Working Group 2 - Deliverables Four, Five, and Six

2016–2017 Output Report: Inspection Activities and Techniques

Working Group 2: On-Site Inspection (OSI)

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Contents

Introduction

The Working Group on On-Site Inspections (Working Group 2) was tasked to examine activities and techniques for on-site inspection (OSI) that could effectively verify compliance with future disarmament agreements. Australia and Poland co-chaired Working Group 2, which met six times during 2016 and 2017 and worked intersessionally to develop and discuss papers related to its task. The IPNDV's three working groups have worked interactively throughout Phase I, and this document incorporates material prepared by Working Groups 1 and 3 in order to provide a more complete product. Working Group 2 is grateful for those contributions.

Throughout this document, the term "Nuclear Explosive Device," (NED) is used to refer to the item subject to monitoring and inspection activities. The term "NED" was used to address specific technical considerations related to the definition of a nuclear weapon that arose during discussions among experts. Other products produced by the Partnership use the more generic term "nuclear weapon." The latter usage is devoid of any specific technical meaning and relies on a general understanding of the term.

This document brings together the outcomes of Working Group 2's efforts for Phase I of the IPNDV's activity. The focus and content of this document reflects Working Group 2's terms of reference and links to the three deliverables identified therein (see Annex I) as follows:

1. **Key Elements of OSI for Verification of Nuclear Disarmament Undertakings**
   - Part I outlines the key elements of OSI for verification of nuclear disarmament undertakings.
   - Part II considers potential new inspection procedures, activities, and techniques that could effectively verify compliance with future agreements.

2. ***Best Practices: Skills, Training Requirements, and Lessons Learned***
   - Part III examines the limitations related to safety, security, non-proliferation, and national interests that are likely to apply for inspections to monitor NED dismantlement and looks at options for managed access.
   - Part IV outlines the kinds of skills and training requirements needed for those involved in inspections to monitor NED dismantlement.

3. ***Proposed Approaches and Topics for Future Development of OSI for Verification of Nuclear Disarmament***
   - Part V proposes approaches and topics for future development of OSI for verification of nuclear disarmament.

Working Group 2 focused its deliberations on how on-site inspection would apply within the above-mentioned Basic Dismantlement Scenario. To do so comprehensively, Working Group 2 found it necessary to consider also some broader elements of a verification framework.

This document has been compiled using material prepared by many authors, but as far as possible represents common understandings of Working Group 2.

Part I: The Key Elements of OSI for Verification of NED Dismantlement Undertakings

Chapter 1. Verification Framework

Definition of the steps to carry out verified dismantlement of a NED, as well as the conditions under which monitoring and inspection activities are to be conducted, would be set out in the framework of a verification agreement. Possible elements for a notional verification agreement appear below.

Types and Status of Agreements

In the parlance of arms control and non-proliferation, verification is carried out under a legally binding framework specified by an agreement. That agreement could be bilateral, plurilateral, or multilateral in nature. A verification framework could be based around a single detailed agreement, such as the START Treaty, or an overarching agreement and separate implementation agreements based on a common model. The IAEA's implementation of safeguards under the NPT is an example of the latter approach.

The verification framework discussed here assumes a single detailed agreement ("the verification agreement") that is either plurilateral or multilateral in scope under which one or more of the member States commit to verifiably dismantle a number of NEDs.

Basic Provisions in an Agreement

Basic undertakings in the verification agreement would set out the broad commitment of member States regarding verified dismantlement of NEDs. Monitoring and inspection objectives and procedures relative to the activities required to dismantle a NED that apply to member States would be included in the agreement. The obligation of States to accept verification to demonstrate compliance would be a key provision of the verification agreement. That obligation is supported by commitments to provide information to member States and to a verification entity to facilitate fulfillment of the requirements of the verification agreement. Chapter 2 considers the possible content of declarations.

Specific Dismantlement Undertakings

Each State agreeing to undertake NED dismantlement would commit to verifiably dismantle a specified number (possibly disaggregated by type) of NED(s) during an agreed period, perhaps of several years. This commitment could form part of the terms of the verification agreement, or be based on a declaration according to guidance in the agreement.

Verification Entity

A verification entity would be established/specified by the verification agreement to implement monitoring and inspection of dismantlement activities on behalf of, and under the executive guidance of, its member States. Chapter 3 examines the role and design of a verification entity.

Preparative Arrangements for Dismantlement Monitoring and Inspection

The verification agreement would include provisions on declarations and notifications by an inspected State or States and the verification entity to facilitate monitoring activities. Chapter 2 addresses this in further detail.

Detailed monitoring and inspection arrangements are likely to vary from State to State and from facility to facility. The verification agreement should provide for an inspected State to enter into facility arrangements with the verification entity to address site-specific issues related to managed access, safety and security arrangements, and the amenities and logistical support to be provided to inspectors. An executive organ of the verification entity should approve facility arrangements so that member States have assurance of a consistent approach to verification activities.

The conduct of monitoring and inspection activities could be facilitated by national procedures for accounting for and control of monitored items implemented by an inspected State. These procedures could follow recommendations setting minimum requirements and issued by the verification entity, approved by the executive organ, or set out directly in the verification agreement.

The authentication and certification of inspection equipment is likely to require procedures such as the establishment of common equipment specifications by member States as well as arrangements for inspected States to familiarize themselves with equipment that is held in the custody of the verification entity. Any equipment held in the custody of a State would also need to be examined by the verification entity prior to its use in inspections. To reduce the need for re-authentication, cryptographic or other suitable methods (e.g., sealing) could be used to ensure that equipment stored on-site has not been altered.

Procedures for the use of equipment during inspections would be developed by the verification entity and approved by member States, or could be included directly in the verification agreement. Potential on-site safety risks should be taken into account in the design of the inspection procedures and equipment. To take account of site-specific requirements, the procedures would be further detailed and adapted as necessary in specific facility arrangement. The procedures should also take into account the possibility of having inspection equipment installed on-site and operational when inspectors are not present.

Inspection Process

Based on declarations/notifications from an inspected State regarding planned dismantlement activities, the verification entity would plan and prepare inspection missions. The objectives and duration/frequency of different kinds of inspections should be addressed in the verification agreement. Many missions would be routine and coordinated with the State's dismantlement schedules. Some missions might be conducted at short notice, for example to check containment and surveillance of stored items or to maintain installed equipment.

Chapter 5 examines the process of an inspection. Related issues that may be explicitly addressed in a verification agreement could include:

- Country and dismantlement site entry procedures for inspectors and equipment;

- The kinds of information to be included in Inspection Reports;
- Mechanisms to address questions left unresolved during an inspection and resolution of any dispute in relation to its conduct.

Rights and Obligations with Respect to Inspections

Initially, access would be needed by inspectors to establish, and where appropriate to verify, declared information about dismantlement facilities and to enable negotiation of facility arrangements. Routine inspection activities to monitor the dismantlement of a NED would be the major ongoing inspection task. Short notice inspections could be used also to maintain continuity of knowledge on storage areas. Access rights of inspectors to dismantlement facilities should be spelled out in the verification agreement, and further elaborated in facility arrangements. If access by inspectors to locations within a dismantlement site outside the declared dismantlement facility will be needed, this should also be addressed. The monitoring objectives to be achieved by inspections help define the appropriate level of intrusiveness required during inspections and would clarify the level of confidence that member States would enjoy from a verification agreement. Overarching monitoring objectives would be set out in the verification agreement and may be further detailed in facility arrangements to address site-specific factors.

States should commit through the provisions of an agreement to cooperate with the verification entity to implement verification and to facilitate the tasks of inspectors to carry out monitoring inspections.

The verification agreement would specify the starting point and scope of verification activities in terms of the dismantlement process.

The verification agreement sets out the inspection techniques and types of inspection activities that may be applied during inspections. The specification of these techniques and activities in the verification agreement (or an annex thereof for ease of adaptation/modification) would establish an inspection access protocol. This would provide a model approach to verification and would establish critical and common requirements to avoid the disclosure of sensitive information that is unrelated to the achievement of verification objectives. Bearing in mind that the negotiators of the verification agreement cannot foresee all future implications of the protocol, and cannot predict potentially useful technological developments, the agreement should include provisions allowing evolution of the protocol, including as lessons are learned from its implementation. If an inspected State chooses to give inspectors access in addition to that specified in the inspection access protocol in order to demonstrate compliance with its basic commitments, the possibility of such additional access should not be excluded.

Continuity of knowledge about each NED and, following disassembly, its components that are subject to monitoring will be fundamental to effective verification. The types of inspection activities specified in a verification agreement should include specific provisions on a right for inspectors to apply appropriate chain of custody measures, including containment and surveillance measures.

Access rights of inspectors, consistent with the inspection access protocol, and the possible application of managed access by an inspected State, should be specified in the verification

agreement. This would include specification of the types of records/information to be available to inspectors.

Effective procedures to avoid the disclosure of sensitive information or data during, or obtained from, monitoring and inspection activities is central to the cooperation of States with those activities, and to avoiding damage to the reputation of the verification entity. Preventing unauthorized disclosure of sensitive information has two broad aspects that should be addressed in the verification agreement:

- **Managed access:** Negotiation of access with the inspected State, the aim of which is to meet verification objectives but avoid the disclosure of sensitive information or data that is unrelated to the inspection, as well as to avoid compromise of nuclear security for NEDs and their critical components. Chapter 16 addresses this issue in more detail.
- **Confidentiality protections:** Managing the circulation, protection, and disclosure of information needed by inspectors and the verification entity.

The verification entity, its staff, and inspectors need to carry out their activities with appropriate independence and free from concerns of interference inconsistent with the objective and purpose of the verification agreement. Privileges and immunities for verification entity staff and inspectors should be specified in the verification agreement in line with the standard provisions found in existing arms control and non-proliferation agreements. It will be important, however, for the provisions of the verification agreement to address how inspector privileges and immunities are implemented together with rights for an inspected State to escort inspectors, observe inspection activities, and protect sensitive information. For example, if negotiators of a verification agreement foresee a right for an inspected State to review and/or prevent the removal of certain information and data gathered by inspectors at sensitive locations, this needs to be balanced carefully with privileges and immunities provisions.

The kinds of amenities and logistical support to be provided to inspectors to facilitate their task should be outlined in the verification agreement. In particular, the provision of suitable office premises and living quarters should be considered. The application of privileges and immunities at these locations should be clear. Site specific details of the amenities and logistical support would be set out in facility arrangements.

In some circumstances, the conduct of inspection activities in parallel with routine national activities at a facility could be incompatible. A verification agreement should establish principles on avoiding such problems or, if necessary, managing their impacts. Site-specific arrangements in this respect would be included in the applicable facility arrangement.

Rights, obligations, and procedures for authentication of inspection equipment by an inspection team and its certification by an inspected State should be set out in the verification agreement or in an annex to it.

Appropriate commitments to the health and safety of participants in inspections should be set out in the verification agreement. It may address arrangements for inspectors to receive site-specific training. The verification agreement should include guidance for situations where a

safety risk or event may impede fulfillment of an inspection mandate. Site-specific health and safety concerns should be addressed in facility arrangements.

Compliance Assessment

Verification assessments would be made by each member State based on declarations and Inspection Reports, as well as information exchanges under a consultative mechanism. As with some existing consultative mechanisms, additional information may play a role in building confidence in compliance. A verification agreement could make clear that its States' parties are not precluded from using information obtained by national technical means of verification, consistent with generally recognized principles of international law. It might also provide for a verification entity and/or member States to draw on open source information to facilitate verification.

An issue for consideration in the design of a verification framework will be whether the verification entity will routinely provide all member States with the detailed reports prepared by inspectors, or only summary findings. Sharing of detailed information on inspections could discourage openness by an inspected State, but may be necessary for resolution of disputes or for clarification of anomalies through the consultative mechanism. At the other end of the scale, an approach modeled on the Safeguards Statement that the IAEA issues each year with respect to safeguards compliance would be unlikely to offer enough detail.

Costs of Monitoring and Verification

A verification agreement should specify responsibilities for meeting the costs of monitoring and verification. The funding of a verification entity could be based on a budgetary allocation model such as that for the IAEA, or may place additional responsibility on countries with nuclear weapons. The latter model might discourage participation of those States.

Other

A verification agreement should also address:

- Definitions of terms;
- Provisions concerning the relationship with other verification agreements (including future ones);
- Interpretation and dispute resolution;
- Liability issues and claims for damages;
- Future technological developments;
- Entry into force, duration, and amendments;
- Withdrawal and fallback measures; and
- Consequences of non-compliance.

Chapter 2. Declaration, Notifications, and Information Exchange for Monitoring NED Dismantlement

High-Level Declarations

As outlined in Chapter 1, each country agreeing to undertake NED dismantlement would commit to a dismantlement program to verifiably dismantle a specified number of NEDs during a defined period. Information on the numbers and types (if applicable) of NEDs possessed by a country may be included in declarations as a confidence building measure and/or to provide baseline information for future disarmament efforts.

