within NSR19
   3. Section 4 – Guidance on arrangements
   4. Section 5 - Guidance on inspection of arrangements and their implementation.

**2.** **The Nuclear Safeguards (EU Exit) Regulations 2019**

1. The NSR19 sets out several specific requirements in respect of the PIT and associated reporting activities including:
   1. Basic Technical Characteristics (BTC)

Regulation 3 requires the declaration of a BTC that includes arrangements and procedures associated with physical inventory taking.

* 1. Programme of Activities

Regulation 4 requires operators submit a programme of activities for the following calendar year indicating provisional dates for the PIT and then to inform ONR at least 40 days before the day on which the physical inventory is to be taken.

* 1. Particular Safeguards Provisions (PSP)

Regulation 5(4)(d) enables ONR to impose particular safeguards provisions on an operator relating to the frequency of, and procedures for, taking a physical inventory.

* 1. Accountancy and Control System

Regulation 6(3) points to Schedule 2 which includes the requirements whereby an operator must carry out a PIT, have procedures in place that describe the PIT (including any measurement uncertainties), generate a list of inventory items (LII) and, on request, supply the LII to ONR to assist in ONRs inspection and assessment activities.

* 1. Operating records

Regulation 10 requires the operating records set out the sequence of actions to prepare for and take a physical inventory to ensure that the inventory is correct and complete.

* 1. Material balance report and physical inventory listing

Regulation 15(3) sets out the frequency of a PIT. A PIT should be taken every calendar year with the period between two successive PITs not exceeding 14 months.

Operators must submit a physical inventory listing (PIL) and an associated material balance report (MBR) to ONR within 15 days of the PIT as required by Regulation 15(1) and 15(2).

* 1. Qualifying nuclear facility with limited operation

Regulation 31 requires those facilities which have been granted the status of a QNFLO, to carry out an annual PIT and inform ONR of the results of the PIT within 30 days in a form specified by ONR.

**3.**  **Purpose of a PIT and Related Inspections within NSR19**

1. The purpose of a PIT is for the operator to establish the physical inventory within an MBA at a given date and involves the operator identifying, counting, and measuring, or deriving quantity estimates of all QNM. The physical inventory is declared by the operator in a PIL.
2. The physical inventory should then be compared by the operator to the book balance which is determined by summing all inventory changes in the MBA during the material balance period and declared on the MBR. The MBR will record the inventory difference (ID) between the physical inventory and book balance. The ID should then be assessed as to its acceptability based on the measurement uncertainties associated with the facility.
3. The PIL and its associated MBR are required to be submitted to ONR within 15 days of completion of the PIT.
4. Inspections related to the PIT contribute to ONR assurance that the NMACS system, required under Regulation 6, is maintained such that the operator can demonstrate the system and its implementation meets relevant good practice and the requirements specified in Regulation 10(1)(e) of the NSR19.

**4. Guidance on PIT Preparation and Arrangements**

1. ONR’s regulatory expectations related to the operator’s arrangements for taking a physical inventory and their implementation are set out in the ONR Guidance for Nuclear Material Accountancy, Control and Safeguards (ONMACS) Nuclear Material and Accountancy Expectation (MACE) 9.2, and include:
   1. that they are readily available, up to date and approved by an appropriate manager or responsible person.
   2. identified job roles and competent persons to perform the activities with clear definitions of responsibilities.
   3. halting the movement of qualified nuclear material for the duration of the PIT.
   4. minimising the amount of qualifying nuclear material held in a process area at the time of a PIT.
   5. ensuring qualifying nuclear material is uniquely identified.
   6. ensuring that there are suitable measurement techniques and technical justifications for estimates of the quantities involved.
2. To demonstrate compliance with NSR19 and meet the regulatory expectations set out in the ONMACS, the operator should have in place the following arrangements or procedures (where relevant):
   1. arrangements for notifications and submission to ONR of:

the programme of activities for the next calendar year by 30 September of the preceding year including estimated PIT date and its likely duration.

notification of the confirmed PIT date at least 40 days before the date on which the physical inventory is to be taken.

for those granted the status of QNFLO under Regulation 31 confirmation the PIT has been performed within 30 days of completion of the PIT.

the PIL and MBR within 15 days of the PIT.

* 1. arrangements and procedures describing the actions to prepare for, and undertake, a PIT and ensure that the inventory is correct and complete including (where applicable):

inventory locations, including a flow sheet identifying points where material can be identified, measured, or estimated.

procedures and methods for operators’ physical inventory taking including the method of identifying individual items.

descriptions of the physical inventory including any hold ups, buffer levels, delay volumes and unverifiable QNM or items.

any inaccessible areas or other constraints.

a measurement quality control programme for nuclear material accountancy purposes including:

description of methods for determining quantities and for estimating measurement uncertainties.

description of the methods for establishing measurements at the flow or inventory measurement points, identifying any equations or tables used and calculations to determine quantities.

identification of areas or systems where there is QNM hold up and how that hold up is measured or estimated.

calibration of measurement and test equipment.

demonstrable compliance with relevant good practice such that the measurement results meet international standards, in particular the IAEA ITVs [11]. If the operator cannot demonstrate that they meet the relevant international standards, then a technically underpinned justification should be provided.

* 1. The generation of a LII. Although the format of the LII is not prescribed, relevant good practice is that an LII (an example of information typically found in an LII is provided in Table 3):

utilises ‘stratification’ i.e., have qualifying nuclear material with similar physical and chemical characteristics and within the same measurement uncertainties (i.e., measured or estimated) or location grouped together.

be complete and define identities and locations of all items in an MBA or a specified location within an MBA.

clearly state any qualifying nuclear material within the MBA that the operator has been unable to physically measure or estimate with the reason clearly recorded.

* 1. Performance of a material balance evaluation (MBE) to determine if any non-zero inventory difference declared on the MBR is consistent with measurement uncertainty or may reflect other causes. In a process facility this should include:

producing a technically justified inventory difference action level (IDAL) following completion of the PIT.

comparing the calculated inventory difference declared on the MBR to the IDAL.

setting out any non-conformance processes or investigation steps in the event of an unacceptable IDAL.

**5. Guidance on Inspection of Arrangements and their Implementation**

1. The following guidance is neither an exclusive nor exhaustive description of activities that may be undertaken by ONR Safeguards inspectors. The attention applied to a facility should reflect the consequences of safeguards non-compliance (hazard and risk in safeguards terms) posed by the facility, along with other factors such as the operators regulatory performance. The factors that inform ONRs judgement of the level of safeguard related regulatory attention are set out in the regulatory strategy for the Safeguards sub-division.

**Determine inspection type and preparations**

1. Once informed of the operator’s intention to perform a PIT the inspector may choose one, or a combination of the following activities:
   1. A Physical Inventory Take evaluation (PITe) which may take place at the same time as the operator’s PIT to enable the inspector to observe the operators PIT process and arrangements in process. Inspectors may however find it more useful to conduct a PITe a short time after the PIT (e.g., following receipt of the relevant statutory reports); This will allow additional preparation to take place, including the examination of accounts prior to the inspection.
   2. A Physical Inventory Verification (PIV) which involves the inspector sampling components of the inventory to establish the accuracy and completeness of the PIT. A PIV should be arranged as soon as possible after completion of a PIT because QNM movements will begin again after the PIT and physical reality may not reflect the information recorded at the time of the PIT.
   3. Nuclear material accountancy compliance activities as a desk-based exercise which may not involve any facility-based activity. As a minimum this should involve assessment of the ID and the IDAL and a comparison of the LII to the PIL, which would take place following formal submission of the PIL and MBR.
2. In addition to the factors detailed in 5.1 the inspector should judge which inspection activities are relevant and the scope of that inspection based on a number of additional factors, including:
   1. regulatory intelligence including any existent or emerging issues in the accounting reports.
   2. hazard and external factors including dose rate.
   3. resource availability/operational schedule.
3. The inspector should notify the operator at least four weeks before the inspection providing an inspection scope detailing any requests for information or activities that need to be arranged.

**Physical Inventory Take evaluation (PITe)**

1. A PITe inspection should include visual observation, discussion with managerial and operational staff in the facilities who were involved in the PIT, and an examination of records. If the inspection is carried out during the PIT, the inspector should make all reasonable efforts to ensure the inspection has minimal impact on the work of the operator during the PIT or any other operational activity.
2. A PITe inspects the suitability of arrangements made and the adequacy of their implementation for any or all the following activities:
   1. Establish that the operator had the plant in an appropriate condition to ensure the best possible results were obtained and they were ready for the PIT, including minimising the qualifying nuclear material in process areas.
   2. Confirm that PIT procedures were available, used by those performing the PIT, consistent, approved and owned by an appropriate or responsible person.
   3. Select and review a sample of PIT arrangements and procedures to ensure they describe the responsibility of those involved, the methods they should use and the records that should be kept.
   4. Select a representative sample of the PIT arrangements and check that the procedures were implemented correctly, including methods and quality assurance requirements such as:

In facilities where the operator takes measurements to determine the nuclear material inventory:

Examine the relevant procedures to determine the suitability of the measurement.

Check that up –to-date calibration records are available for all measurement instruments used.

Observe the taking of the measurement and any calculations to derive the reported values.

* 1. Confirm the personnel involved in the PIT were suitably qualified and experienced persons (SQEP).
  2. Confirm all data processing methods are up to date, used as instructed by the arrangements, appropriately understood by the user, and produce validated outcomes.
  3. Examine the arrangements and procedures for all measurement activities conducted for accountancy purposes and check for compliance with the declared methodologies including:

Measurement results should be validated, traceable and approved by a responsible person.

Where the accountancy data is based on calculations from models, both this data and the models should be validated, traceable and approved by a responsible person.

Relevant good practice is for the measurement results to meet international standards, in particular the IAEA ITVs [11]. If the operator cannot meet the relevant international standards, then a justification should be provided.

The inspector may carry out other inspection activities at the same time as a PITe if previously identified in the inspection scope document.

**Physical Inventory Verification (PIV)**

1. The inspector may judge that it is appropriate to inspect the compliance of an operator’s PIT process and outcome by means of performing some verification of the physical inventory. This inspection activity need not be standalone and may form part of an inspection alongside other activities undertaken.
2. The PIV would take place at the closing of a material balance period and as soon as possible after the completion of the PIT by the operator to minimise the impact on operational activity and whilst the information on the LII is still valid.
3. The PIV enables ONR to assess the physical inventory as taken by the operator and as recorded in the LII and may include any or all the following activities:
   1. ensure the LII is available no later than the opening meeting of the inspection.
   2. establish how up to date the LII is at the start of the inspection period, its usefulness and how correct and complete it is, e.g., if any changes in inventory has taken place after the PIT, the LII is acceptable and adequate if:

Increases in the inventory of the qualifying nuclear material are:

clearly distinguishable from the inventory at the PIT date

kept physically separate from PIT material

declared if they result from nuclear production.

* 1. Decreases in the inventory of the qualifying nuclear material are:

known to ONR because of an inspection or assessment of that qualifying nuclear material as it was removed

confirmed as received by a receipt from the receiver of the qualifying nuclear material

declared if they result from measured discards or nuclear losses.

* 1. the inspector should use their judgement to identify from the LII a sample of components to be checked, for example by physically identifying, counting, asking the operator to check weigh or other means. The rationale for selecting the sample components should be recorded along with any results that deviate from expectations.
  2. request justification should the operator have any qualifying nuclear material indicated on the LII which has either been removed from the inventory after the PIT without adequate assessment, or which cannot be inspected or verified during the PIV due to its specific properties or location.

**Operator PIT Completion and Declaration / Submission Activities**

1. On completion of a PIT and generation of the LII, a PIL report will be prepared by the operator detailing all batches of qualifying nuclear material in the MBA. The PIL should be prepared in the format specified in Part 4 of Schedule 1 of NSR19, showing all batches separately, and submitted to ONR within 15 days of the PIT as required by NSR19.
2. The physical inventory determined at the PIT and declared in the PIL is compared by the operator to the book balance which is determined by summing all inventory changes in the MBA during the material balance period and is declared on the MBR. The ID is recorded on the MBR and is calculated as the “ending physical inventory” (PE) minus the “ending book inventory” (BA). The MBR must be submitted to ONR alongside its associated PIL.
3. Any inventory difference between the physical inventory and book balance recorded in the MBR should be assessed by the inspector as described under the Material Balance Evaluation section below.

**Material Balance Evaluation**

1. ONR assessment of the PIL and related declarations would normally be an office-based activity when all the relevant records and reports have been received.
2. During the assessment the inspector should:
   1. compare the LII from the PIT to the submitted PIL for completeness and correctness.
   2. confirm the MBR records the ID and assess the declared value against the operator produced IDAL.
3. Relevant good practice is for the operator to calculate a technically underpinned IDAL that is specific to the facility and the material balance period being assessed (i.e., the plant, its material flows, inventory locations and their associated measurement uncertainties).
4. Whilst the International Standards of Accountancy included in the IAEA Safeguards Glossary provide generic guidance detailing the expected measurement uncertainty associated with closing a material balance achievable (based on operating experience) for specific facility types under normal operations (refer to Appendix 1), the international target values for measurement uncertainties in safeguards (ITVs) [11] provide for a more accurate assessment and calculation of IDAL and set the standard for acceptable measurement uncertainties for different measurement techniques and approaches within a facility.
5. Analysis by inspectors of ID and IDAL should identify areas of statistical significance (> 3 standard deviations) and whether the facility measurement system is adequate. Where there are areas of statistical significance the inspector should seek justification and clarification from the operator as to the underlying causes.
6. Further guidance on the regulatory expectations for material balance evaluation has been set out in the ONMACS Nuclear Material Accountancy and Control Expectation (MACE) 9.3.
7. The following data and elements for an LII may be required as appropriate. Items marked with an Asterix (\*) are essential to enable the inspector to assess and evaluate any measurement results.

Table 3: Information typically found in a List of Inventory Items (LII)

| Information typically found in an LLI |
| --- |
| Cut-off time and date of PIT\* |
| MBA code\* |
| Locations (KMP / other area identification) \* |
| Stratum identification\* |
| Item identification reference\* |
| Batch identification reference\* |
| Element code\* |
| Element weight\* |
| Isotope weight for enriched uranium and U-233\* |
| Irradiation status (fresh or irradiated) |
| Item description (drum, tray, rod, assembly etc.) |
| Material description (MOX, sintered UO2, alloy etc.) |
| Material Description Code (MDC) |
| Gross weight |
| Tare weight |
| Net weight (of chemical compound) |
| Element concentration factor (with indication of whether it is nominal, measured or derived) |
| Isotope enrichment factor (with indication of whether it is nominal, measured or derived) |
| Poison material (weight %) |
| Volume |
| Density |
| Cooling time of irradiated fuel |
| Burn up of irradiated fuel |
| Remarks (if applicable) |

# **Appendix 3: Safeguards Systems Based Inspection (SSBI)**

**1. Purpose and Scope**

1. The purpose of this Appendix is to provide guidance for ONR inspectors when planning and carrying out inspection activities related to an operator’s NMAC systems. It has been produced as an aide for use during inspection activities carried out by inspectors at QNF subject to NSR19 to judge the operator’s compliance with NSR19. Within this guide the term “SSBI” is taken to mean a Safeguards systems-based inspection, distinct from an ONR Safety Systems Based Inspection.
2. This Appendix sets out the scope and purpose of activities to be performed by inspectors during SSBIs. The inspector is expected to be proportionate in applying this guidance in relation to the circumstances of the QNF(s) under inspection.
3. The term ‘operator’ is used throughout this guide as defined in NSR19 as “a person or undertaking setting up, operating, closing down or decommissioning a qualifying nuclear facility for the production, processing, storage, handling, disposal or other use of qualifying nuclear material”.
4. SSBIs are inspections of systems that directly support NMACS across a site, multiple sites, or within an MBA. The aim of an SSBI is to obtain assurance that the systems in place for NMACS are proportionate to and appropriate for the BTC of the QNF. It is recognised that for a QNFLO this would not be an appropriate inspection type.
5. SSBIs seek regulatory assurance that a system delivers the NMACS function which is claimed within the operator’s arrangements (e.g., within the ACP). By their nature, SSBIs are focused on systems that are important to accountancy & control and as such, not all facilities and sites maybe suitable for SSBIs.

**2. Relationship to Relevant Legislation**

1. Regulation 6 of NSR19 makes clear that an operator of a qualifying nuclear facility must maintain a system of accountancy and control of the relevant qualifying nuclear material in each qualifying nuclear facility.