Initial Dismantlement Declaration

An initial dismantlement declaration by a State to the verification entity sets out plans and data necessary to prepare for and implement OSIs to verify fulfillment of the abovementioned dismantlement program. An initial declaration could include:

- Verifiable parameters and technical characteristics about the NEDs to be dismantled to facilitate the verification entity's assessment of the techniques needed to conduct inspections. Verifiable parameters that are appropriate for all NEDs would likely be included in the verification agreement;
- Specification of each dismantlement site. This refers to the installation within which a dismantlement facility is located, and includes amenities outside the facility such as inspection team office premises and living quarters;
- Specification of each dismantlement facility. This refers to the building or buildings where dismantlement activities take place and is monitored by inspectors; and
- For each dismantlement facility, proposed timing and scope of one or more campaigns to implement the dismantlement program. The term "campaign" refers to plans to dismantle a specified number of NEDs over a certain period at a specified facility as part of a dismantlement program.

Declaration of a Dismantlement Site and Dismantlement Facility

For each dismantlement site, the inspected State declares to the verification entity information about:

- The name and location of the dismantlement site;
- The location within the dismantlement site of each dismantlement facility subject to inspection;
- Details of office premises and any other amenities at the site proposed to support the work of inspectors;
- Any proposed conditions or restrictions on movement of inspectors within the site; and
- Any health and safety requirements related to access within the site (other than to monitored facilities).

For each dismantlement facility, the inspected State declares to the verification entity information about:

- Relevant details of the layout and structure of buildings or structures in which dismantlement activities are to be conducted, including where NEDs arrive, are stored, are disassembled, and where components are to be stored;
- Any proposed conditions on access by inspectors within, and around the immediate periphery of, the dismantlement facility;
- Health and safety requirements related to access to and within the dismantlement facility; and
- Specific conditions that may affect planning for inspections (e.g., possible limits of numbers of inspectors present).

Periodic Declarations

At least annually a State carrying out dismantlement activities provides an update of its declarations to the verification entity. Such periodic declarations facilitate the allocation of resources and planning of inspections by the verification entity.

National Arrangements

Each member State notifies the verification entity of the National Authority setup to fulfill its obligations and/or participate in verification, including arrangements for receipt of notifications.

Each inspected State notifies the verification entity of points of entry (POE) (if provided for in the verification agreement) and related arrangements to enable prompt entry into its territory.

Operational Notifications

Member States would provide several recurring formal notifications to the verifying entity. Such notifications could include designation of inspectors who could conduct monitoring and inspection activities in a State. Regarding such notifications:

- The verification entity nominates inspectors for designation to States with an obligation to receive inspections;
- Unless a State notifies the verification entity of the rejection of a nomination within a set period, the nominated inspectors would be designated as available for inspections in that State; and
- An inspected State will maintain the right to reject a previously designated inspector without affecting an imminent or ongoing inspection, or the effectiveness of inspections overall.

An inspected State notifies the verification entity (and/or inspectors if during an inspection) of events that may affect planning of monitoring and inspection activities. Examples might include damage to a seal that may affect continuity of knowledge and unanticipated health and safety issues.

The verification entity notifies an inspected State of a planned OSI, including details of the inspection team members, equipment it is bringing (or any that is already on-site that it may wish to use), and the mandate for its activities. The verification entity notifies an inspected State about the planned rotation of inspectors during the course of an inspection if necessary.

Notifications are exchanged by the verification entity and inspected States in relation to non-inspection activities at a site, such as site-specific health and safety training required for inspectors.

Information Exchanges during an Inspection

An inspected State facilitates the conduct of each OSI, including by providing the inspection team with the information needed to fulfil its mandate, and consistent with its right to apply managed access. Specific exchanges could include:

- Pre-inspection briefings on procedures for accessing the dismantlement site and the dismantlement facility;
- Support by national escorts; and
- Clarification of any anomaly identified by the inspection team with respect to inspected items or locations.

Other Information Exchanges

An inspected State and the verification entity would also exchange information on:

- Arrangements for certification of inspection equipment by the inspected State;
- Notification by the verification entity of the results of inspection activities; and
- Notification and resolution of disputes.

The verification entity notifies member States of the results of inspection activities.

Chapter 3. Verification Entity

Any multilateral agreement requiring verified dismantlement of NEDs would need to rely on an independent *verification entity* to implement monitoring activities on behalf of, and under the executive guidance of, its member States. A plurilateral agreement may require this also.

The verification entity's staff would prepare for and conduct inspections, including by negotiating facility arrangements with inspected States for approval by member States. The verification entity would establish and train an inspectorate to conduct inspection activities. In the case of a multilateral agreement, it would be expected that the inspectors belonging to the verification entity would conduct inspections. In the case of a plurilateral, or bilateral, verification agreement, the inspectorate would likely be composed of a cadre of experts drawn from member States to carry out inspection functions.

Procedures for both the nomination/designation of inspectors and the acceptance or rejection of inspectors by States via regular provision of inspector lists by the verification entity should be included in the verification agreement. An inspected State would maintain the right to decline individual inspectors without affecting an imminent, or ongoing inspection.

Declarations from States can be used to support negotiations on the facility arrangements and for inspection planning on those declared facilities thereafter. (All declarations should be maintained in a secure electronic archive.) Additionally, an Operations Center, able to operate for 24 hours per day and 7 days a week (24/7) during the course of ongoing inspection activities could be established to facilitate the conduct of inspections and ensure that deployed inspection teams can maintain 24/7 communications with the verification entity. The verification entity and National Authority will also be able to communicate through an Operations Center.

The verification entity initiates negotiations with relevant States on facility arrangements that would help define the details of how inspections would be conducted at specific facilities. This could include the number of inspectors, access restrictions including managed access, facility perimeters, measuring points, confidentiality procedures, administrative and logistic arrangements, etc. as required by the inspection parameters established by the verification agreement taking into account facility conditions.

The verification entity's staff would analyze the results of monitoring and inspection activities and provide member States with factual information to facilitate assessments of compliance. As with some existing verification mechanisms, additional information may play a role in building confidence in compliance.

Establishment of a Verification Entity Prior to Entry into Force of an Agreement

To prepare for entry into force of an agreement, it is helpful to establish a Provisional Technical Secretariat (PTS) for the verification entity composed of a skeleton team of core staff members. The PTS can carry out the following types of essential preparatory work: coordinate with member States and assist policymaking organizations; draft confidentiality manuals, declaration handbooks, inspection manuals, health and safety manuals, and technical specifications for

inspection equipment; designate and prepare lists of inspectors; conduct inspector training; and perform other administrative tasks.

Using the Organization for the Prohibition of Chemical Weapons as a model, the following illustrative flow chart provides a notional sequence of events for establishing and implementing a verification entity under a notional verification agreement. This chart is intended to visualize the kinds of activities that would be needed for the verification entity to fulfil its role and to derive the knowledge and skills required for the staff (i.e., verification officers and inspectors) of the verification entity.

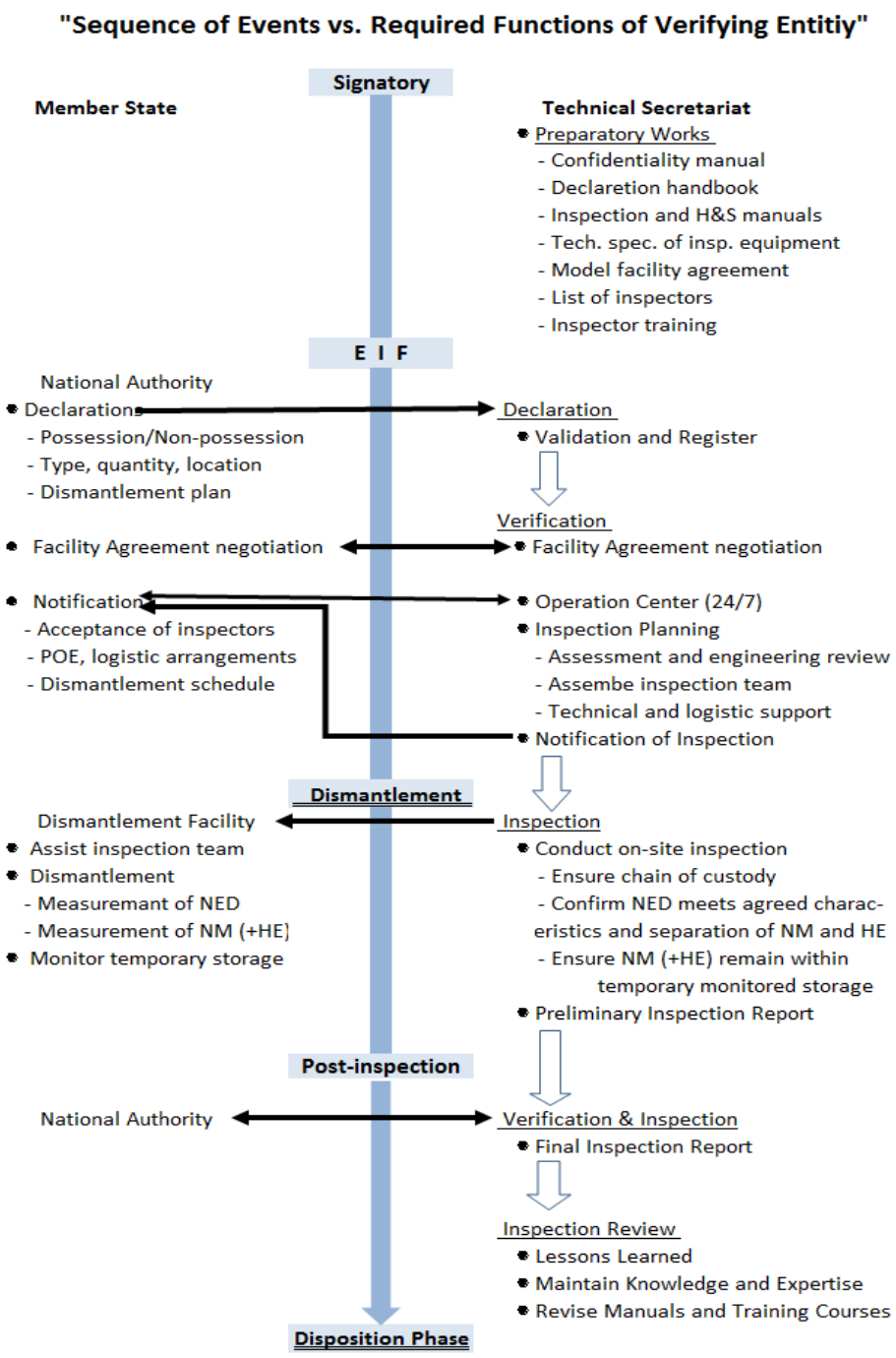


Figure 1: Sequence of Events vs. Required Functions of Verification Entity

Part II: Inspection Procedures, Activities, and Techniques

Chapter 4: Functional OSI Objectives for NED Dismantlement

Working Group 2 identified the following list of practical objectives for the design of a verification regime for monitoring a notional NED dismantlement process as outlined in the Basic Dismantlement Scenario.

Preparative Steps

The inspected State and verifying entity:

- Agree that planned dismantlement/disposition processes and facility designs are consistent with fulfillment of verification requirements and minimize opportunities for diversion or spoofing; and
- Develop a facility arrangement that includes facility-specific monitoring procedures.

Verifying entity plans for specific inspections to monitor and document dismantlement processes.

Inspected State certifies and inspectors authenticate the functionality of verification equipment, including information barriers.

Monitoring of Dismantlement

Inspectors maintain continuity of knowledge for a NED, for example through application of tagging and containment and surveillance measures.

Inspectors confirm consistency between physical measurements (such as radiation emissions) and agreed characteristics of a NED, as well as of components of a dismantled warhead.

Inspectors confirm separation of nuclear material and high explosives from a NED.

If continuity of knowledge about declared items is lost, inspectors utilize inspection techniques like physical measurements or template data to:

- Help to confirm the identity of a NED or NED component; and
- Check that a NED or NED component is physically consistent with others of the same type.

Inspectors maintain continuity of knowledge, as necessary, with respect to the monitored dismantlement facility and monitored items stored in it. This could include monitoring at boundaries or at key locations to deter and detect items or activities that might aid diversion or spoofing.

The inspected State operates a record system to account for and control relevant items, materials, and activities in the dismantlement process. Inspectors request access to this information as appropriate to check consistency with on-site observations.

Information collected by inspectors is reviewed by the inspected State to identify that which is sensitive and not relevant to the purpose of the inspection (guidance will be needed to identify what is sensitive and what may not be relevant). Such information should not be included in reports of the inspection.

The verification entity develops assessments of confidence that declared activities have taken place and characterize any uncertainties or anomalies.

Overarching Considerations

Information requirements in inspections in order to gain trust and confidence need to be balanced with inspected State constraints (i.e., sensitivities and limitations with regard to safety, security, and non-proliferation).

Confidentiality requirements are observed by the verification entity for sensitive information to which inspectors require access.

Disputes should be resolved either promptly by inspectors or the verification entity or at a political level.

Need to seek solutions to challenges including those related to safety, security, and non-proliferation concerns inferred by inspected State constraints; e.g., in finding suitable combinations of confidence building measures, information, and procedures.

Chapter 5. Process for Conduct of an Inspection

Planning of Inspection Processes

The verification entity begins the inspection planning process by:

- Assessing declarations and reviewing the proposed dismantlement process;
- Finalizing an inspection plan after receiving applicable notifications from the inspected State regarding the logistic arrangements for the inspection team;
- Finalizing specific instructions for the inspection team;
- Arranging for required technical and logistics support for the inspection team; and
- Notifying the inspected State of the pending inspection.