**3.**  **Guidance on Planning an SSBI**

1. Generic planning aspects for Systems-Based inspections (SBIs) are set down in ONR guidance document [2]. The purpose of this section is to assist inspectors in planning those specific aspects of SSBIs relevant to safeguards alone, that can be examined during inspections to establish whether the NMAC systems are being adequately managed and maintained to fulfil the requirements of a system of accountancy and control at the QNF as set out in Regulation 6 of NSR19.
2. The frequency and scope of SSBIs should be commensurate with the basic technical characteristics (BTC) of the site and/or QNF. For applicable sites, intervention plans must adequately cover SSBIs and where appropriate, a multi-year plan (nominally five years) covering the full cycle of SSBIs will be developed and implemented at the sub-division tactical level.
3. The focus of an SSBI are the systems, structures, and components (SSCs), and therefore where an SSC is used across multiple MBAs the inspection may span multiple MBAs. For example, a site may have a single computer system for compiling accounting reports that covers all of site. This may be inspected in a single SSBI.
4. Where applicable to relevant nuclear material flows, SSBIs should be coordinated across several facilities or MBAs to allow inter-facility comparisons to be made and to be as efficient and effective as possible.
5. SSBIs should be coordinated with other planned inspections and other regulatory functions to increase efficiency and reduce the regulatory burden on the operator (e.g., a safety systems-based inspection on the fuel route at a reactor site provides an opportunity for an SSBI to be carried out in parallel).
6. It is likely that other safeguards inspections will also examine aspects of safeguards systems. For example, an accountancy focused inspection will test the accountancy procedures that generate the operator records and the output of the accountancy and data processing systems that produce accounting reports. An inspector might infer the accountancy system’s performance from that type of inspection, but they would not gain direct assurance of the system’s suitability and reliability to the same level as in an SSBI. SSBIs are distinct in that they will examine the systems in question in a holistic way to obtain more complete assurance of the system.
7. Typically, SSBIs on a complex nuclear chemical plant may require multiple days on site to carry out a comprehensive inspection potentially employing inspectors from across ONR’s specialisms. For simpler SSBIs it may be sufficient to plan for one day on site undertaking inspections and may only require two inspectors.
8. The site lead safeguards inspector will normally be part of the team.   
   For example, for an SSBI on the SSCs for measurement and characterisation of QNM in a reprocessing facility the team may comprise of the site lead safeguards inspector, plus two safeguards inspectors with this skillset and the relevant nuclear material accountancy specialist inspector. Specialist support may also come from colleagues from other ONR specialisms.
9. Inspectors should consult the operator’s ACP, BTC and relevant safeguards information once they have selected the sample of SSCs for inspection to understand the expected arrangements to be implemented around those SSCs.
10. Inspectors should refer to the current list of NMAC SSCs when planning an SSBI to aid in comprehensively targeting an appropriate sample for inspection. This list of SSCs should contain indication as to which of the five key fundamental expectations each SSC may be inspected against.
11. The five key ONMACS expectations that may be inspected as part of SSBIs are outlined below and an inspector should consider how appropriate each FSE is to the facility to be inspected:
    1. FSE 3 – Competence Management
    2. FSE 5 – Reliability, Resilience & Sustainability
    3. FSE 6 – Measurement Programme and Control
    4. FSE 7 – Nuclear Material Tracking
    5. FSE 8 – Data Processing and Control
12. An SSBI may include any or all these expectations, though if not all expectations are being inspected an inspector should consider whether an ACP inspection may be more appropriate.
13. Advice on inspecting against these expectations is provided in Section 5 of this Appendix.
14. While NMAC systems should primarily be considered from a nuclear material flow perspective, operator safeguards specific systems can be categorised and linked to the ONMACS as follows:
    1. Identification Equipment – Systems which allow for the unique identification of batches of QNM, and the ability to process those identities.
    2. Computerised tracking (without data processing) – Computer systems which track material inventories but do not compile accounting reports, e.g., pond tracking systems.
    3. 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 accounting reports and are sent to ONR. This category also includes any systems that solely compile the reports without any tracking functionality; the crucial aspect is the compilation of the accounting reports (ICRs, MBRs and PILs).
    4. Measurement systems – Primary measurement systems which are responsible for providing the flow and inventory data within operator reports, i.e., weigh scales, volume and density measurement equipment or nuclear material assay equipment such as gamma spectrometers.
    5. Confirmatory measurement systems – Secondary measurement systems that provide additional confirmation of QNM quantity. It confirms that QNM weights align with the primary measurement, e.g., endoscopy or weigh scales for confirmatory checks of nuclear materials accountancy data which have been obtained from a primary measurement system. Confirmatory measurements are considered as supporting the material tracking system by providing an extra check of item characteristics. For confirmatory measurement systems to be useful they need to be within acceptable/justified tolerances to the result from the primary measurement systems, otherwise the check will provide little value.
15. SSCs I to V above are rated under Fundamental, Significant, and Support importance to NMACS, with each defined as follows:
    1. **Fundamental** - System, structure or component that provides a Fundamental nuclear material accountancy, control, and safeguards function. Without the SSC the validity and accuracy of the reporting data would be challenged, and/or the operator would be challenged to produce the accounting reports. These SSCs tend to not be easily substitutable.

Examples include accountancy and control reporting software, and bespoke/unique accountancy and control equipment.

* 1. **Significant** - System, structure or component that provides an Important nuclear material accountancy, control, and safeguards function. The system is important, but the outcome can be achieved by alternative means. This SCC provides more than an assurance role but is not fundamental to NMAC and can be substituted or is one of several SSCs in the MBA providing the same role. These SSCs often minimise human error.

Examples include bar code readers, cylinder ID readers, measurement equipment, and local accountancy software.

* 1. **Support** - System, structure or component that provides a Support function to nuclear material accountancy, control and safeguards. An SSC that has a role in NMAC but doesn’t perform a vital role, only providing additional assurance to NMAC.

Examples include confirmatory weigh scales and endoscopes.

1. Inspectors should primarily consider those systems of fundamental and significant importance to NMACS when planning an SSBI, to ensure there is a regulatory focus on those SSC’s which are of the most importance to NMACS.
2. Inspectors should review and refer to the safeguards inspection plan for the facility and previous SSBIs when selecting their sample of SSCs to avoid duplication of effort. They should also incorporate past regulatory issues and ensure adequate coverage in the overall sample selected throughout the cycle of inspections.
3. The relevant SSBIs from the multi-year plan should be incorporated into the IIS plan for that site/QNF along with the other compliance inspections and interventions to prevent overlap and enable deconfliction of regulatory activities both within the safeguards sub-division and with other ONR purposes.
4. The inspector should liaise with the relevant ONR colleagues from all ONR purposes to establish any current regulatory intelligence that may impact on or focus an SSBI (e.g., nuclear safety or security inspectors regarding operational challenges or arrangements for containment of and access to QNM).

**4. Guidance on SSBI Implementation**

1. This section provides advice to inspectors concerning the implementation of SSBIs. Generic advice on planning and execution of SBIs can be found in [2].
2. It is important that the inspection team has identified beforehand the relevant matters from the ACP that will allow them to determine whether the SSC adequately meets its NMACS functional requirements. The inspectors are required to form an overall judgement as to whether the SSC adequately fulfils its NMACS functional requirement, as claimed in the operator’s arrangements.
3. When carrying out an SSBI, it is important to note that the inspector is also inspecting the adequacy of the implementation of the arrangements for the ONMACS expectations in relation to a particular SSC.
4. Operating instructions are implemented to maintain NMAC in a manner appropriate and proportionate to the facility and aligned to the safeguards regulatory strategy and provide information necessary to recover from SSC faults or failures during the operations, as well as any safeguards discrepancies that affect NMACS.
5. Inspectors will be reviewing the relevant operating instructions, procedures and records associated with activities carried out on SSCs for systems related to safeguards to ensure that safeguards functions, and actions supporting safeguards functions, are capable of being met. Operating instructions should include redundant and diverse provisions, and back-up or stand-by arrangements for those SSCs rate of high importance to NMAC.
6. SSBIs should be coordinated across entire nuclear material flows where possible. This may span several facilities and will allow inter-facility comparisons to be made. In addition, the site visits should be coordinated with other necessary planned visits to achieve maximum efficiency and reduce the regulatory burden on the operator.
7. The inspector should apply proportionality in judging whether the SSC adequately fulfils its NMACS functional requirement in relation to a particular FSE, considering whether the SSC is of high, medium, or low importance as described in this Appendix.
8. The inspector’s judgement on whether the SSCs can fulfil their safeguards function adequately should be incorporated as regulatory intelligence to feed into ACP inspections, where the ACP may reference arrangements regarding that specific SSC.
9. Maintaining records in the form of Intervention Records (IRs) and intervention plans in relation to an SSBI is critical such that once the nominal multi-year cycle of SSBIs has been completed, the outcomes can be reflected in future planning cycles and inspectors can review previous findings to inform future SSBIs.
10. When conducting an SSBI, the inspector may consider any or all of the five key expectations identified in this guidance, as well as any other relevant expectations within ONMACS, however if the inspection does not include all five expectations, or contains additional expectations, the inspector should consider whether an ACP inspection may be more appropriate.
11. When rating an SSBI, ONR inspectors should follow the guidance provided in “Appendix 9 – inspection ratings guide” of [3].

**5. FSE-Specific Guidance for SSBI Implementation**

1. **FSE 3 – Competence Management** - Operators must implement and maintain effective arrangements to manage the competence of those with assigned NMAC roles and responsibilities.
   1. ONR guidance on assessing competence ( [12] and [13]) may provide insight for the inspector with respect to training and SQEP under FSE 3.
   2. Review of training records that demonstrate claimed competence for SQEP staff to use the SSC. Inspectors should note that operators may have developed their own unique training programme and these unique programmes should be assessed on a case-by-case basis.
   3. Review of sign-off requirements and associated certification on key SSCs (e.g., DAP sign-off, in date, etc.).
   4. Conversations with individuals playing key roles in NMACS including walkthrough of processes involving the use and maintenance of SSCs to support a judgment on FSE 3 (e.g., DAPs, plant managers, SSC owners, those responsible for maintaining SSCs).
   5. Checking job/role holder competence assessment to ensure that the competence and experience the individual has meets the competence and experience requirements identified for that job/role.
   6. Check training/assessment records to determine if an assessment of competency has been completed and that it includes the application of the individual’s knowledge and experience relating to nuclear safeguards activities that are relevant to the role.
   7. Check that the competency of duly authorised and other ‘suitably qualified and experienced persons’ (SQEPs) to operate the SSC and fulfil their role is reassessed.
   8. Through sampling, check that SQEPs/DAPs understand their responsibilities and authority with respect to the SSC and the specific job/role they are undertaking.
2. **FSE 5 – Reliability, Resilience & Sustainability** - Operators must design and support their nuclear material accountancy and control regime to ensure it is reliable, resilient, and sustained throughout the entire lifecycle of the facility. The ONR inspector should confirm:
   1. That the operator can demonstrate and manage the competence of staff operating a safeguards system, and that maintenance is carried out in line with claimed safeguards performance. The expectations of ONMACS [9], FSEs 3 and 5, provide further detail on ONR’s expectations in these areas. Where computerised systems are involved, the inspector should be aware of cyber security expectations in FSyP 7 of the SyAPs [14].
   2. That the requirements for safeguards SSCs are regularly reassessed.
   3. That the potential dependencies and/or vulnerabilities of the SSC have been identified and mitigated.
   4. Whether LFE regarding use of the SSC is captured and distributed to safeguards personnel.
   5. That a process of continuous improvement is in place relative to the SSC’s reliability, resilience, and sustainability.
   6. That evidence of the response to the failure or loss of part, of or all, a safeguards SSC is regularly exercised or rehearsed.
3. **FSE 6 – 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 nuclear material accountancy and control. The ONR inspector should:
   1. Confirm the operator has an established measurement system for determining quantities of nuclear material received, produced, shipped, lost, or otherwise removed from the inventory that conforms to the relevant international standards (Regulation 6(6)). The system should include measurement arrangements that are appropriate for any key measurement points (KMPs) in place.
   2. Confirm the SSC is capable of recording measurements for the purposes of NMAC in alignment with the claimed tolerance, accuracy, precision, etc.
   3. Confirm that measurement SSCs utilised for NMAC undergo regular calibration prior to usage and ongoing verification that the SSCs are working as expected between calibrations.
   4. Confirm that measurement results generated by the SSC are validated, traceable and approved by a responsible person. The expected implementation of the measurement system is described in detail in FSE 6 of the ONMACS [9].
   5. Confirm that safeguards measurement SSCs receive regular and systematic examination, inspection, maintenance, and testing (EIMT).
   6. Confirm any outputs and LFE of technical papers associated with NMAC&S SSCs in sampled MBA’s (e.g., inventory difference action level investigations) are considered or utilised in the maintenance and development of the measurement systems.
   7. Where MBAs receive material measured elsewhere, identify the chain of custody to the point where the material was measured.
4. **FSE 7 – Nuclear Material Tracking** - Operators must implement and maintain a nuclear material accountancy and control system that is able to provide identification, quantity, characteristics and track any QNM in their facilities at any time. The inspector should:
   1. Confirm the existence of unique identifiers for items of QNM in the form of the marker which makes an item uniquely identifiable e.g., serial numbers and barcodes. Material Accountancy & Control Expectation (MACE) 7.2 – Identification of Nuclear Material, in the ONMACS provides further detail on ONR expectations regarding unique identifiers.
   2. Confirm whether the identification equipment for safeguards fulfils its claimed capability and can determine the identity of an item e.g., barcode readers and endoscopes. Unique identifiers and identification equipment are considered to support the nuclear material tracking system.
   3. Seek evidence to demonstrate that these SSCs (and subsequent arrangements within the ACP) can provide the required information on QNM within the facility.
5. **FSE 8 – Data Processing and Control** - Operators must implement and maintain data processing systems that can produce the nuclear material accountancy and control declarations required under the NSR19 and that integrate technical and procedural controls to protect the confidentiality, integrity and availability of sensitive nuclear information.
6. The expectation is that operators have a system that can produce the accounting reports required under NSR19 in a timely and compliant manner. The inspector should:
   1. Confirm the data processing system can produce inventory lists permitting inventory checking by the operator.
   2. Confirm inventory lists provide the information necessary to identify discrepancies between the locations described in the records and the real physical location.
   3. Confirm there is regular reconciliation of operating records and accounting records when the accountancy of QNM in process involves separate storage of these records.
7. Confirm that information detailing the results of inventory checking and database reconciliation, including documentation of discrepancies encountered (for the purpose of performance indicators) is maintained.

# Appendix 4: Accountancy and Control Plan (ACP) Inspection

**1. Purpose and Scope**

1. The purpose of this Appendix is to provide guidance for inspectors when planning and carrying out inspection activities related to an operator’s Accountancy and Control Plan (ACP).
2. ACP inspection involves a set of activities carried out by inspectors at a QNF to assure them that the arrangements and procedures described in the ACP that form the system of accountancy and control are being implemented effectively at the facility.
3. The purpose of an ACP inspection is to ensure that the operator has established a robust accountancy and control system and that its implementation on site complies with the requirements specified in NSR19. However, elements of an operator’s ACP may be inspected through the other safeguards inspection approaches depending on the frequency of inspections undertaken at that facility or site.
4. This guidance has been prepared as an aid for use during the planning, preparation, and implementation of inspection activities carried out by inspectors at QNFs subject to NSR19 and is to be predominantly used in judging the operator’s compliance with NSR19.

**Note:** The inspection of ACPs for QNFLOs is described in another process within the ONR management system.

1. This Appendix sets out the scope and purpose of activities to be performed by inspectors during ACP inspections. The inspector should be proportionate in applying this guidance in relation to the circumstances of the QNF under inspection.
2. This guidance does not indicate the frequency or scope for inspections of the operator’s ACP under NSR19. This is covered in individual inspector’s inspection plans, the scope and content of which are determined using the ONR Safeguards sub-division regulatory strategy and associated governance.
3. Note that the requirements of NSR19 relate only to those activities undertaken for civil purposes; activities for defence purposes are excluded from the UK nuclear safeguards regime.
4. The FSEs for NMACS are identified as the foundation for the subsequent MACEs in the ONMACS [9]. They are founded in UK law through NSR19, in the requirements of relevant international agreements and in international good practice. The FSEs are split into two distinct parts; strategic enablers, which are aligned with other ONR regulatory compliance arrangements, and material controls, which focus specifically on the implementation and maintenance of NMAC arrangements.

**2. Relationship to Relevant Legislation**

1. NSR19 Regulation 7 requires operators to produce an ACP for a qualifying nuclear facility[[1]](#footnote-2) including QNFLOs, which must describe in writing[[2]](#footnote-3) the arrangements and procedures adopted or to be adopted by an operator to establish and maintain an NMACS system as required by Regulation 6.
2. Regulation 8 relates to the replacement, amendment, and revocation of an ACP. Operators must amend the ACP following a change to the Basic Technical Characteristics (BTC) of the QNF and send the amended ACP to ONR within 30 days beginning on the day on which the change is made (unless otherwise specified in a PSP). ONR’s use of PSPs is expected to be limited but it does remain an option available to inspectors. Operators may amend any parts of the ACP for a QNF that have not been approved by ONR; they must not amend any part of the ACP that has been approved by ONR without the prior written consent of the ONR.
3. Regulation 9 requires operators to implement and comply with the arrangements and procedures described in the ACP[[3]](#footnote-4).
4. Prior to an ACP inspection, inspectors should prepare a pre-inspection briefing for the operator to talk through the provided inspection scope, clarify ONR’s regulatory expectations and requirements relating to the sampled arrangements, and outline in more detail some examples of evidence that may be sought in relation to the FSEs described in ONMACS. This guidance should therefore be read and used in conjunction with ONMACS.

**3. Guidance on Inspection Against ACPs and their Implementation**

1. The operator must implement and comply with the arrangements and procedures described in their ACP. The implementation of the arrangements should be examined periodically by the safeguards inspector. ONR uses a sampling approach in deploying its resources, and as such, it may not be necessary to assess the implementation of every aspect of an ACP in full. The breadth and depth of the inspection should be established by the inspector as part of the inspection plan.
2. The inspector should confirm that all sampled arrangements and procedures are being implemented as claimed in the ACP. Though the following is not exhaustive, this may be done by:
   1. Discussions with key staff identified in those arrangements and procedures to determine their understanding of process flow, the purpose and use of key equipment, and response to NMACS discrepancies.
   2. Observation of physical identifications of QNM items / batches, through direct observation or operator photographic/video footage where appropriate, considering safety rules.
   3. Observation of key accounting records to be produced from the movement of QNM between and within MBAs, followed by the checking of these records against the physical reality.
   4. Confirming the existence of a non-conformance resolution procedure, as well as its implementation through viewing of records detailing the actions to resolve past discrepancies.