A fundamental part of inspection planning is familiarity with the facilities to be inspected. In addition to information provided through initial and recurring declarations, a familiarization visit during the preparatory phase prior to entry into force can help to clarify which facilities are subject to inspection, the level of access, access controls, and the timeline associated with the dismantlement process. During a familiarization visit, the main objective is to achieve broad understanding regarding how to conduct inspection activities and the control measures that would be used by inspected States at specific locations. Such visits can be used to help in developing facility arrangements.

Several issues could be discussed during a familiarization visit, for example facility schematics, locations where images could be taken by inspectors within facilities, physical measurements made on inspected items, format of unique identifiers, and locations and processes for placing tags and seals.

In-Country and On-Site Preparations

When the inspection team arrives in the inspected State (at the POE assuming that the verification agreement includes such provision), the inspected State and the inspection team conduct arrival, or POE, procedures. During this activity, the inspection team will provide the inspected State with a copy of the inspection mandate and begin inspection equipment check-out procedures. The inspected State's escorts would provide transportation for the inspection team and its equipment to the inspection site within any required time-frame, and the escorts would coordinate any needed logistic support for the inspection team, i.e., accommodations, storage for inspection equipment, secure communication access, and any other required support.

On-site activities would begin with an opening meeting with representatives from the inspected State to ensure a common understanding of the inspection activities, a security and safety briefing by facility personal and/or national escorts, and certification (by the inspectorate) and authentication (by the inspected State) of equipment to be used during the inspection. The inspection team and escorts would consult to settle on a detailed plan of the access that inspectors would be granted to conduct inspection activities, taking into account the terms of the applicable facility arrangement as well as any additional managed access measures.

At the beginning of each day, the inspection team and the escorts meet to review the facilities and operations scheduled for that day including the dismantlement and inspection activities to be performed.

Consistent with the approach in treaties such as the Chemical Weapons Convention (CWC) and the Comprehensive Nuclear-Test-Ban Treaty (CTBT) where "office premises" are designated, the inspectors would benefit from a dedicated Inspector Station protected by privileges and immunities as outlined in the verification agreement. Ideally, an Inspector Station would be located in a low security area, either within or nearby the location(s) where inspections would take place. Within an Inspector Station, the restrictions on activities would be minimal, allowing the inspectors to pursue negotiations, review documentation, write reports, and perform data analysis as defined by the verification agreement.

Planning by the Inspected State

In a future verification regime for NED dismantlement, inspectors will need appropriate access to locations in sensitive facilities where NEDs and their components will be present. Such access will have to be managed carefully by the inspected State to prevent the disclosure of sensitive information, both in compliance with the NPT and in consideration of national security. At the same time, inspectors must take care to respect managed access restrictions so as not to gain proliferation-sensitive information. This is an over-arching objective for the design, planning, and conduct of inspection activities. Inspected State legal requirements related to security and health and safety may also restrict activities within facilities subject to inspection.

The inspected State will normally deploy several methods in order to implement security and inspection activities:

- Identity checks before and during the visit;
- Security briefings;
- Changes of clothing and metal detector checking;
- Escorting and guarding;
- Shrouding and exclusion zones;
- Control of equipment and measurements; and
- Documentation and information control including measures such as numbered notepads.

Inspected State escorts would liaise with site personnel and facilitate access for inspectors based on the verification agreement, facility arrangements, and inspection plan and help to resolve any ambiguities that may arise. Escorts would exercise rights for the inspected State by observing inspectors' access and preventing any departure from agreed arrangements that might risk the disclosure of sensitive information.

It may be appropriate for the inspected State to split the escort support with respect to activities, objects, and equipment or sensitive areas. This might increase the number of facility staff required as escorts but would allow them to best understand and implement the agreements specific to their area of responsibility. If the facilities have limits on personnel numbers, the need for escorts to be present could have a significant effect on the number of inspectors able to access an area and the rate at which they can conduct their activities. Regardless of the approach

taken by the inspected State, it will be essential that all inspected State staff members are well trained in the procedures required.

Many of the above measures are primarily based on security concerns. However, health and safety also are overriding considerations for the inspected State. Many areas within a complex where a NED is handled are subject to strict health and safety regulations and the inspected State must ensure that these are followed during the course of the visit. All necessary safety equipment is supplied or certified by the inspected State to ensure compliance with health, safety, and security requirements.

The inspected State will want to take care when considering national security and proliferation concerns that the information provided to satisfy the individual inspector requests does not become sensitive when it is aggregated. The inspected State escorts might consider agreeing to requests "in principle" until all of the inspector requests have been collated. The escorts will have to consider the effect of the inspection process on facility operations and available resources.

The scope of the verification regime is driven by the inspected State's declaration because the inspectors can only confirm what has been declared. The choice and capabilities of the equipment will then need to reflect this information. The inspected State will need to perform a rigorous risk assessment of proliferation and security concerns with respect to the overall potential gains in inspector confidence. This is both a technical and political matter for further consideration.

Conduct of Inspection Activities

The NED may be dismantled in stages in a process that can take several days or weeks to complete. The inspectors should be presented with the containerized NED and its dismantled components at agreed points in this process. At the end of each day, a NED is likely to be stored in an interim storage area.

Prior to any activities being undertaken within the dismantlement facility, the inspectors need to confirm the absence of materials and sources that could impinge on the inspection activities. Radiation monitoring activities may be undertaken using gamma and neutron monitors. Tags and seals applied to the inside of the facilities immediately after they have been inspected provide assurance that nothing can enter or leave the facility undetected. This technique relies on the inherent tamper-indicating properties of the seals. Deploying and evaluating a large number of seals is time-consuming, and CCTV cameras can play a central part in any type of inspection, potentially providing direct visual confirmation that no personnel or material enter or leave the facility while the inspectors are not present.

A measurement system using an information barrier is used to confirm that a container presented for inspection, declared to contain a NED, has attributes consistent with the inspected State's declaration. After completion of the dismantlement process, the information barrier system may be used to confirm that the containers declared to hold the SNM and HE components continue to meet this declaration. All others have to be monitored to confirm the absence of any such attributes.

Photographs of inspection-relevant items may be taken to provide documentary evidence that the inspectors have carried out their inspections on-site as agreed.

Exercises have emphasized the importance of considering the movement of information and equipment across areas with differing security restrictions. Movement of information and equipment between the sensitive facilities and the Inspector Station is a complex issue that should not be underestimated. All such transfers will need inspected State approval. For example, written notes on escort-supplied paper or photographs of a seal could easily be checked by escorts, but computers, electronic equipment, and complex data files would be more difficult to clear. This must be carefully considered when designing verification activities.

Shrouded objects are a special topic, particularly where the shrouding is hiding tooling that will be used in the dismantlement process—these items cannot be sealed. The design of inspection approaches should bear in mind that unsealed but shrouded objects could hide shielded covert sources or shielded containers to be used for material diversion.

Conclusion of the Inspection

The inspection team finalizes the Inspection Report and the inspected State provides any comments in writing. At the conclusion of the inspection, the escorts facilitate the conduct of post-inspection procedures, including transport of the inspection team back to the POE, if used, or departure from the territory of the inspected State and travel back to the verification entity headquarters.

The inspection team provides a copy of the Inspection Report as well as any additional observations or assessments of the inspection process to the head of the verification entity for his/her review. The verification entity then completes and submits a report, which could suggest further actions at the political level if required (i.e., consultation with the inspected State, decision for subsequent inspection to resolve any ambiguities and/or disagreements, report to the policymaking organizations, etc.)

The verification entity keeps the records and analyzes the lessons learned from each inspection for the purpose of maintaining knowledge/expertise regarding the conduct of future inspections. It maintains and revises inspection manuals, including training on confidentiality and inspection procedures.

Chapter 6. Types of Inspection Activities and Techniques Available to Inspectors

Verification of Dismantlement of NEDs and Placement of Resulting Components into Monitored Storage at the Dismantlement Site

Access to sites, facilities, and NEDs (under managed access as necessary) is crucial to building confidence in the verification of the NED dismantlement process. Because it is unlikely that all activities involved in NED dismantlement can be monitored directly by inspectors, complementary measures will have to be taken to confirm that dismantlement has taken place as declared.

Outlined below are possible inspection types, activities, and techniques that could be used for monitoring the dismantlement of a NED under the Basic Dismantlement Scenario. These are derived from the inspection types, activities, and techniques used under existing multilateral verification regimes listed in Annex IV.

Objective: Verify Facility Design Information and Maintain Continuity of Knowledge for Related Facilities

One of the reasons for access to the dismantlement facility is to make sure that no activity involving swapping or hiding of relevant material or components can take place unnoticed. This implies a verifiable declaration of the facility, like "design information" or Basic Technical Characteristics, as with IAEA and Euratom safeguards. To ensure that no activity goes unnoticed, measures such as seals and surveillance should be implemented based on an analysis of the design of the facility, especially targeted on access and exit routes. Surveillance can use different methods, such as visual light or infrared sensors or other radiation monitors. There are a wide array of seals that can be used for the purpose of confining an area. To verify that the facility has not been altered in between visits, a 3D-laser scan can be performed. Measures to shroud sensitive equipment and so forth might have to be implemented and, if so, dealt with to ensure that they do not negatively affect the confidence in monitoring of the declared activities.

If new facilities are constructed, the initial declaration of the construction of the facility could include parameters such as dimensions, construction material, and passages of different sorts (doors, windows, sewers, etc.), including a description of relevant equipment. Facility information will be vital for planning purposes when deciding which techniques would be used for monitoring and also to enable planning of which measures may be needed to maintain continuity of knowledge. As sensitivities about design information may be facility specific, it is recognized that mutually satisfactory arrangements will also be facility specific. Nonetheless, the objective of inspectors to establish and maintain the integrity of a bounded volume so that no activity inside can go unnoticed needs to be respected. Where certain physical characteristics of facilities must be withheld from inspectors, the monitoring solution developed must still meet this objective. The integrity and design of the bounded, secure volume will be subject to monitoring by inspectors in subsequent (routine) inspections.

Inspection types to accomplish objective (Annex IV lists examples from IAEA safeguards and CWC verification):

- Initial inspection;
- Ad hoc inspections; and
- Inspections carried out under managed access arrangements.

Inspection activities to accomplish objective (Annex IV lists examples of such activities in IAEA and Euratom safeguards):

- Design information verification; and
- Scope of activities/techniques defined by an inspection access protocol.

Inspection techniques to accomplish objective (Annex IV lists examples of such activities in several treaty regimes):

- Examination of dismantlement facilities, including a check of their measuring instruments and operating characteristics;
- Check of the operations carried out at dismantlement facilities;
- Techniques for design information verification;
- Containment and surveillance;
- Remote sensing;
- Geophysical monitoring and mapping;
- Interviewing facility personnel;
- Requesting clarification in connection with ambiguities; and
- Determining geographic coordinates using satellite system receivers.

Identified Gap

Both the managed access arrangements and the restricted access provisions would be defined for this objective on a facility-specific basis.

Objective: Ensure Chain of Custody of the NED, from the Agreed Point Prior to Dismantlement, until Both the Explosive and Nuclear Material Are in Temporary Monitored Stores

Continuity of knowledge can most likely be accomplished with a combination of chain of custody measures, including sealing/tagging, surveillance, and possibly unattended monitoring, in combination with the knowledge that no other material or components are present at the specific location where the dismantlement is done. This objective is closely related to Objective 0 above but the emphasis is on the actual NED thereof. Annex IV lists several examples of inspection types, activities, and techniques related to this objective in IAEA and Euratom safeguards.

Inspection types to accomplish objective:

- Random inspection; and
- Inspections carried out under managed access arrangements.

Inspection activities to accomplish objective:

- Containment and surveillance;

- Physical verification;
- Accountancy verifications;
- Scope of activities/techniques to be defined by an inspection access protocol.

Inspection techniques to accomplish objective:

- Visual observation;
- Containment and surveillance;
- Inspecting documentation/records and carrying out an inventory; and
- Requesting clarification in connection with ambiguities.

Identified Gap

Both the managed access arrangements and the restricted access provisions would need to be defined for this objective on a facility-specific basis.

Objective: Confirm the NED Meets the Agreed Characteristics

When it comes to initial confirmation that a declared item is an actual NED, the sensitivity due to non-proliferation and security concerns is clear. Under the Basic Dismantlement Scenario, the IPNDV assumed that a device will consist of less than 10 percent Pu-240 or more than 90 percent U-235 and contain at least 0.5 kg plutonium or uranium. Given this starting point, additional technical analysis is required as to which measurement methods might be applicable to confirm a declaration without also extracting sensitive information, given the restraints that are/will be identified some examples are nevertheless listed below. Annex IV lists several examples of inspection types, activities, and techniques related to this objective in IAEA and Euratom safeguards and New START verification.

Inspection types to accomplish objective:

- Type two inspection (New START);
- Routine inspection; and
- Inspections carried out under managed access arrangements.

Inspection activities to accomplish objective:

- Confirming unique identifier;
- Physical verification;
- Accountancy verifications; and
- Scope of activities/techniques to be defined by an inspection access protocol.

Inspection techniques to accomplish objective:

- Audit of records and reports;
- Visual observation; and
- Physical verification by visual measurements weighing (operator balance), gamma measurements, and neutron measurements.

Identified Gap

Both the managed access arrangements and the restricted access provisions would need to be defined for this objective on a facility-specific basis. Quite a lot of work has been done in this area, both in bilateral partnerships such as U.S.-Russia, UK-U.S., UK-Norway Initiative (UKNI) as well as other multilateral fora. Annex IV lists those inspection types and techniques that are drawn from existing verification regimes. Verification techniques using information barriers and template matching have not been widely implemented in treaties so far, and should be an area for future work.

The measurement techniques used by the IAEA and Euratom are aimed at detecting defects (gross, partial, bias—in the future) by non-destructive assay (NDA), and may not be suitable as is.

Objective: Confirm the Dismantlement of the NED

The resulting components after dismantlement should be measured to some extent. Given that some of the sensitive information relating to the design of the NED might no longer be accessible, measurement of the components can prove a significant addition to overall confidence. Annex IV lists several examples of inspection types, activities, and techniques related to this objective in IAEA safeguards.

Inspection types to accomplish objective:

- Routine inspection; and
- Inspections carried out under managed access arrangements.

Inspection activities to accomplish objective:

- Containment and surveillance;
- Physical verification; and
- Scope of activities/techniques to be defined by an inspection access protocol.

Inspection techniques needed to accomplish this objective include all those stated for Objective 2 above but perhaps implemented in a more intrusive way since some of the agreed characteristics of the NED might no longer be distinguishable.

Identified Gap

Both the managed access arrangements and the restricted access provisions would need to be defined for this objective on a facility-specific basis.

Objective 4: To Ensure the SNM and High Explosive Material Remain within the Temporary Monitored Storage Area until the Next Stage of the Dismantlement (or Disposal) Process

Movements and storage of components can be monitored with sealing/tagging, containment, and unattended surveillance, but continuity of knowledge is quite vulnerable absent a measurement of the components—if continuity of knowledge is lost there may be no simple way of regaining it without a measurement. Annex IV lists several examples of inspection types, activities, and techniques related to this objective in IAEA safeguards.

Inspection types to accomplish objective:

- Random inspection; and
- Inspections carried out under managed access arrangements.

Inspection activities to accomplish objective:

- Containment and surveillance; and
- Scope of activities/techniques to be defined by an inspection access protocol.

The inspection techniques needed to accomplish objective are the same as Objective 1, above.

Identified Gap

Both the managed access arrangements and the restricted access provisions would need to be defined for this objective on a facility-specific basis.

Chapter 7. Verifiable Characteristics of a Nuclear Explosive Device

Potential verifiable characteristics of a NED or its component SNM and HE include:

- Those whose measurement gives increased confidence that either:
  - A NED has been presented for dismantlement and that dismantlement has occurred; or
  - An item presented for verification is consistent with others declared to be of the same type, or is the same item as one that was previously presented to inspectors.
- Those that are technically possible to measure using existing technology, or for which measurement technology could reasonably be developed; and
- Those whose measurement is acceptable to inspected States with regard to safety, security, and non-proliferation requirements.

The following presents a set of item characteristics that can be measured when conducting an inspection, i.e., a baseline standard that inspectors should be able to measure during all inspections related to a given type of NED or component. As much as possible inspected States should standardize the types of containers used during inspection activities so that inspectors can expect consistent results when confirming the same type of item over multiple inspections. This standardization could include a commitment that the container used during the inspection of a specific type of NED or component will not vary unless the verification entity is notified of changes.

On-Site Inspection Goals

The goal of OSI for monitoring NED dismantlement has two main aspects. First, inspections must give confidence to stakeholders that a given disarmament activity has occurred and second, that they occurred in accordance with the declaration made to the inspectorate by the country with a nuclear weapon. The Table 1 provides a list of the item characteristics that should, by their measurement, increase confidence that the dismantlement process has occurred as declared. Some measurements are directly relevant to confirming the nature of the item, i.e., that an NED is in fact an NED, while others are more relevant to confirming consistency with measurements of other NEDs that are declared to be of the same type.

Context

Measurement techniques are presented with the understanding that suitable information barriers would have to be developed for many of them. The primary assumption underlying each measurement is that individually none will give sufficient confidence that dismantlement has occurred, rather that confidence will be achieved through the combination of various techniques. By combining the limited data from key characteristic measures, a sufficiently confident conclusion can be made without divulging proliferation-sensitive information.

Further assumptions include:

- That all inspections for a given type of NED will be conducted using the same equipment and methods, unless both parties agree to change;

- That multiple examples of a given item will be verified, allowing comparison for consistency over multiple measurements;
- That the same techniques will be used both pre-and post-dismantlement, for instance, an isotopic measurement of the NED and of its components;
- That information barriers will be used to protect sensitive information; and
- That all inspections will be carried out according to detailed procedures, which will be specific to both the site and the item being verified, which will serve to minimize instances where inspectors may be denied the right to measure or access something during the course of the inspection.

Table 1: Characteristics

Physical

Characteristic	Measurements	Reason for Measuring	Notes
Geometry of container	Shape and size of the items' container	• Limits the maximum physical size of contents • Ensures consistent locating of measurement equipment	• Permission for inspectors to touch the container may vary from facility to facility • Permission for inspectors to touch the container may be contingent on the use of appropriate barriers, for instance, disposable gloves
Weight	Mass of container and its contents	• Allows comparison of the weight of the container plus its contents with data from inspected State declarations and data from other inspections where the same type of NED has been dismantled	• The mass of the container could be easily altered by using weights, limiting the additional confidence provided by this technique • Movement of the container, and weighing of the same container at several different dismantlement steps, may pose safety, security, and non-proliferation concerns for the inspected State • Suitable information barriers could be developed to reduce

			security and non-proliferation concerns • This measurement could reveal classified and proliferation-sensitive information
Center of gravity	E.g., weighing each corner	• Allows comparison of the center of gravity of the container with data from inspected State declarations and data from other inspections where the same type of NED has been dismantled	• The center of gravity of the container could easily be altered via the inclusion of weights, limiting the additional confidence provided by this technique • Determination of the center of gravity of the container may pose safety, security, and non-proliferation concerns for the inspected State • Suitable information barriers could be developed to reduce security and non-proliferation concerns • This measurement could reveal classified and proliferation-sensitive information
Material composition of the outside of the container	Visual observation	• Allows comparison of the composition of the outside of the container with data from inspected State declarations and data from other inspections where the same type of NED has been dismantled	• Could be assessed in simple ways, e.g., metal or plastic, ferrous metal or no, etc. • The thickness of the outer skin will not be known • The thickness and composition of potentially multiple inner layers of high-Z

		• Relevant to radiation measurements	and low-Z materials will not be known

Radiological—Passive			
Characteristic	**Measurements**	**Reason for Measuring**	**Notes**
Heat development	Infrared emissions	• Allows assessment of the temperature of the container, e.g., warmer or cooler than surroundings • A baseline temperature scale could be established for temperatures that are within the range for weapons grade fissile material, e.g., between X and Y degrees C	• Could be spoofed through use of heaters/chillers, insulation, etc. • The heat signature of uranium will be negligible • The size and composition of the container may make any heat signature impossible to measure—a topic for possible elaboration in future work
Presence of uranium and/or plutonium	Gamma emissions	• Detecting the presence of uranium and/or plutonium • Identifying isotopes of uranium and/or plutonium • Assessing the mass of uranium and/or plutonium • Assessing the rough location and axis of symmetry of uranium and/or plutonium	• Assumes isotopic uniformity throughout the item • Assumes lack of other interfering gamma emitters • Lack of knowledge of container construction/source geometry limits accuracy of mass measurements • A suitable information barrier would need to be used to guard against the release of proliferation-sensitive information, such as

		• Assessing the age of uranium and/or plutonium	precise isotopic or mass data. For this purpose, a baseline range should be established that can confirm the presence of weapons grade fissile material, without revealing its exact enrichment, e.g., higher than X% U-235 or Pu-239 or both, but nothing more • The Basic Dismantlement Scenario assumed less than 10% Pu-240 or more than 90% U-235 and contained in at least 0.5 kg Pu or U.
	Neutron emissions	• Detecting the presence of uranium and/or plutonium • Identifying isotopes of uranium and/or plutonium	• Assumes lack of other interfering neutron emitters • A suitable information barrier would need to be used to guard against the release of proliferation-sensitive information, such as precise isotopic or mass data. For this purpose, a baseline range should be established that can confirm that the presence of weapons grade fissile material, without revealing its exact enrichment, e.g., higher than X% U-235 or Pu-239 or both, but nothing more

			• The Basic Dismantlement Scenario assumed less than 10% Pu-240 or more than 90% U-235 and contained in at least 0.5 kg Pu or U.

Radiological—Active			
Characteristic	**Measurements**	**Useful for Measuring**	**Notes**
Presence of uranium and/or plutonium	Active neutron	• Detecting the presence of uranium and/or plutonium • Identifying isotopes of uranium and/or plutonium • Assessing the mass of uranium and/or plutonium • Evaluating the container for consistency	• May lead to unacceptable criticality safety and radiation protection concerns • A suitable information barrier would need to be used to guard against the release of proliferation-sensitive information, such as precise isotopic or mass data. For this purpose, a baseline range should be established that can confirm that the presence of weapons grade fissile material, without revealing its exact enrichment, e.g., higher than X% U-235 or Pu-239 or both, but nothing more • The Basic Dismantlement Scenario assumed less than 10% Pu-240 or more than 90% U-235 and contained in at least 0.5 kg Pu or U. These thresholds could be revised after

			relevant technical input or after all parties gain experience in disarmament verification
Presence of high-Z materials	Muon radiation	• Detecting the presence/absence of high-Z materials • Evaluating the container for consistency	• Natural muon fields could be used • Muon tomography detectors are technologically less mature • Detectors may be physically large to the point of causing portability issues • A suitable information barrier would need to be used to avoid overly detailed imaging of high-Z components in the item

Chemical			
Characteristic	**Measurements**	**Useful for Measuring**	**Notes**
Presence of high explosive material	Ratios of elements consistent with high explosives—N, Cl, H	• Determining whether substances which are consistent with high explosives are present	• Such testing is not definitive as there are inert substances that possess similar ratios • Such testing may involve bombarding the container with neutron or x-ray energy, which may lead to safety, security, and non-proliferation concerns from the inspected State
	Explosive residue swipes	• Testing the presence or	• The utility of swipes could be limited.

	(similar to those used at airports)	absence of high explosive material both pre- and post-testing	Taking a swipe of the NED itself will not be permitted, while taking swipes anywhere else may be difficult to relate to the NED itself • Swipes made in a facility dedicated to dismantlement or any military nuclear activity could reveal highly classified and proliferation-sensitive information, and would not be permitted • Suitable information barriers could be developed to reduce security and non-proliferation concerns, but these may not allay concerns that the results are difficult to link to the specific NED being dismantled

Chapter 8. Chain of Custody

Chain of Custody and Dismantlement Facility Design

The key to an effective monitoring and verification regime is the ability to strike a balance between the inspectors' access to information for verifying the dismantlement of a NED and the protection of the proliferation-sensitive information as well as the inspected State's national security-related information. Such effectiveness will be supported by maintaining a continuous chain of custody to help ensure continuity of knowledge regarding SNM and HE components of a NED throughout the dismantlement phase, while minimizing the risks for the disclosure of proliferation-sensitive and national security related information.

Chain of custody is a useful measure to ensure the authenticity of tracked items, so long as continuity of knowledge is maintained by both the inspection team and the inspected State. As for the dismantlement process of a NED, the inspectors' full access may not be possible at all times. Because the NED and its dismantled components may be solely under the custody of the inspected State as shown in the Figure 2, some alternative technique is required to fill the gap in inspector knowledge between point 3 and point 4, and the inspected State is also required to provide the logical and physical evidence to maintain the chain of custody during the time when inspectors are not present.

The following subjects should be addressed to ensure the credibility of OSI at a dismantlement facility: (1) confidence in chain of custody procedures vs. potential non-destructive measurements to fill the gap within the dismantlement station when inspectors are not present; (2) reliable measurement technologies vs. high and low Z multi-layered (NED) containers; and (3) protection of proliferation-sensitive information vs. inspection under managed access restrictions.