**4. Guidance on ACP Inspection against ONMACS – Fundamental Safeguards Expectations**

**FSE 1 – Leadership and Management for Nuclear Material Accountancy, Control & Safeguards**

1. The periodicity of leadership and management for NMACS interventions will be influenced by the annual ONR assessment of the operator’s safeguards performance, together with any findings and regulatory intelligence obtained during previous inspections. Once these initial considerations have been reviewed, the inspector should be able to define and agree the outcomes and outputs sought from an intervention. Where delivery of these objectives identifies the requirement for additional regulatory resources, support from other specialists, for example ONR Leadership and Management for Safety (LMfS) inspectors, should be sought.
2. During an ACP inspection targeting arrangements for leadership and management for NMACS, inspectors may wish to consider whether:
   1. The operator’s board of directors (BoD) ensures that NMACS is given due priority alongside safety and security when providing strategic direction and leadership. This might be evidenced through policy and receipt of an annual NMACS performance report.
   2. described mechanisms to ensure the BoD receive current, high quality NMACS information on risks are being implemented e.g., risk committee or annual NMACS performance report.
   3. the board has implemented the appropriate membership and competence to assess and act effectively on NMACS information where claimed.
   4. NMACS, standards and expectations are effectively communicated across the organisation to those with roles of NMACS responsibility or consequence.
   5. NMACS activities are included in operational schedules e.g., PIT/PIV.
   6. relevant staff are routinely consulted and engaged on NMACS issues such that their skills and knowledge are used to inform decision making at senior levels.
   7. NMACS arrangements are included in an integrated management system that adheres to RGP.
   8. the BoD is an ‘intelligent customer’ with sufficient NMACS competence or experience to ensure assurance reports inform effective decision making.
   9. the operator design authority’s formal processes understand and maintain NMACS design knowledge and assess the impact of proposed design changes on the functionality, reliability, and availability of NMACS arrangements contained in the ACP.
   10. All relevant stakeholders (both internal and external) are involved in the decision-making process.
   11. NMACS is given due consideration alongside safety, security and environmental factors to ensure that NMACS is not eroded or de-prioritised, and there is a process for the organisation to make decisions where there may be a conflict between safety, security, environment and NMACS.
   12. There is an independent internal assurance function with clearly defined terms of reference (including responsibility, accountability, and authority), and the board demonstrates it uses this function and that it values its outputs.
   13. the outputs from assurance activities feed a well-defined governance structure. There should be an executive meeting to consider NMACS performance for the organisation and determine improvement priorities and re-prioritisation.

**FSE 2 – Organisational Culture**

1. During an ACP inspection targeting NMACS organisational culture, inspectors may wish to consider whether:
   1. the organisation has a clear and accessible NMACS policy statement that is contained within the overall management system and is reviewed and updated periodically.
   2. leaders and managers check to ensure that the NMACS culture of supply chain partners meet their standards and expectations.
   3. the operator has a clear mechanism to ensure contractors display ‘site-wide’ behaviours and culture, and tenant organisations and contractors have access to ‘site-wide’ NMACS training and NMACS culture initiatives.
   4. during investigation of events, the arrangements ensure NMACS culture is considered as a contributing feature and the potential impact of subsequent improvement programmes on NMACS culture considered.
   5. leaders and managers display behaviours which demonstrate their commitment to the NMACS policy statement, and support and accept challenge.
   6. members of staff with roles and responsibilities that could impact NMACS recognise the NMACS policy statement and can they explain their role in its implementation.
   7. annual reviews of staff performance include an element looking at NMACS performance and culture.

**FSE 3 – Competence Management**

1. ONR provides general guidance on the inspection of competence management on safety and security in [15] and [16]. Much of this guidance is equally applicable to safeguards inspectors.
2. Methods and activities that inspectors may wish to employ in confirming the implementation and maintenance of arrangements to manage the competence of those with assigned NMAC roles and responsibilities include:
   1. confirming evidence of the training records of staff, as well as established arrangements for all staff such as training plans, competence management and succession planning.
   2. discussions and walkthroughs of process with staff to determine familiarity with key processes including non-conformance resolution, escalation and the reporting of discrepancies and anomalies.
   3. Specific activities that may contribute to the confirmation of competence management and SQEP staff are included throughout this document under the individual material control FSEs 6-10.

**FSE 4 – Reporting, Anomalies, and Investigations**

1. Methods and activities that inspectors may wish to employ in confirming the implementation and maintenance of arrangements for the timely and accurate reporting of information required by NSR19 include:
   1. confirming the existence of a procedure to recognise, investigate and document the treatment of non-conformances (or other unusual occurrences) in a timely manner, as well as the application of this procedure through examining records.
   2. confirming the responsibilities defined for the internal communication required when actions under NSR19 Regulations 16 & 17 are required, as well as the implementation of the mechanisms under which such personnel will inform the ONR.
   3. confirming the responsibilities and authority defined to provide further detail or explanation when requested under NSR19 Regulations 3(5), 12(3) and 16(2).

**FSE 5 – Reliability, Resilience and Sustainability**

1. During an ACP inspection targeting reliability, resilience and sustainability, inspectors should consider whether:
   1. reliability, resilience, and sustainability has been included and implemented from the design stage through other lifecycle stages for any facility or NMACS system, within the relevant operational requirements documentation.
   2. there is evidence that the requirements for NMACS systems are regularly reassessed.
   3. the competencies required to sustain a nuclear NMACS workforce are maintained through recruitment, retention, and training.
   4. essential services (such as power) necessary for the correct functioning of the NMACS system have the levels of NMACS, reliability and resilience claimed.
   5. NMACS systems ‘fail secure’ as described and if they do not, NMACS requirements are appropriately balanced against other competing requirements (e.g., safety and security) with compensatory NMACS measures implemented.
   6. operators’ experience of NMACS system failure and breakdown is in line with reliability claims, trends and recovery and substitution arrangements.
   7. a process for capturing project assumptions related to EIMT generated by the on-going design and NMACS analyses, along with an auditable record of where these assumptions are recorded in operational documents is being implemented.
   8. the results of human factors assessments of EIMT tasks during testing and commissioning have been implemented; inspectors could look for error traps and common cause failure mechanisms created by the procedures or by operator actions.
   9. EIMT is carried out within the specified intervals, and by SQEPs using the claimed tools and procedures and calibrated as specified in the relevant EIMT and/or calibration procedure.

**FSE 6 – Measurement Programme and Control**

1. Methods and activities that inspectors could employ to confirm the implementation and maintenance of a programme of measurement and control activities are suggested in this section.
2. When an accreditation against standard ISO/IEC 17025 [17] covers the complete measurement system, inspectors may wish to confirm that the measurement methods under the accreditation are the ones used for nuclear material accountancy declarations. Where the measurement system is not accredited, inspectors may wish to confirm the existence of arrangements for making and managing measurements under ISO/IEC 10012 [18] which ensure they are being managed effectively.
3. Inspectors should consider whether there is a designated person to approve measurement results, check that they are competent, and check that they are approving results and associated uncertainties.
4. Inspectors should consider the existence of measurement procedures and evidence of the ongoing verification of equipment.
5. Sampling should be representative of the material and inspectors should check for the existence of a sampling plan, relevant procedures, and their implementation. Sampling plans and sampling procedures should be based on statistical considerations, and the approach should be recorded.
6. Inspectors should consider that the implementation of a records management system (e.g., traceability from the source data through to data included in nuclear material accounting reports) enables the maintenance of a comprehensive record of measurement data.
7. Where data provided for the purposes of NMACS is based on calculations that are not direct measurements, inspectors can confirm the calculation method applied is documented, technically justified, and validated with real data where possible.
8. Inspectors should consider if measurement methods used are covered by relevant international standards, e.g., ITVs [11]. Where the measurement method is covered then no validation of the approach is necessary from the operator. Where the measurement method is not covered and it is used for nuclear material accountancy and control purposes, then the inspector may seek to understand how that measurement method was validated for use.
9. Regarding traceability of measurement results, inspectors should check calibration procedures, records, calculations, logbook entries, non-conformities, and the associated processes/arrangements for their follow-up.
10. Inspectors should consider whether the calibration range of an instrument is coherent with the typical measurement range of the instrument.   
    The calibration range should cover all measurements and usual measurement quantities should be at or near the middle of the calibration range.
11. The inspector should consider if reference materials (e.g., calibration weights, spikes used for analytical calibration etc.) are appropriately stored and have valid certification (e.g., calibrated value, uncertainty, confidence interval etc.).
12. Accuracy should be determined by the calculation and generation of measurement uncertainty figures for every measurement result.   
    Inspectors should check if this has been performed in accordance with the GUM Guide [15]. **Note:** Limits should be pre-stated, and it should be assessed not only during validation, but on a regular basis for every measurement.

**FSE 7 – Nuclear Material Tracking**

1. Inspectors should consider sampling different items or batches of QNM to check if the NMAC system is able to provide complete information about the material concerned. Inspectors should also check records of changes of location, identification, form, or quantities of QNM.
2. Inspectors should confirm that there is a documented process to ensure transfers of QNM into the installation are correctly recorded, and the inspector should sample those records.
3. Inspectors should confirm whether, if the required accountancy data relies on results from sampling and analysis, the data has been entered into the accountancy system correctly and has been identified as provisional and/or estimated pending the return of those analysis results.
4. Inspectors should ensure that records of items sealed by the operator are retained by the operator.
5. Inspectors should ensure that the inventory control by the operator includes physical checks of the inventory. They should also confirm whether the method of performing these checks has been documented, and that they are being implemented.
6. Inspectors should ensure that any NMA data authentication includes a full audit trail to original source documents, and that any amendments to source data for QNM movements have only been amended with endorsement by a SQEP.
7. Inspectors should confirm that the documented procedures for identification of QNM are being implemented as declared, and that any item identification changes have been recorded. If there are multiple layers of containment, inspectors should confirm that the required information is available to correctly identify the QNM content.
8. Inspectors can refer to the relevant BTC to confirm whether the different locations in which QNM can be held have been identified and are being used as the basis for recording this information. Further ONR guidance on BTC inspection is available in Appendix 5.
9. Where appropriate, inspectors should confirm whether there is a way to identify specific positions within areas, and whether this identification is being implemented to locate QNM.
10. Inspectors should consider sampling specific positions and confirm whether the NMACS system is able to provide complete information on the identification, quantity, and characteristics of the QNM present. Inspectors may also wish to confirm that records of any movements have been retained by the operator.
11. Inspectors should ensure that the NMACS system can provide complete information on QNM that has entered a process or has been subject to repacking.
12. Inspectors should ensure that the NMACS system can trace the QNM from a product to the raw material(s) in the facility.
13. Inspectors should ensure that procedures for identifying, investigating, and documenting NMACS anomalies are being implemented by the operator.

**FSE 8 – Data Processing and Control**

1. Inspectors should confirm that safe and secure storage measures of all data required for the proper working of the NMACS system are in place. Standard NMACS and safety tools such as access records and access rights, as well as automatic back-ups should be included. If these measures are not in place, inspectors should confirm whether a justification by means of risk assessment has been carried out.
2. Regarding implementation of the data-processing system, inspectors should check that the following items are captured within the system (this information may be automatically generated or manually compiled):
   1. declarations required under NSR19
   2. standard deviation of the material balance
   3. various types of documents linked to ICRs such as shipping documentation
   4. working documentation for routine inventory control e.g., LIIs
   5. working documentation for PITs
   6. LII resulting from PIT and used during PIV or other verification.
3. Regarding capabilities of the data-processing system, inspectors should check that the following items are produced within the system:
   1. Provision of inventory lists permitting inventory checking by the operator
   2. Inventory lists providing any information necessary for identifying discrepancies between the locations described in the records and the real physical location.
4. Inspectors should confirm the capability of the data-processing system to perform match verification between records when there is a double-records keeping system [16].
5. Inspectors should confirm the implementation of procedures for and records of non-conformities and corrective actions.
6. Inspectors should consider the capability of the data-processing system to receive information on discrepancies from physical verifications, and records matching, and treat that information for the purpose of providing performance indicators.
7. Inspectors should consider verifying that any activity logs produced for data-processing execution provide the NMAC Manager with relevant supervisory information.
8. Inspectors should consider whether NMACS documentation:
   1. is derived and reconcilable with a single set of source data.
   2. is appropriately protective marked in accordance with the classification policy; inspectors may also wish to confirm whether the procedures for protective marking are being implemented as claimed.
   3. is readily retrievable for independent audit/verification.
   4. has records that are traceable to an authenticated source and kept in a manner that guarantees traceability.

**FSE 9 – Material Balance**

1. Inspectors should confirm whether the nuclear material accounts have been correctly compiled in accordance with NSR19. Further information is available in Appendix 2 on ONR inspections associated with an operator’s PIT, in guidance for accountancy inspections and in [21].
2. Inspectors should consider whether the procedures for receipt and shipment of QNM and associated activities are being implemented as claimed through a review of relevant records.
3. Inspectors should consider whether the PIT and material balance evaluation procedures are being implemented as claimed. Further information is available in Appendix 2.

**FSE 10 – Quality Assurance for Nuclear Material Accountancy and Control**

1. Inspectors should consider that the NMACS system performance is being monitored and reviewed through any performance metrics established in associated procedures.
2. Evidence on the implementation of quality assurance should also be gained from undertaking the activities described under the other FSEs above.

# Appendix 5: Basic Technical Characteristics (BTC) Inspection

**1. Purpose and Scope**

1. The purpose of this Appendix is to provide guidance for inspectors when planning and carrying out inspection activities related to an operator’s Basic Technical Characteristics (BTC). It has been produced as an aid for use during inspection activities carried out at QNFs subject to NSR19. It is to be predominantly used in judging the operator’s compliance with NSR19.
2. This Appendix sets out the scope and purpose of activities to be performed by inspectors during BTC inspections. The inspector should exercise proportionality in applying this guidance in relation to the circumstances of the safeguarded QNF under inspection.

**2. Relationship to Relevant Legislation**

1. NSR19 requires the operator to produce a BTC document for each QNF using the relevant questionnaire in Part 1 of Schedule 1 of NSR19. Relevant regulations within NSR19 include Regulation 3(1-5), 5(1), 5(4).
2. BTCs are used to capture and describe safeguards-relevant design information for QNFs.
3. Part 1 of Schedule 1 of NSR19 specifies eight types of QNF:
   1. Reactors
   2. Critical and Zero Energy Installations
   3. QNFs where conversion, fabrication and reprocessing are carried
   4. QNFs that are used for Storage
   5. QNFs where Isotopes are separated
   6. QNFs using qualifying nuclear material in quantities in excess of one effective kilogram
   7. QNFs for the treatment and storage of waste
   8. Other QNF or a QNF with limited operation
4. Each type of facility has a BTC questionnaire and these all require information at proportionate levels of detail that:
   1. Identify the date of issue / revision
   2. Identify the QNF - including the operator and location of the QNF and types of QNM the operator manages there and generally the description of the installation, the form, quantity, location and flow of QNM being used, the layout of the installation, containment features.
   3. Describes the accountancy and control arrangements - in terms of the procedures for QNM Accountancy, Control & Safeguards (NMACS) including procedures for physical inventory taking and organisational arrangements for accountancy and control of QNM.
5. Under Regulation 3(3) an operator must inform ONR of the changes to a BTC. It is an ONR expectation that the operator will, in an appropriate and proportionate manner, submit the revised BTC with that change highlighted, should it be of NMACS significance to the QNF.
6. Regulation 3(5) allows the ONR to request in writing any further details, explanations, amplifications, or clarifications of any information required for regulatory purposes which the operator must then supply.
7. In the case of new QNFs under Regulation 3(2) the operator must declare BTCs to the ONR at several design and construction stages:
   1. Preliminary BTC - as soon as the decision to construct or authorise construction has been taken
   2. BTC based on the final design of the QNF using the relevant questionnaire shown in Part 1 of Schedule 1 - not later than 200 days prior to and ending on the day on which construction is started
   3. BTC of the facility as built, using the relevant questionnaire shown in Part 1 of Schedule 1, not later than 200 days before the day on which

QNM is first received at the facility

In the case of a QNF which only treats or stores conditioned or retained waste, the treatment or storage begins; and

In the case of a QNF whose principal activity is the extraction of ores in the United Kingdom, the operations start

1. Submissions of the extant and as built declarations should be considered for inspection using the same planning principles as for the BTCs of operating facilities.

**3. Purpose of NSR19 Regulation 3**

1. The information is used by ONR to ensure that not only do the operators comply adequately with NSR19 but also to meet UK obligations for submission of design information to the IAEA for all eligible facilities under the UK/IAEA Safeguards Agreement.
2. The IAEA uses this information to inform decisions on the designation of facilities for inspection and for its development of the IAEA approach for safeguards inspection and verification at facilities which are chosen for designation. IAEA guidance is available to member states which describes the nature and extent of design information expected as part of any submission [22].
3. BTC information is also used by ONR to inform its approach to regulating compliance with NSR19 for the facility, including the assessment and inspection of ACPs and, where appropriate, the development of safeguards system-based inspections (SSBIs).