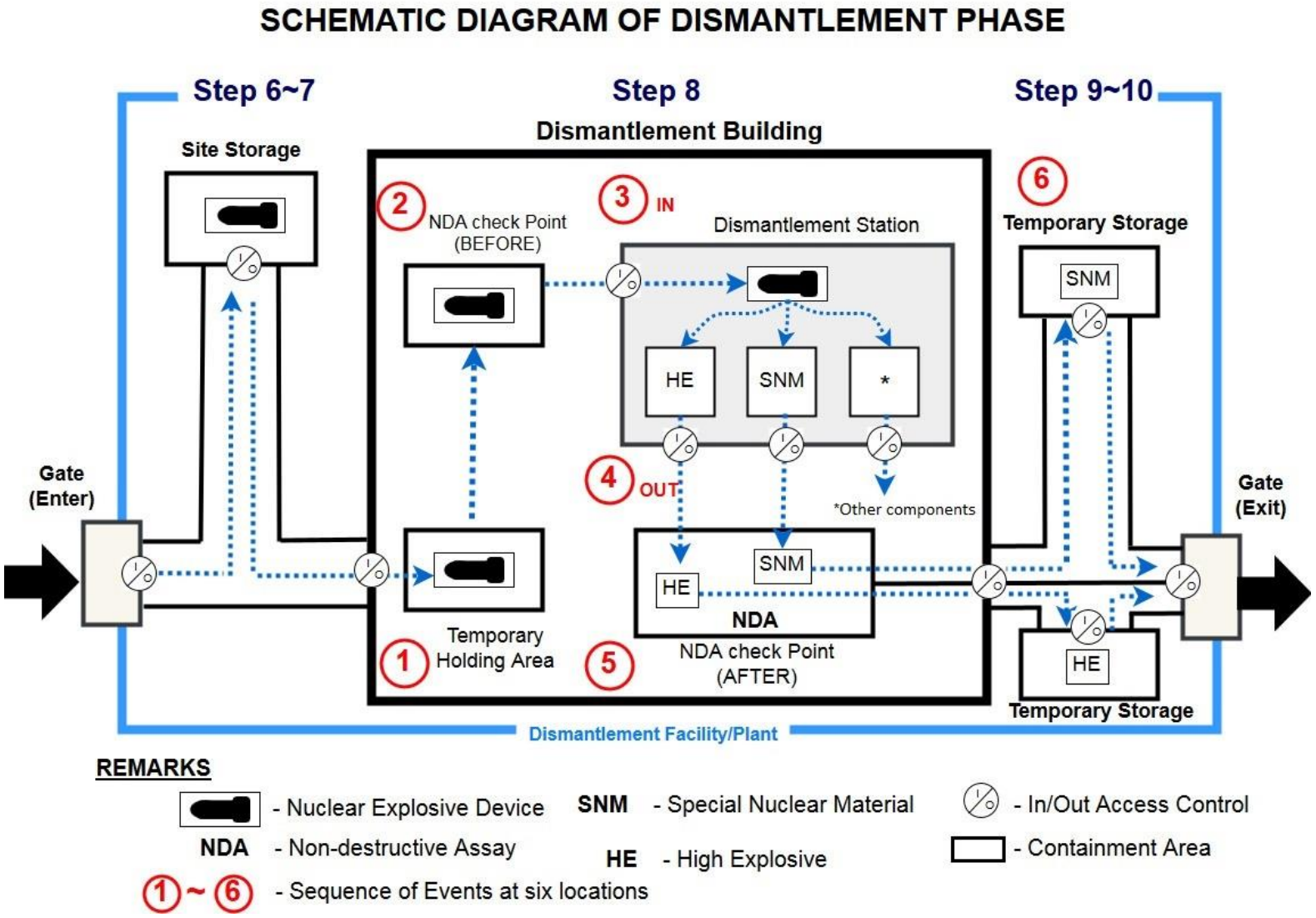


Figure 2: Schematic Diagram of Dismantlement Phase

This chapter elaborates the concept of chain of custody within a notional dismantlement facility by addressing these three questions, as well as elaborating on an alternative option that assumes the readiness of adequate techniques for radiological measurement to be conducted through a heavily shielded munition body and its container. As it may take some time to identify state-of-the-art radiological analysis equipment for such an application, an alternative option could be developed to address this issue in two steps; first, confirm the dismantlement of the NED by the combination of chain of custody and qualitative measurement procedures; and second, confirm the disposition of the NED components by a combination of chain of custody and the quantitative measurement, explained in more detail in the next section.

Confidence in Chain of Custody Procedures vs. Potential Non-Destructive Measurements

The chain of custody should be maintained, in a broader sense, by a combination of various surveillance techniques (subject to the health, safety, and security restrictions of that facility) that constitute the "chain" to ensure that the identities of accountable items are unchanged throughout the process: i.e., boundary control more broadly, including:

- Perimeter/portal monitoring;
- Internal facility monitoring, especially if the dismantlement facility is required to store, for some period, NED components;
- Tags (including unique identifiers) and seals for items, containers, doors, and other secure volumes;
- Passive and active item tracking systems;
- Template matching measurements to check the presence/absence of fissile material; and
- Review of relevant facility records and access to the relevant communication and data exchange networks of the facility.

It is important to note that the use of many techniques by inspectors, without managed access controls in place, would raise NPT compliance issues. In relation to the OSI activities by inspectors to ensure the chain of custody, the most proliferation-sensitive issue is the direct or even remote observation by inspectors from countries without nuclear weapons of the actual NED dismantlement operations.

Non-destructive measurement (i.e., radiological measurement) would be a useful tool to maintain inspector confidence, if a continuous chain of custody procedure is not being maintained. For example, a declaration that SNM or HE is not inside a particular container removed from the dismantlement station can be tested. This ensures the custody of the NED/dismantled components processed in the dismantlement station, while not disclosing proliferation-sensitive information.

In addition to the non-destructive measurements conducted at point 3 and point 4, inspectors can maintain the confidence in the chain of custody by checking the physical presence and the identifying data of the NED before it enters the dedicated dismantlement area (DDA), and then by verifying the presence and identity of nuclear materials after their exit at step 8. Because 100 percent confidence cannot be achieved without witnessing the actual dismantlement activity, nor is it possible to measure the exact quantities of SNM (as measurements are limited to the

agreed attributes of the NED), combining an inspection of the DDA before and after dismantlement, and a suitable template matching technique to verify the presence of SNM can assure the consistency of the identification of the NED. An inspection of the DDA would include a check for absence of SNM and HE, as well as the application and integrity-checking of tags and seals within the DDA.

This approach may provide a solution to the technical difficulties in measuring radioactive attributes from the NED stored in a container of unknown composition. It could be considered as a kind of "quarantine" procedure: when the item's provenance has not been conclusively established during the inspection, then it could be kept under custody for more detailed analysis at the dismantlement phase, recognizing that there may be safety or security concerns of the inspected State that may limit when a more detailed analysis could take place. If detailed measurement at step 8 is not possible due to the non-availability of suitable techniques, then detailed measurement to verify the identity (as well as the quantity, to the extent possible) of SNM could be carried out at disposition phase.

Available Measurement Technologies vs. High and Low Z Multi-Layered Container

If confidence in the chain of custody can only be achieved through radiological measurements of the NED (through its associated container), there will be some limitations on the degree of measurements that can be made due to the potential to disclose proliferation-sensitive information. The available measurement technologies vs. a high and low Z multi-layered NED container will depend on (1) how capable are state-of-the-art instruments in measuring radioactive attributes of the uranium and plutonium present (including their isotopes), and (2) how powerful are such instruments in measuring the radioactive attributes of the NED stored in high and low Z multi-layered containers?

Measurements are conducted to check for the presence of SNM and HE within a NED container prior to dismantlement, and to check the presence/absence of SNM and HE contained in the following three streams:

- SNM that can be measured to confirm agreed attributes (noting that a mass threshold may not be met post-dismantlement, if the item is in several pieces) and the absence of HE;
- Material that can be tested for the presence of HE and the absence of SNM; and
- Other components that can be measured or otherwise checked to confirm the absence (or detect the presence) of both SNM and HE.

Difficulties also exist in measuring radiation from nuclear components that consist of more than one type of fissionable material and in measuring radiation from the high and low Z multi-layered NED container. Under the Basic Dismantlement Scenario, a proposed technical requirement for such technologies was used as follows:

- The declared NED contains the following materials:
  - More than 0.5 kg plutonium with an isotopic composition of less than 10% Pu-240; **or**
  - More than 0.5 kg plutonium with an isotopic composition of less than 10% Pu-240, **and** more than 0.5 kg uranium containing 90% or more of the isotope U-235.

- The declared NED contains HE material;
- The container for the declared NED will contain multiple layers of high and low Z material; and
- Non-destructive analysis should accommodate the need to avoid disclosure of proliferation-sensitive information.

The kinds of technologies that will be used in verifying these attributes should not reveal any data other than that necessary to confirm the presence or absence of specific quantities of material as specified in the verification agreement. (It means, e.g., that the mass measurements should indicate to inspectors that the presence of fissile material is more than 0.5 kg, not the exact quantity.)

Using the kinds of measurements mentioned above, it could be possible for inspectors to conduct the following inspection procedures to verify the dismantlement of the declared NED:

- Verify the physical presence of the NED in its container and check the consistency of the identification data (including radioactive template matching) of the NED until the beginning of step 8, followed by conducting the radioactive attribute matching measurement of each type of nuclear material contained in the NED at the end of step 8;
- Inspectors can confirm, for the purpose of maintaining chain of custody, the identification of the NED by comparing measurements of certain attributes against measurements of the same attributes made prior to dismantlement, using a method that does not risk disclosure of proliferation-sensitive or classified information; and
- Then, inspectors can conduct the selective measurement for the attributes of each type of nuclear material at the disposition phase to confirm the completion of the dismantlement of the NED.

Protection of Proliferation-Sensitive Information

In order to effectively address the protection of proliferation-sensitive information while conducting inspections under managed access restrictions, we are concerned with how much access can be provided for inspectors whose task it is to verify the chain of custody, while the inspected State concurrently needs to ensure the maximum level of protection against the disclosure of proliferation-sensitive information during the dismantlement process. Maximum protection could be achieved by adopting the "box in a box" approach: designating the DDA as a "black box," which is located in the dismantlement building. Inspectors' access to the actual dismantlement process is restricted to avoid the disclosure of proliferation-sensitive information (namely, the technical data regarding the NED design or the visual images of the inside of the NED). These procedures must also take into account the need for inspectors to have sufficient access to allow them to ensure the chain of custody of the declared NED and its SNM and HE components individually after the dismantlement process. To satisfy these contradicting tasks, the inspection procedure within the dismantlement building should be designed taking into account these conditions:

- Inspectors conduct the inspection on behalf of all States parties to the verification agreement, and the inspected State has the obligation to provide sufficient access to

inspectors in accordance with applicable agreements so that the inspection team can effectively carry out its mandate;

- Inspectors should be provided with only the technical information required for the inspection, such as basic information about the dismantlement process, declared data to be shared by the facility, health and safety standard operating procedures, etc.;
- The facility will very likely keep records relating to operations for management purposes. Inspectors may need access to some of those records that are directly related to the verification activities and that could form a basis for an Inspection Report. Such records could include movement and in/out records at each of the check points, in-out records of the DDA, any incidents that affect the inspection, etc. The extent to which records are available for release would likely be specified in the verification agreement;
- Inspectors can have access to the inspection-related information only and should not seek access to any information not specifically allowed by the verification agreement, including proliferation-sensitive information;
- The maximum risk of disclosure of proliferation-sensitive information exists in the DDA during the dismantlement process where the internal components of the NED are physically exposed. Inspectors' physical access to this portion of the dismantlement process must be prevented;
- Inspectors could have access to the DDA before starting and after completing the dismantlement process to observe whether there is any potential indication of spoofing;
- Inspection equipment brought into the country may be stored at the POE, if provided for, or at the dismantlement facility in a manner that ensures that the inspected State does not have an opportunity to tamper with the equipment once it is accepted for use by both parties. This might include measures such as jointly monitored equipment stores, tamper indicating enclosures, and tags and seals for inspection equipment. A jointly agreed process for the release of equipment for subsequent inspection activities would also be necessary (noting that this may not be achievable due to security restrictions relating to material contamination of deployed equipment and of the persistence of information in non-volatile memory); and
- Data collected during inspection activities may be in the form of notes taken by the inspection team, or in the form of electronic data collected by several different monitoring systems. The inspected State shall be given access to such notes and electric data, so that the integrity of these data will be assured. The data collected during inspection activities should be appended to the Inspection Report as part of the formal record of the inspection.

In summary, non-destructive measurement (e.g., radiological measurement) is needed to fill the gap between point 3 and point 4 shown in Figure 2 in addition to the chain of custody before point 3 and after point 4, and the inspectors' need to access the area between point 3 and point 4, before and after the physical dismantlement process taking place. Such access shall be given under managed access in order to avoid the potential disclosure of any proliferation-sensitive information as well as to comply with national security or safety concerns of the inspected State. The inspectors' access to the DDA must be restricted during the actual dismantlement work, because such access will pose a considerable risk for the disclosure of proliferation-sensitive

information (by exposing aspects of the NED design data and/or the physical images of the inside of a NED).

Chapter 9. NED Storage and Transfers

The exercises carried out within the UK-Norway initiative in 2008 and 2010 focused on monitoring short-term storage during the dismantlement process, from the arrival of the NED at the facility gates to the location for long-term storage under bilateral control. Intra-site transfer of the NED and, to some extent, transport on public roads were included in the exercise scenario.

Storage

Key lessons from UK-Norway initiative, and from others, is that maintaining chain of custody may be difficult for a NED in temporary storage in an existing complex facility. For example, there may be many diversion routes in a non-purpose–built storage area. Everything from ventilation ducts, doors, adjacent rooms not being a part of the storage, and more will be a serious hindrance when it comes to maintaining chain of custody. From the perspective of the verification entity, purpose-built facilities for the dismantlement process are much easier when developing inspection procedures. However, the time and costs associated with constructing purpose-built facilities for dismantlement would be substantial, and would delay the commencement of dismantlement.