**4. Guidance on Planning the Inspection against BTCs**

1. The process of planning an inspection is set down in the main text of this guidance document. The purpose of this section is to assist inspectors in identifying aspects of BTCs that can be examined during inspections to establish whether the declaration is correct and complete and/or that in the inspector’s opinion implementation of the operators’ declared arrangements demonstrates adequate compliance with NSR19.
2. When a new BTC has been submitted for a planned QNF, or one under construction, inspection activities should be considered, and focussed by assessment, at the earliest relevant time including, for example, to confirm the design and construction of key NMACS related features of the QNF which may become inaccessible following construction during the facility’s lifecycle. Detailed assessment may be warranted in the situation of complex facility’s whereupon the guidance for assessment of BTCs should also be used in parallel.
3. When a revised BTC is submitted which indicates changes to an operating QNF already subject to safeguards regulation by the ONR, BTC inspection activities may be carried out before, during, or after the changes, as is appropriate for the QNF to assure ONR that the changes have been implemented as declared and the outcome does not impact on the existing safeguards approach being adopted by ONR.
4. Some of the following may help the inspector when planning for BTC inspection. The following list is neither exclusive nor exhaustive and will be subject to review and revision in the light of operational experience:
   1. Establish that the QNM present, its use and purpose of the QNF are as declared in the BTC.
   2. Confirm that the geographical location, buildings, QNF layout, quantities of QNM and their containment are as declared in the BTC.
   3. Confirm the leadership and management system and that there is a clear understanding of owner / operator accountability.
   4. Confirm that a nuclear material accountancy reporting system is in place and effective.
   5. Confirm that arrangements are in place to report and demonstrate control of QNM and are they being followed.
   6. Identify constraints on the NMACS system.
   7. Confirm the accountability and significance of NMACS is understood throughout the management chain.
5. Aspects of BTCs such as those listed above may also assist and inform the ONR assessment and inspection of ACPs.
6. Access to key personnel with the required knowledge of the BTC and its implementation should be identified and planned.
7. The ONR Safeguards inspector should liaise with other ONR colleagues to understand any current regulatory intelligence that may impact on or focus an NMACS inspection (e.g., safety or security inspectors regarding operational challenges or arrangements for containment of and access to QNM).

**5. Guidance on Inspection Against BTCs and their Implementation**

1. BTC inspection involves a set of activities carried out by inspectors at a QNF to assure themselves of the correctness and completeness of the design information provided by the operator in the BTC.
2. The design information is verified to confirm that the as-designed BTC during construction and the as-built QNF is as declared by the operator. If changes in design information are declared to have taken place, such changes may be confirmed by ONR, including as a possible basis for changing the ONR approach to regulating compliance for the QNF against NSR19.
3. A BTC inspection contributes to the cumulative knowledge of the QNF design; its operation; and the continued validity of ONR’s approach to regulating compliance.
4. Preliminary BTC information must be provided as soon as the decision is taken to construct a new facility and provides the basis for early consideration of safeguards requirements for any new project (known as safeguards by design (SBD)). Such early consideration and maintaining engagement thereafter have benefits for all stakeholders. Examples of these benefits include minimising the risk associated with project scope, schedule, budget, and licensing; and reducing the cost of safeguards implementation to the operator, ONR and the IAEA.
5. BTC inspections may be performed throughout the lifetime of a QNF. The lifecycle phases of a QNF are primarily determined by its operating capabilities. The BTC inspection activities to be carried out are determined not only by the type of QNF, but also by the lifecycle phase noting different parts of a facility may be in different lifecycle phases. Section 6 describes the lifecycle approach in more detail.
6. Due to specific conditions or operational intentions at a QNF it may be useful to prepare a BTC inspection strategy as part of underpinning wider inspection planning. Inspectors should consider the operators’ plan of key activities to identify areas where ONR could include as part of its BTC inspection strategy, as well as prepare for reactive inspections corresponding to changes in the operators planned schedule if proportionate to do so. The scope and objectives of the BTC inspection and any methods and activities to be used should be discussed with the operator in advance of the inspection.
7. The intensity of BTC inspection during the lifecycle phases of construction and commissioning will differ from that in other phases. BTC inspection activities should be planned and carried out in a manner designed to avoid hampering or delaying the construction and commissioning of facilities. The operator’s construction and commissioning plans should be reviewed with the aim of developing an integrated ONR plan which includes safeguards activities alongside those planned for other ONR purposes.

**Key Considerations**

1. As part of a BTC inspection, inspectors may wish to consider some of the following activities to help them judge the operator’s compliance against Regulation 3 of NSR19:
   1. confirming that the design information submitted to ONR is correct, complete, consistent, and timely and the correct BTC questionnaire has been used.
   2. confirming the nuclear operations in the QNF are as declared. In undertaking this activity, inspectors might look to physically identify the QNM flow routes and storage locations as declared in the BTC as part of their inspection. Inspectors may make such observations or measurements necessary to verify the accuracy of the BTC and any changes to them declared under Regulations 3 or 31.
   3. ascertaining the category and quantity of QNM inventory present at the QNF to help assess the declared capacity / throughput of the QNF.
   4. checking that the use and installation of operator accountancy measures is as described in the BTC and that they continue to be fit for purpose. Inspectors may wish to see the installation, maintenance and servicing schedules and requirements of installed accountancy measures, and procedures that assure the control of QNM during such periods, as well as review calibration records and measurement approaches against international good practice.
   5. confirming that declared accounting records and relevant operating records are being managed appropriately including being correct, appropriate, and up to date, and can be made available to ONR and IAEA inspectors upon request.
   6. confirming where appropriate the physical QNM throughput and capacity of the QNF and comparing this with the declared throughput and capacity (e.g., inspectors may wish to request the operator to provide the current plant status of the QNF).
   7. confirming that the operator’s QNM flow and inventory verification methods continue to be fit for purpose.
   8. confirming that the operators can demonstrate adequate control of QNM according to the declared arrangements.
2. Where inconsistencies with the submitted BTC are identified, inspectors should seek to initially resolve these through discussion with the operator.

**Additional Considerations**

1. The lifecycle phases of a QNF are primarily determined by its operating capabilities; different parts of the QNF may themselves be in different lifecycle phases. As it is likely that lifecycle changes will be accompanied by a revision to the BTC, ONR’s inspection of the BTC should be considered at all lifecycle stages of a facility as defined in ONMACS and should be targeted and proportionate.
2. It is the responsibility of the operator to revise the BTC dependent on any changes to the facility or site and submit an updated document to the ONR. Upon receiving a revised BTC the inspector may carry out an inspection to confirm the submission and will consider alignment with ONR other purposes. This inspection may form part of an assessment or be standalone reflecting the activities of the site or facility (e.g., pre-construction phase; commissioning, decommissioning etc).
3. Some activities that inspectors may wish to employ in carrying out BTC inspection can include:
   1. facility walk-through and confirmation of floor plan layouts.
   2. physical identification and follow-through of QNM flow routes and inventory locations, including areas where QNM may be difficult to access and/or measure.
   3. examination of records, and any other information related to the QNF and associated NMACS arrangements.
   4. establishing that facility equipment which is essential for safeguards purposes is as described in the BTC (e.g., by confirming its presence, checking its functionality, maintenance, and operation).
   5. engagement with the relevant key operator personnel.
4. The Essential Equipment List (EEL) [23] is safeguards terminology for those items of equipment, systems, and structures necessary for the declared operation of a QNF. ONR may choose to compile EELs for certain QNFs. Assessment and inspection of the status of equipment on such EELs will inform decisions on whether or not the QNF can be considered as decommissioned for safeguards purposes and is also used to support engagement with the IAEA to confirm the removal of QNFs from the list of those eligible under the UK/IAEA Safeguards Agreement.

**6. BTC - The Lifecycle Approach for Assessment and Inspection**

1. The operator must declare BTCs at several design and construction stages and must inform ONR of the changes to a BTC. It is good practice for the operator to re-submit a BTC to ONR following such a change.
2. As a QNF moves through its lifecycle phases, the uses of the QNM within the QNF change, the operations carried out within it change and can lead to changes in the accountancy and control arrangements.
3. It should be anticipated that BTC changes will be declared to ONR throughout the design process and later lifecycle changes. ONR may elect to assess and / or inspect the compliance of the BTC with NSR19 at any stage using a targeted approach aligned with the ONR Safeguards sub-division regulatory strategy.
4. The safeguards lifecycle can be separated into these phases.
5. Pre-construction phase
6. Construction phase
7. Commissioning phase
8. Maintenance / modification phase
9. Operating phase
10. Shut-down phase
11. Closed-down phase
12. Decommissioned for safeguards purposes
13. The following are guidance on the definition of each phase. The additional objectives of assessment and inspection at each lifecycle phase other than those identified earlier are set out against each of these phases in table 3. The objectives are not an exhaustive list, and it is for the inspector to judge which of these (and any other objectives) are to be applied to the QNF in that stage of its lifecycle. As maintenance and modification are a specific task these are explained in more detail below.

**Pre-construction phase**

1. The pre-construction phase for a QNF begins as soon as the plan for constructing a nuclear facility or site is decided. This phase includes the planning, design and engineering activities which precede the actual construction of the QNF or site.
2. An initial approach to regulating compliance against NSR19 can be prepared by assessing the preliminary design information. As the design of the QNF progresses, there should be further engagement and provision of more detailed information as necessary to allow ONR to refine the approach.
3. Assessing BTC information from the outset and discussing the outcomes with the operator assists inspectors to determine whether a QNF design makes or can be made to give adequate provision for NMACS by the operator (including ONR’s ability to inspect the implementation of those arrangements).
4. Inspectors may also use BTC submissions on new QNFs in this phase to establish and maintain suitable dialogue with the IAEA regarding their appetite for possible designation of the new QNF concerned, and therefore the need to prepare for IAEA verification activities and any equipment involved in them.
5. The objectives in this phase should be focussed on understanding the purpose of the QNF and defining its NMACS in the best way to build in NMACS by design.