To mitigate problems with non-purpose–built dismantlement and storage facilities, various technical tools can be applied. Methods like seals, secure CCTV transfers, and change detection systems may be needed. The actual techniques that need to be applied in a certain situation strongly depend on the length of time the NED cannot be visually observed by the inspection team, but also on the layout of the facility. Some of the techniques that need to be considered are:

- Personnel (inspectors);
- Tamper indicating devices (Seals);
- Three-dimensional (3D) laser technologies to detect possible movements;
- Video surveillance (CCTV with tamper-proof data transfer);
- Accelerometers to monitor possible movement of NEDs and their components; and
- Portal monitors for radiation detection.

Transfer

As part of the standard operating procedure of a dismantlement facility, NEDs may be transferred from one location to another (intra-site transport). A suitable way for inspectors to maintain chain of custody over NEDs during such intra-site moves will need some consideration. Although such procedures may seem innocuous, the procedures may indirectly reveal classified or proliferation-sensitive information, for example, concerning mass, size, or geometrical properties of the NED. Consequently, inspectors may not be able to continuously observe part or all of such intra-site movements.

If inspectors are not allowed to observe intra-site movement, alternative means of ensuring the chain of custody may be required. Techniques such as application of tamper indicating devices, attribute measurements, and template comparison (used in conjunction with technologies such as information barriers) may be applicable and of particular interest.

Chapter 10. Equipment Authentication and Certification

Equipment authentication and certification needs of the inspected State and inspection team are interdependent and balancing these needs is a challenge for a nuclear disarmament inspection regime. Equipment authentication is a process by which an inspection team under a verification agreement obtains confidence that the information reported by equipment used during inspection activities accurately reflects the true state of an item under inspection, and an inspected State can confirm that there are no additional capabilities in the equipment that might provide information that is not subject to the provisions of the verification agreement. Equipment authentication is important because the inspection team's equipment may be inspected and/or in some circumstances operated by the inspected State, and may be stored in locations under inspected State control. In addition to ensuring initial functionality of the equipment, authentication also allows the inspection team to maintain confidence that the equipment has not been altered, removed, or replaced, and that when used provides accurate and reproducible results for the duration of a given inspection.

Equipment certification is the process by which the inspected State assures itself that equipment used during inspection activities meets relevant safety and security requirements and will not divulge proliferation-sensitive information or classified information not related to the inspection. To maintain equipment certification, the inspected State verifies that inspection equipment has not been altered, removed, or replaced, and continues to function as intended throughout the implementation of the verification agreement.

Authentication Principles

Both the verification entity and the inspected State have the shared objective of ensuring that inspection equipment produces accurate and reproducible results. The following equipment authentication objectives contribute to confidence-building between the parties:

- To ensure that inspection equipment design possesses only expected functionality and does not have hidden features;
- To ensure that the equipment used matches the exact design specified in the verification agreement (i.e., to ensure that the equipment has been assembled as designed);
- To ensure that the environment in which the equipment is used matches that specified in the verification agreement (i.e., to mitigate external influences that may affect operation of the equipment and cause different results than otherwise expected);
- To ensure that the procedures under which the equipment is used—including any procedures governing its manufacture, storage, and entry/egress from the facilities where inspections take place—do not allow for the inspection process to be subverted, and that those procedures are followed (i.e., to ensure that the equipment functions as designed throughout its lifecycle); and
- To ensure that the interplay of the authentication processes and approaches used with the equipment do not allow the inspection process to be subverted (i.e., to ensure that the equipment functions as intended under use case scenarios).

Confidence in Authentication

In practice, there will likely be tension between the inspection team's objective of obtaining the highest level of confidence in inspected State-supplied inspection equipment, and the inspected State's objective of maintaining equipment certification. Complete satisfaction of the inspection team in equipment authentication processes may only come with a level of information release and intrusiveness that the inspected State may be unwilling to tolerate. As a result, equipment authentication techniques and processes may be subject to agreement by the verification entity and the inspected State. Given that total confidence in equipment authentication may not be achievable by either party, each must decide how much it needs in order to meet its objectives. This will need to be balanced against the costs incurred (which may be high if the most exhaustive technical authentication options are pursued) and other resource constraints, including time and availability of personnel.

There are various approaches to gain confidence in equipment authentication to balance inspected State and inspection team needs. One might involve defining a broad set of evaluation criteria for equipment authentication, perhaps with an associated scoring methodology. Another might look at confidence in authentication from a probabilistic perspective. Ultimately, the application of any such process will require a cost-benefit analysis in which each side determines whether or not it wants to pursue a given approach. As part of that analysis, each side will also need to determine target and minimum acceptable levels of confidence from equipment authentication in each circumstance.

Verification Equipment and Lifecycle Authentication

During the life of a treaty, various constraints and requirements may be placed on equipment authentication activities. There is no certainty that these constraints and requirements will remain constant in all places at all times. Similarly, equipment authentication is not carried out at a single point in the lifetime of verification equipment. It is instead a set of complementary processes and technical measures carried across the lifecycle of the equipment.

Equipment used in verification activities may be commercially available, custom designed with commercially available components (in whole or in part), or custom designed with entirely bespoke components. Early lifecycle decisions on verification equipment drive much of the subsequent approach to equipment authentication.

Incorporating equipment authentication concepts and measures during the design process of inspection equipment may be advantageous but may also add additional costs and delay fielding. Additionally, the comprehensive documentation of system hardware and software will facilitate easier authentication of the equipment throughout its entire lifecycle; and, if done sufficiently well, it would help to avoid potentially costly modifications in the future.

Summary and Authentication Challenges

Authentication techniques and processes for nuclear disarmament regimes are crucial to ensuring that conclusions from data collected during inspection activities are accurate and genuine. Factors affecting equipment authentication techniques to establish validity and confidence include:

- Design information of each system (including hardware and software);
- Functional and operational testing of each system's hardware and software;
- Inspection procedures to meet verification agreement obligations and perform authentication of the systems; and
- Chain of custody measures implemented throughout the lifecycle of authentication activities.

The authentication of inspection equipment is challenged by advancements in technology. Additional increases in the quality of measurement data may provide additional benefits, but it is likely that the increase in complexity of software and hardware that may be used in inspection equipment will introduce further challenges.

The development of the highest achievable authentication level for the inspection regime requires a compromise be made among costs, intrusiveness to inspected State operations, and confidence levels assured for the inspected State and the inspection team. The implementation of a combination of authentication techniques and procedures provides a robust set of authentication assurances to prevent single-point failures, to provide multi-layered defense measures, and to increase the probability of tamper detection and vulnerability exploitation. As political and security environments change, equipment authentication techniques will continue to evolve and will need to address and provide solutions that anticipate future requirements.

Chapter 11. Data Handling During an Inspection

Procedures for inspections need to ensure the integrity and timely availability to inspectors of information and data needed to fulfil the mandate of an inspection. The procedures also need to ensure that sensitive information or data that inspectors or their equipment may be exposed to has appropriate protection. The procedures will need to be developed for, and applied in, an environment to which the inspected State is likely to apply stringent security controls to protect nationally sensitive information and data, and to prevent the disclosure of any proliferation-sensitive information.

Information and data collected by inspectors at a monitored dismantlement facility could include:

- Completed forms and records describing the activities carried out by inspectors, including notes, photos, or hand-drawn illustrations. These could be recorded on paper or in electronic forms;
- Data from containment and surveillance equipment. These might be transferred outside the facility on recorded media or as a data stream (e.g., video data); and
- Measurement data concerning a NED or component.

Integrity and Availability of Information and Data

Maintaining the integrity of information and data is in the interest of both inspectors and the inspected State. Technical procedures in this respect for handling electronic equipment and data media have been developed by numerous verification organizations and could be adapted for monitoring NED dismantlement. For inspections to monitor NED dismantlement, such procedures would need to establish a chain of custody for all information and data gathered by inspectors and for related information assets (equipment, media etc.). Authentication signatures would also need to be applied to electronic data. Approaches should be kept as simple as possible, because complex technical systems could be seen by an inspected State as posing a risk for disclosure of sensitive information.

Ensuring the integrity and timely availability of data to inspectors is addressed, in part, by designing data recording, storage, and evaluation systems that are technically robust and in using technologies that do not require long measurement times. It also needs to be addressed in the design of inspection procedures so that managed access or confidentiality procedures do not delay the task of inspectors.

Protecting Sensitive Information: Concepts

Many of the concepts and procedures for protecting sensitive information developed for instruments such as the Chemical Weapons Convention or the Comprehensive Nuclear-Test-Ban Treaty can be adapted for inspections to monitor NED dismantlement. However, because the consequences of unauthorized disclosure of proliferation-sensitive or classified information unrelated to the inspection are significant, additional measures may be considered to minimize the risk of such disclosure in the first place.

The first line of protection for sensitive information is the design of inspection procedures (including equipment), as set out in a verification agreement, a facility arrangement, and/or through the application of managed access. These procedures aim to provide necessary access for inspectors, but also to prevent that which is unnecessary and may risk the disclosure of sensitive information. Although such arrangements can and should be effective, the competing nature of the two aims means that some risk for disclosure will remain. Inspection procedures will also need to prevent incidental but unplanned collection of information, such as environmental particles on clothing or other items.

Appropriate confidentiality protections should apply to sensitive information related to an inspection that inspectors require access to in order to fulfil their mandate. A first key aspect of such protections is the application of physical and procedural barriers to prevent unauthorized access to the information. A second key aspect should be that sensitive information or data is used by inspectors and the verification entity on a need-to-know basis. An example of the latter could be that some technical information about the design of a monitored dismantlement facility may need to be available for use by inspectors when on-site, but may not need to be referred to in reports of inspections, which will have a wider readership. Such information could be stored on-site, under joint control to maintain assurance of its integrity.

Additional Checks and Balances

It is possible that inspectors would (intentionally or inadvertently) record sensitive information unrelated to an inspection even where managed access has been applied. An example could be that an inspector records sensitive details about a facility in his/her notes. The inspector might think that the information is useful, but does not recognize that it is sensitive. Because the consequences of unauthorized disclosure of, for example, sensitive information unrelated to an inspection are significant, an inspected State is likely to require additional measures to prevent its release from the dismantlement facility, even after it may have been gathered by inspectors. A procedure through which an inspected State may constrain the further use by inspectors of data or information after it has been collected would require careful design. A possible approach that aims to balance the interests of both sides is outlined here.

It is useful to consider two different types of inspector activities: (1) information and data gathering activities conducted within the boundary of a monitored dismantlement facility; and (2) activities outside that boundary (but still at the inspected site), such as planning inspection activities and preparing reports. Type 1 activities are those that would be under close escort by the inspected State and where managed access would apply to prevent the unnecessary disclosure to inspectors of sensitive information. Type 2 activities would take place in the Inspector Station. Inspectors would be unable to gather any additional information at this location, but could evaluate that which they have collected with appropriate privacy.

The same concept would affect the way in which inspection equipment is used. Equipment used within the boundary of a monitored dismantlement facility would be kept separate from that used by inspectors in the Inspector Station. A process for transfer of data between the two types of equipment would be implemented.

A review of information or data prior to its removal from the monitored dismantlement facility would offer the opportunity for the inspected State to identify any that raises sensitivities. The inspected State would use this opportunity to indicate that particular information must be handled according to a specified confidentiality classification. The inspected State could also specify information or data that it has identified as very highly sensitive, and that it does not wish to see released outside the monitored dismantlement facility. In that case, the inspectors and the inspected State could seek to negotiate a mutually satisfactory alternative. If agreement could not be reached, the matter may need to be further considered under dispute resolution procedures. In any case, the information or data should not be lost, and could be placed in a container under dual control.

Procedures for the abovementioned review and negotiation process need to be consistent with the objectives of maintaining the integrity of data and information and its timely availability to inspectors wherever possible. Where possible, the review should be conducted jointly and promptly. However, the inspected State may wish to review the information and data privately so that its deliberations do not themselves disclose sensitive information. In that case, the integrity of the data and information could be protected by retaining a copy under joint control. Concerns that sensitive environmental particles could be removed from the monitored dismantlement facility along with items such as documents may also mean that the content of the documents needs to be captured electronically and used by inspectors in place of the original document. In that case, all physical documents could be retained under joint seal. For similar reasons, additional procedures will be needed if other items such as data media are to be removed from the monitored dismantlement facility.

Because a review and negotiation process could become complex and introduce delays, it should be kept as simple and flexible as possible unless specific problems arise. To avoid its overuse, the applicable facility arrangement could specify types of information that should not normally be considered sensitive, and not require much time for review. This could include the information and data entered into pre-agreed forms, including simple information on the activities conducted and on the results obtained using an information barrier. Data from appropriately designed containment and surveillance systems should be unlikely to pose a risk for release of sensitive information. Indeed, the careful and detailed negotiation of a facility arrangement to set out detailed inspection procedures for a particular facility will be critical to smoothly and effectively conducting inspections.

Chapter 12. Inspection Reporting

During an inspection, the inspecting and inspected parties should document what transpires. Using a pre-developed and agreed format, which requires the inspecting and inspected parties to record what transpires during the course of the inspection, provides policymakers and stakeholders with a jointly documented frame of reference for understanding how the inspection unfolded. The signatures of representatives of both the inspected State and inspection team on the document acknowledges that the document accurately reflects how the inspection was conducted, without addressing either side's compliance.

Items that could be included in an Inspection Report that would be useful for all parties include:

- A timeline of how the inspection unfolded;
- Pertinent information about the data that is being confirmed as part of the inspection;
- A record of any measurements made and supporting documentation such as photographs;
- A certification that the inspection had no disagreements or ambiguities or if disagreements and ambiguities exist, comments from both the inspected State and inspection team explaining their perspectives on what happened; and
- Any inspection-related materials exchanged by the inspection team and inspected State.

The totality, accuracy, and integrity of the Inspection Report must be such that it can serve as the basis for further review and discussion between the parties as agreed and provided for under the verification agreement to help determine compliance.

The signed Inspection Report should be completed in two original versions, one for the inspected State and one for the inspection team. The inspected State keeps its copy of the Inspection Report using its own record keeping system. The inspection team provides its copy of the Inspection Report to the verification entity for its use in analyzing the results of the inspection. The verification entity also makes a copy of the Inspection Report available to States parties for review and analysis and serves as the basis for further discussion if necessary. The Inspection Report represents a common understanding and formal documentation of what transpired during the inspection. The Inspection Report could be distributed through a secured computer network similar to that in use by other multilateral treaty organizations or it could be distributed through agreed diplomatic channels.

Confidentiality and Inspection Reports

The Inspection Report should be classified at a level appropriate to the sensitivity of what is seen and discussed. The verification agreement may have provisions related to the protection of certain inspection-related information. Measures should be established to ensure the inspected State has confidence that this information is suitably protected. Dissemination of Inspection Reports should be limited to those with a legitimate need-to-know and who have proper authorization because the information included relates to the State's national security and could contain sensitive security information. Any public release of any portion of an Inspection Report must be agreed by the verification entity and the inspected State, taking into account provisions of the verification agreement, confidentiality, and national security considerations.

Chapter 13. Ambiguities and Compliance Assessment

Practices during an Inspection

An inspection regime should focus on the technical aspects of the implementation of a verification agreement. If an inspector encounters an ambiguous situation during an inspection, the decision to declare an inspected State to be in violation of such an agreement must be taken at higher levels, either in States Parties' capitals or by the agreement's verification entity. An inspector should document what occurred during the course of the inspection but must also be aware that they may not have the full picture of what is actually occurring at the inspection site. The verification entity or various States parties may have access to information that can shed further light on the situation or may have a better understanding of any ambiguous areas in the agreement's text. In light of this, it is important to consider how a disagreement or ambiguity documented during an inspection should be addressed.

If, during the course of an inspection, an inspector believes something does not comply with their understanding of the verification agreement, they should first discuss the issue internally with other members of their inspection team, in particular with the inspection team chief. The inspection team chief should then raise the issue with the inspected State and see if they can come to a mutual understanding of how to address or resolve the issue.

If the two parties can resolve the issue themselves, that resolution should be documented as a comment in the Inspection Report that describes the event or situation and explains how it was resolved. Documenting issues, including what measures were taken or not taken to resolve such issues and the ability to take photographs related to such issues and resolutions, can serve as a road map for a compliance review by higher authorities or as a basis for addressing similar issues if they arise during future inspection activities.

If the two parties are unable to resolve the issue, then the issue and circumstances surrounding it should be documented as completely as possible in the Inspection Report as a discrepancy or an ambiguity (depending on the nature of the issue) by both the inspection team and the inspected State. The inspection team should attempt to complete as much of the remaining portion of the inspection as possible.

Both the inspected State and the inspection team should have opportunities to make comments in the Inspection Report.

If adjustments to the terms of a facility arrangement become necessary during an inspection, these adjustments would be negotiated by inspectors and the inspected State if possible. Although certain issues, such as those concerning safety, would be difficult to work around, it is possible that some issues might be resolved by negotiation. If an adjustment to a facility arrangement occurs during an inspection but is not seen as a case of force majeure, it would be expected this would warrant a comment in the Inspection Report and could be subject to conversations in the agreement's compliance body.

Role of a Compliance Body in Resolving Discrepancies, Ambiguities, and Making Compliance Determinations

Once an ambiguity or discrepancy is brought before the compliance body, the involved parties should be prepared to explain what transpired during the inspection.

- The inspection team, as the on-site representative of States parties, can present information garnered from the inspection from their perspective, as well as through other means, to discuss any comments or ambiguities that were documented in the IR.
- Similarly, the inspected State can use the Inspection Report and its supporting information to present its perspective.

The compliance body should consider all information presented and work with both parties to reach a mutually satisfactory solution. If the discrepancy or ambiguity is the result of a procedural question, a resolution to the issue might result in either party changing its procedures. If an issue arises in which the parties have different understandings of the requirements of the verification agreement, the text might be amended, or supplemental procedures developed to clarify expectations for future inspections.

Although it is in the interest of both the inspection team and inspected State to see the issue resolved through the compliance body, a declaration that a violation of the verification agreement has occurred might ultimately prove necessary. If the agreement contains provisions for consequences for such a violation, specific enforcement actions would follow. For all inspection activities, the compliance body is responsible for making compliance determinations.

Part III. Limitations Related to Safety, Security, Non-Proliferation, and National Interests

Chapter 14. Concerns and Objectives for an Inspected State at Dismantlement Facilities

There are numerous concerns for inspected States associated with allowing inspectors access to sensitive NED-related facilities. Many of these concerns are shared by the verification entity, and should be built into the design of monitoring and inspection procedures.

This is not a fully comprehensive assessment of the concerns of inspected States, because those concerns may differ among the States and at each individual facility, but it gives a general overview of areas of concern. The concerns listed are those that exist today, and it should be kept in mind that some of these may change under a future nuclear disarmament regime, although many will not.

In addition to ensuring their own compliance with the verification agreement, the key objectives of an inspected State would be:

- Ensure safety of all personnel (inspected States and inspectors) during an inspection;
- Ensure safety of all items and equipment during an inspection;
- Ensure no proliferation-sensitive information is released to inspectors; and
- Ensure protection of classified or sensitive information not related to the inspection.

Concerns: Safety, Security, and Non-Proliferation

Safety and non-proliferation are legal and regulatory obligations. Security information may need to be protected for two different reasons. First, the unauthorized release of classified information may assist another State to gain a military advantage. This may be more important in earlier stages of disarmament, while States reduce numbers but still have a posture of nuclear deterrence. Second, and something that should be of concern to all States, is protecting this information from criminals and terrorists. The threat should be considered in terms of what would help terrorists acquire information on NEDs or conduct attacks (including suicide missions) against these facilities. The long-term security of any information released to inspectors, and of inspectors involved in these activities, will need to be considered.

Safety

Physical safety of inspectors on-site: inspectors may need to undertake safety training including awareness of hazards, alarms, and emergency response procedures. Inspectors will be escorted at all times.

Radiation safety: limitations are likely for inspectors on their proximity to and time spent near radiation sources. Inspectors may be required to wear protective clothing and there may be restrictions on food and medication in certain areas.

Explosive safety: strict limitations on flammable materials and electronic equipment including, but not limited to, anything using high voltages, Wi-Fi/RF emissions, and batteries (possibly including pacemakers). Restrictions may be required on the proximity of inspectors to explosive materials, the number of personnel within an explosive building, clothing, footwear, and other measures to manage static discharges.

Safety rules tend to be governed by legislation and liability laws, enforced through regulating bodies, although sites may apply a more rigorous approach as standard procedure within their facilities. Facilities may also hold licenses to operate hazardous operations based on safety procedures. Changing such safety procedures may be possible but may require significant time to do so while regulating bodies assess the effect. Such changes may also require updates to licenses and legislation. In some States, such changes are only possible with a ratified Treaty instrument; political agreements are not necessarily sufficient.

Security

General site security: restrictions may be placed on certain items including cameras, inspection team devices, drugs, and items that could be used as weapons (against staff or items). Inspectors will be escorted at all times, although the level will vary considerably depending on the sensitivity of the area. Possible searches of inspectors, including the use of sniffer dogs and metal detectors, may be required on entering the site, with further searches before entering higher security areas.

Physical security: concerns may exist over inspectors gaining a full understanding of and therefore being able to pass on information regarding security arrangements of the site, standard building access requirements, building physical construction, container physical construction, building and container locking mechanisms, guard levels and routines, site and building monitoring arrangements (CCTV/other), emergency response procedures, and other security features.

Cyber security: concerns may exist over allowing any inspector access to facility information systems, and gaining knowledge over the associated security arrangements of such systems. Access to inspection team networks or systems by inspectors is therefore unlikely, with exceptions for specially provided and controlled systems. Inspection equipment will need to be certified taking into account technologies like Bluetooth and wireless transmitting capability to prevent the surreptitious gathering or release of data. Also, non-approved equipment, like personal electronics that are not for inspection purposes, will likely not be allowed in the facility when conducting inspection activities.

Safety checks: while safety checks are undertaken on equipment or personnel for genuine safety reasons, how safety checks are undertaken is a security concern. Such information may allow future inspectors to circumvent such safety checks on subsequent inspections.

Transportation: security is likely to be particularly sensitive during transportation of NEDs or their components. Without the layers of physical security present in a fixed facility, there will be a high level of sensitivity regarding security information on transport containers, vehicles, routes, and timings.

Personnel security: personal information on staff may also be protected, including restrictions on taking images of staff. These may be due to legal, contractual, or union/labor agreements.

Non-Proliferation

Protection of NED design information and manufacturing techniques will be managed by preventing physical access to, and sight of, the NED, its interior, or its sensitive components as well as certain tooling and equipment. Although this can be relatively easily achieved through enclosing and shrouding such items and equipment, this can pose additional issues for inspectors if they cannot verify what has been hidden from them. Prevention of inadvertent swipe sampling may require the use of further protective clothing. Limitations, like information barriers, will also be placed on verification equipment, which could measure or record proliferation-sensitive information. The inspected State will also need to prevent the use of unauthorized measurement devices or misuse of inspection equipment to gain such information.

Previous study has indicated that for equipment to meet all the requirements for non-proliferation, safety, and security, the inspected State may have to have the last sole custody of inspection equipment prior to use (or entry into joint custody). Release of such equipment after use may also be problematic. Under these circumstances, finding ways inspectors can trust such equipment and the data they produce is critical.

Summary

The above is a list of areas where the inspected State may have concerns. This does not indicate what is or is not possible, but what must be considered if a successful inspection can be carried out. It is also likely one solution will not work in all States or even all facilities within a State; a tool box of techniques and technologies will be required to meet differing challenges within each facility.

Chapter 15. Review of Safety, Security, and Non-Proliferation Issues

Given the discussion of concerns and objectives above, we reviewed key findings, and mitigating examples to demonstrate how they can be used as a baseline for creative and acceptable solutions to issues surrounding safety, security, and non-proliferation. Common and central to these solutions is the idea that during disarmament inspections both the inspectorate and the inspected State will strictly abide by pre-agreed procedures, in which the safety, security, and non-proliferation concerns of all parties have been taken into account.

Safety

Key concerns: Ensure the safety of inspectors, inspected State personnel, items, and equipment during inspections.

Ensuring the safety of inspectors, inspected State personnel, and equipment during the conduct of an inspection is essential to all parties. Although the ultimate decision on safety rests with site personnel, it is important that safety considerations not be used to unnecessarily refuse, hinder, or otherwise adversely affect inspection efforts. It should also be in the interest of the inspected State that inspectors understand why safety-related restrictions will necessarily affect access.

There are many ways to ensure that safety rules are respected during successful inspections. These include:

- **Transparency in safety rules:** Inspectors must understand relevant rules in advance of an inspection so that it is clear that they are not being applied arbitrarily or made up on-site. If site indoctrination training is required, this must be made clear in advance.
- **Safety rules follow standards:** Although specific safety procedures may vary, they adhere to accepted standards established either by an international standards entity or by a future disarmament body.
- **A reporting, review, and resolution mechanism:** Although it is conceivable that inspections might be adversely affected by safety considerations, there must be a mechanism for the verification entity and the inspected State to report the incident and the effect it may have had, and have a resolution mechanism. A mechanism that might fulfill this role is that of the Inspection Report.

As an example, IAEA safeguards inspectors routinely and successfully navigate diverse and changing safety regimes (which could differ not only between countries, but also between jurisdictions within countries) at civilian, and in some cases, military facilities. Safety norms are communicated to the IAEA, and site-specific safety training is given by some facility operators. In Comprehensive Safeguards Agreements and Additional Protocols, there are explicit provisions for both communicating relevant safety rules to IAEA inspectors, and for the limitation of IAEA inspector access, which may be useful as exemplars, including the use of managed access. Disputes between the State and the IAEA inspectorate, if not resolved at a lower level, can be reviewed by the IAEA Board of Governors, a neutral and multinational body.

The notable differences between the activities performed by inspectors responsible for safeguards versus inspectors charged with dismantlement verification may also support this

possibility. Safeguards inspections are by their nature intrusive, granting inspectors wide freedoms to access relevant locations, take multiple measurements, and use various instruments. Conversely, a dismantlement inspection will be significantly more targeted and restricted in terms of access and measurements, is more likely to use pre-approved and custom-built equipment, and will most likely occur only at a handful of sites worldwide. Against that background, the use of detailed pre-agreed procedures to manage safety for an inspection team should be possible.