**Construction phase**

1. The construction phase of a QNF begins with the commencement of foundations and continues until the entire QNF is constructed and ready for commissioning. During the construction phase, the design information will evolve as changes to the design occur.
2. As construction progresses, or as soon as possible after construction completion, BTC assessment and inspection activities may be carried out to verify specific NMACS related requirements. For instance, the provision of any storage locations or retrieval machines that may be utilised for measurement, control, or verification by the operator. In the event of the IAEA designating a QNF for implementation of safeguards measures, negotiation of the IAEA’s verification approach may result in an approach which includes the installation of IAEA equipment.
3. The objectives in this phase should be focussed on confirming that the NMACS systems proposed in the design are being installed and the nuclear material control or nuclear material accountancy reporting IT equipment, systems or processes are finalised.

**Commissioning phase**

1. The commissioning phase of a facility begins after completion of construction and before the facility is operational. This stage will include the use of QNM for testing. Inspectors should ensure the notification requirements set down in NSR19 are met.
2. Participation by ONR (as well as the IAEA where necessary to support possible designation of the facility for inspection under the UK/IAEA VOA) in testing activities should be arranged jointly with the operator to enable ONR to gain assurance that the NMACS system declared in the BTC is being operated effectively while minimising the interference on the facility’s commissioning phase. The approach taken to commissioning must ensure that ONR can make an independent assessment.
3. The objectives in this phase should be focussed on confirming that the NMACS systems installed are being brought on line and set to work, and that testing confirms QNM can be accounted for and controlled proportionately and appropriately.

**Operating phase**

1. The operating phase (routine operations) of a facility begins after commissioning is completed and when QNM has been introduced to the main facility, or support facility, so that it may function for its designed purpose. During the operating phase the major objective of BTC assessment and inspection activities is to ensure that the facility is operating in accordance with the declared design information.

**Maintenance / modification phase**

1. The maintenance / modification phase may involve all or part of a QNF. It may also coincide with other phases, such as operating or shut-down phases. The maintenance / modification phase may include design changes to the QNF. The major objective of BTC inspection activities during this phase is to ensure any changes to the facility’s design, function, operation, and capability, and essential equipment as defined by ONR have been identified and that the modifications to the BTC are implemented.
2. Within this phase it is important to recognise that QNM needs to be controlled and accounted for whilst the NMAC systems are going through changes. Thus, the inspector may consider via assessment or inspection whether:
   1. The maintenance and / or modifications were appropriate for the declared purpose.
   2. The work performed met that specified in the maintenance / modification declared work plan.
   3. The integrity of the control measures for QNM were compromised during the period of change.
   4. The QNM verification methods were affected by the maintenance / modification work.
   5. The declared accounting and relevant operating procedures after the modification / maintenance are correct, appropriate up-to-date and implemented.
   6. The use, function, capacity, and operational status of essential equipment have been modified.

**Shut-down phase**

1. The shut-down phase of a QNF involves interrupting the operation of a QNF for a period significantly exceeding that of normal outages. During this phase, the QNF is not in operation, contains QNM and could be restarted in a short time should the operator choose to do so.
2. During the shut-down phase, ONR continues with BTC inspection activities to ensure that the operational status of the facility is as declared and that no undeclared changes are made to the facility.

**Closed-down phase**

1. The closed-down phase of a facility begins when operations have been stopped and QNM has been removed, but that decommissioning has not started and the potential for undeclared start up remains. A QNF which has been built but never operated and which has no QNM inventory may also be considered to be in a closed-down phase. ONR should still be performing BTC inspection activities during the closed-down phase – and the IAEA will be doing so for facilities that have been designated.
2. A closed-down QNF may be in either a Care and Maintenance (C&M) phase or a state of decommissioning and as with shut-down the work of the inspector focuses on assurance related to control of QNM.
3. A closed-down facility is in a C&M phase when:
   1. Major process operations were never started or have been declared as stopped.
   2. QNM inventory was never received or has been removed or cleaned out to the extent possible.
   3. The installation is not in a decommissioning stage, nor has it been decommissioned.
4. BTC inspections are performed during the preservation state to ensure that the QNF is not operating and in a preserved closed-down state.
5. A closed-down QNF is in a state of decommissioning when:
   1. It is closed down as defined for a state of preservation.
   2. ONR has been informed of the decision to begin decommissioning.
   3. The removal or rendering inoperable of essential equipment has begun.
6. BTC inspection activities are performed during this state to ensure that the QNF is not operating and to confirm the declared decommissioning activities. ONR can confirm the removal and / or rendering inoperable of the essential equipment (see EEL above) such that the relative difficulty (time and cost) of re-activating or misusing the facility undergoing decommissioning can be assessed. The BTC inspection activities are performed according to the decommissioning schedule as declared by the operator.

**Decommissioned for safeguards purposes**

1. NSR19 includes a definition of “Decommissioned” in relation to a QNF as meaning ‘a QNF for which it has been confirmed to the satisfaction of the ONR that residual structures and equipment essential for its use have been removed or rendered inoperable so that it is not used to store and can no longer be used to produce, handle, process, dispose of or utilise QNM’.
2. Removal of QNM is therefore an important factor in determining that a QNF has been decommissioned for safeguards purposes; and this should have already occurred during closed-down phase.
3. The operator should provide ONR with the updated information specifying the decommissioned status of the facility. BTC inspection activities will be scheduled by ONR to confirm that the QNF has been decommissioned as specified by confirming that sufficient declared essential equipment has been removed or rendered inoperable. Once ONR can determine that the QNF can no longer be used for its declared purpose, the QNF is considered decommissioned for safeguards purposes and the inspector should inform the operator accordingly.
4. ONR will cease to perform BTC assessment and inspection activities once it has concluded that the QNF has been decommissioned for safeguards purposes. However, ONR and the operators concerned must bear in mind that the UK/IAEA Additional Protocol includes provisions for IAEA complementary access to confirm the decommissioned status of a facility which was designated under the UK/IAEA Safeguards Agreement [17].

Table 4: Safeguards Inspection Objectives versus Facility Lifecycle

|  | Life Cycle Phase | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Pre-construction | Construction | Com-missioning | Operating | Maintenance / modification | Shut-down | Closed-down | Post-POCO Care & Maintenance | Decom-missioning | Decom-missioned for safeguards |
| **Objective** |  |  |  |  |  |  |  |  |  |  |
| Financial, technical and human resource requirements for ONR’s approach to regulating compliance against NSR19. | Estimate potential | Define | Confirm | Confirm | Amend | Amend | Amend | Amend | Amend | None |
| Function and capability of the facility. Including planned buildings, locations, declared purpose and use | Become informed | Understand | Confirm | Confirm | Confirm impact of change | Limited Approach | Limited Approach | Limited Approach | Limited Approach | None |
| Detailed approach of ONR in regulating compliance against NSR19 (e.g., including scope and structures of the MBAs and KMPs, usage and appropriateness of flow KMPs) | Preliminary definition | Finalise approach | Confirm approach | Utilise approach | Amend approach | Limited Approach | Limited Approach | Limited Approach | Limited Approach | None |
| Operator QNM accountancy and control features in the facility -including material flow routes, material inventory locations | Identify | Understand | Confirm | Confirm | Confirm impact of change | Limited Approach | Limited Approach | Limited Approach | Limited Approach | None |
| Essential equipment for determining a facility is decommissioned for safeguards purposes (EEL) | Identify | Understand | Confirm | Confirm | Confirm impact of change | Confirm | Confirm | Confirm | Removal including appropriate inspection | None |
| Material control – appropriate measures identified and in place | Identify where appropriate | Understand | Confirm | Confirm | Confirm impact of change | Identify and understand | Confirm | Confirm | Confirm | None |
| QNM accountancy and control relevant accounting and operating records and procedures including that they are correct, appropriate and up-to-date, appropriate measurement systems, uncertainties in measurement, expectations against International Target Values for safeguards purposes | Identify where appropriate | Understand | Confirm | Confirm | Confirm impact of change | Identify and understand | Confirm | Confirm | Confirm | None |

1. Qualifying nuclear facility is defined in NSR19 and Section 76A of The Energy Act 2013 as “a facility (including associated buildings) in which qualifying nuclear material is produced, processed, used, handled, stored or disposed of”. [↑](#footnote-ref-2)
2. Writing includes the use of electronic media. [↑](#footnote-ref-3)
3. Concerning a matter arising which could be regarded as an operator having failed to comply with these arrangements and procedures, this will not be the case if the ONR has previously informed the operator in writing that in the ONR’s opinion, it is unlikely to be prejudicial to the maintenance of the system of accountancy and control in respect of the QNM at the QNF. [↑](#footnote-ref-4)