Ratification of a verification agreement may require the adaptation of domestic legislation to reflect the new legal rights and obligations that it contains. In particular, national laws and regulations governing NED-related facilities may need adjustment to enable multilateral inspectors to obtain access to locations where they need to make observations and measurements. Such amendments could prove to be a lengthy undertaking. It is possible that existing legislation governing foreign access to various national nuclear fuel cycle facilities to enable safeguards inspections may provide examples of some provisions that could be applied toward dismantlement inspections in order to reasonably assure site, inspector, personnel, and equipment safety.

The combined risks of radiation and high explosives must be accounted for in NED dismantlement. There are clear precedents for inspectors having to work under nuclear (IAEA) or explosive (OPCW) safety constraints. Further lessons from inspectors at nuclear weapons sites can be learned from the experiences the United States and Russia have gained under START/New START arrangements. Although no inspection regime has yet dealt with the full combination of these issues, the fact that they have been shown to be manageable individually provides confidence that they can be managed in combination. Furthermore, there may be lessons that can be drawn from national chemical, biological, radiological, and nuclear (CBRN) capabilities. Most States have highly specialized units trained to respond to CBRN threats. CBRN teams are trained to understand radiation and high explosive safety constraints that may have relevance to those that inspectors might face.

Given the considerations above, it should be possible to construct a verification regime that respects, but is not hindered by, applicable safety rules, provided such rules are rational and aligned with existing international standards and norms, or could be aligned with standard practices. Many safety concerns could in fact be mitigated via robust inspection procedures and via the provision of qualified site escorts.

Security

Key Concerns: Protection of information, physical security, site security, cyber security, and transportation.

The same mitigating factors that applied to safety can, to a somewhat limited extent, be applied here. That is, inspectors must understand relevant rules in advance of an inspection so that it is clear that they are not being applied arbitrarily or made up on-site. Cases where security concerns affect an inspection should be documented in the Inspection Report.

Of course, security brings additional complex challenges such as transparency with respect to what is being protected, and this could also limit the ability to document, review, and resolve an ambiguity related to security concerns. In allowing multilateral inspectors to perform NED dismantlement inspections, the flexibility of NED site security protocols will be challenged and the risk of divulging classified information will be elevated. Additional security measures can also be considered, including information barriers and managed access procedures. For example, blindfolds or covers have been used by sites hosting the IAEA or other parties in disarmament and safeguards inspections.

Regarding cyber threats, it is worth noting that these threats exist even in the absence of disarmament verification. Compared to ambiguous everyday cyber threats, the potential threat posed by a dismantlement inspection team gaining access to or observing classified information is comparatively well-defined and thus easier to manage. Along with existing firewalls and counter-cyber espionage efforts, it is expected that inspectors would be subject to physical searches prior to entering the site to ensure they are not carrying any unauthorized equipment, and the use of site information technology infrastructure by inspectors could be limited or disallowed completely to in part ensure that no information can be illegally recorded, or malicious viruses/malware introduced to information systems.

The selection of inspectors could also have clear rules to verify the integrity and character of candidates that could include background checks or multinational review panels. The methods for selecting inspectors could also be enhanced to include only nationals from countries that are signatories to relevant treaties on disarmament, such as the NPT, or have taken on equivalent legal obligations regarding the dissemination of proliferation-sensitive information. For countries without nuclear weapons, inspectors could be limited to States that have in place IAEA safeguards; that have no unresolved reports of safeguards non-compliances before the IAEA Board of Governors; and that are not facing any UN or other security-related sanction(s), among other criteria. The selection process could also include provisions that permit an inspected State to reject a proposed inspector, so long as such refusals do not impede the conduct of an inspection.

Most importantly, the strict adherence of both the verification entity and the inspected State to the provisions of the verification agreement and facility arrangements cannot be overstated as the most reliable and effective method to ensure the physical and information security of both parties. Inspectors would only have access to a specified set of locations and equipment, which would be negotiated in advance with both the verification entity's mandate and the States parties' security considerations in mind. Such compartmentalization of access and information is a strong tool to ensure that there are no security risks in the controlled environment in which inspectors would operate.

Non-Proliferation

Key concerns: Proliferation of NED designs, manufacturing techniques and technical specifications that may contribute to vertical and/or horizontal proliferation.

The risk of deliberate nuclear proliferation acts arising from a dismantlement verification inspection is real. In addition to the mitigating factors mentioned above related to information

security, the risk of proliferation has a robust and legally binding moderating factor—the NPT. Articles I and II of the NPT legally prohibit the transmission and receipt of proliferation-sensitive information, respectively. It is assumed here that any non-NPT States that are engaging in future nuclear disarmament would have undertaken equivalent obligations, perhaps contained in the verification agreement itself.

Countries without nuclear weapons have pledged not to acquire nuclear weapons and demonstrate this by submitting to intrusive safeguards verification, as required by the NPT. In terms of suitability for supplying disarmament inspectors, a country without nuclear weapons' adherence to the NPT and perhaps the CTBT, and compliance with relevant safeguards agreements, could be a prerequisite for its citizens to be inspectors. This is not to say that meeting such a test would avoid the need for strong managed access measures during inspections. Countries with nuclear weapons do not of course disclose sensitive information to their own citizens beyond what is necessary for closely vetted individuals to do a job.

Because disarmament verification inspections could also occur in non-NPT States, it is worth noting that all States that possess NEDs are presumably strongly motivated by self-interest to deter the spread of NEDs to other States. Given the military benefits conferred by NEDs, even States without NPT commitments can be expected to have robust programs in place to prevent the unauthorized dissemination of information and material. However, to provide legally binding assurances in such cases, commitments akin to Article I of the NPT could be included in a possible disarmament treaty. This would ensure similar legal requirements on all disarming States, whether NPT signatories or not.

The inadvertent release of proliferation-sensitive information must also be considered, but this is exclusively an inspected State responsibility. States that host NED dismantlement verification inspections will need to have programs in place to ensure that areas that are accessed by inspectors are sanitized of any proliferation-sensitive information before inspectors arrive. This may include the obscuring of information that is already in the open-source, as the confirmation of the validity of such open-source information could itself be proliferation-sensitive.

Recommendations

Rather than forming a set of weaknesses, measures to address the areas discussed above overlap and strengthen each other. The creation of agreed access and verification procedures to address nuclear disarmament provides the appropriate forum to also address safety, security, and non-proliferation concerns to the satisfaction of both the inspected State and a verification entity. Such procedures should embody the following principles:

- **Safety:** Promote harmonization of safety standards and practices at nuclear facilities, combined with additional training, such as to reflect the unique safety requirements of dismantlement verification.
- **Security:** Use existing security screening and counter-cyberattack strategies augmented with additional selection criteria and security practices for inspectors. Ensure measures are in place, which limit inspectors' access only to information that is necessary for their task.

- **Non-proliferation:** Trust in the NPT Article I and II obligations States have made, but verify these commitments through IAEA safeguards and additional security measures. NPT-equivalent assurances could be sought from non-NPT States. Also rely on security practices that prevent the dissemination of sensitive information and on the ability to limit the selection of inspectors to those of established integrity and character.

Chapter 16. Managed Access Rights and Obligations

"Managed access" is an often-used term to describe various special arrangements relevant for conducting inspections. For instance, "A process by which one party ("the host") enables another (the "inspector") to gather necessary and sufficient information for assuring that the inspected State is in compliance with an agreement, while at the same time protecting sensitive information from unnecessary disclosure," is the definition taken from the "Verification Annex" of the CWC. In IAEA safeguards, managed access includes arrangements "to prevent the dissemination of proliferation-sensitive information, to meet safety or physical protection requirements, or to protect proprietary or commercially sensitive information" (IAEA Additional Protocol, Article 7a). Information may be characterized as sensitive either because it is classified, proprietary (e.g., linked to intellectual property rights), or private, and must therefore be protected from disclosure during inspections. It makes no fundamental difference whether a facility is military or commercial. The consequence of unnecessary disclosure of sensitive information might be significant, whether by weakening national security, undermining non-proliferation commitments, or giving away commercial trade secrets to business competitors.

Background

Sensitivity will be attached to information or data related to monitoring the dismantlement of a NED because of the risk that unauthorized disclosure could pose for nuclear security or other national interests, or for nuclear proliferation. Effective procedures to avoid the disclosure of sensitive information or data during, or obtained from, monitoring and inspection activities is central to the cooperation of countries with nuclear weapons, and to avoiding damage to the reputation of the verification entity. Such procedures have been elaborated with respect to IAEA safeguards, verification under the CWC and the CTBT, and other international verification instruments, including bilateral agreements, such as the New START Treaty. Preventing unauthorized disclosure of sensitive information under these regimes has two broad aspects:

- Negotiation of inspector access with the inspected State to meet verification objectives but avoid the disclosure of sensitive information or data (including proliferation-sensitive information or data) if the disclosure is not needed; and
- Managing the circulation, protection of, and disclosure of information needed for achieving an inspection mandate, i.e., need-to-know and confidentiality protections.

Managed access provisions that may be useful in the context of monitoring NED dismantlement can be found in the model IAEA Additional Protocol (Articles 5 and 7) as well as the CWC ("Verification Annex," Part X, Section C, Paragraph 46-52) and CTBT (Annex 2, Part II, Section D, Paragraph 86-96), and in some other existing verification instruments, including bilateral agreements such as the New START Treaty (Annex on Inspection Activities). These provisions offer useful principles that could be applied to NED dismantlement inspections.

The balance of rights and obligations captured by managed access provisions is important for ensuring that the negotiation of managed access procedures serves the objectives of both the inspected State and the verification entity. For example, the CTBT (Section D, Paragraph 62c)

provides that the reports of inspections will include an account of cooperation granted by the inspected State, giving an opportunity for the CTBT Organization's Executive Council to review the balance achieved in negotiation of managed access. The IAEA Additional Protocol (Article 7a) requires that managed access arrangements for complementary access "shall not preclude the Agency from conducting activities necessary to provide credible assurance of the absence of undeclared nuclear material and activities at the location in question."

Managed access is a tool for dealing with site- and situation-specific concerns by an inspected State that sensitive information could be exposed. It is unlikely even to be the major mechanism constraining inspector access when monitoring NED dismantlement. The specifications in a verification agreement of what inspection techniques and equipment are permitted already establish an inspection access protocol. It will be important for the designers of an inspection regime to keep this difference in mind. The concept of an inspection access protocol is set out below.

Managed Access for Inspections to Monitor NED Dismantlement and Related Storage

Who Negotiates, and What Is Negotiated?

Managed access is the result of negotiations between an inspected State and a verification entity that determines the access provided by an inspected State within which inspectors can conduct activities to achieve an inspection objective, taking into account the sensitivities of a verification context. As such, a verification agreement should clearly specify principles for how managed access should work, including the rights and obligations of all parties. Procedures for application of managed access at a specific facility should be settled to the fullest extent possible ahead of any inspection. "Access" refers to the physical access of inspectors and inspection equipment to a particular location or item as well as the observations and measurements that they make. It is also likely that one solution designed for one particular case may not apply to another situation (even within a single State, different facilities may require different solutions). The way in which managed access can be implemented varies from formal, written agreement to ad hoc measures worked out during an inspection.

The verified dismantlement of an NED is expected to take place at facilities designated by an inspected State. The design of such facilities (or at least those parts of a facility where dismantlement and storage take place) and of the NED dismantlement procedure are likely to be unique to the facility. A further set of parameters for inspector access that are specific to the facility would thus be negotiated by the inspected State and the verification entity beforehand. These would be recorded in a facility arrangement. The terms of a facility arrangement should address as many of the inspector access parameters as possible, so that routine inspections can be conducted smoothly and efficiently. Codifying in advance a set of agreed measures is mutually beneficial for both parties: the inspection team on the one hand, which knows in advance what information is relevant and accessible to carry out verification activities, and the inspected State on the other, which is able to avoid unnecessary and costly protection measures.

If adjustments to the provisions of a facility arrangement become necessary during the course of an inspection, these adjustments would be negotiated by inspectors and inspected State escorts and could be subject to final approval by the verifying entity and/or its member States.

Managed Access Principles

Managed access can be described as a balance between:

- An inspection team's ability to accomplish its mandate;
- A right for an inspected State to restrict access to prevent the disclosure to inspectors of sensitive information that is unrelated to achieving verification goals; and
- The State's commitment to accept verification to demonstrate compliance with the central provisions of a verification protocol.

The terms of a verification agreement establish rights for inspectors to have access to achieve inspection objectives, subject to any application of managed access. Managed access procedures can be developed once site-specific environments and processes are better understood, and what can and cannot be done or seen by inspectors is codified in more detail. In terms of process, managed access for inspections of NED dismantlement benefit from the development and use of a facility arrangement. Working on the basis of a verification agreement and a model arrangement, the verification entity and the inspected State negotiate bespoke access procedures for monitoring and inspection of NED dismantlement at a designated facility. If the inspected State wants to restrict inspector access in certain areas, an alternative way of demonstrating compliance is developed in consultation with the verification entity. The resulting facility arrangement is subject to approval/review by the verification entity and its member States.

Inspectors carry out an inspection in accordance with the terms of the verification agreement, taking into account the applicable facility arrangement. This arrangement should have been prepared in advance of the inspection itself, and agreed at a higher level. If operational issues complicate specific accesses or deployments by the inspection team, this could be the subject of discussion on the ground. This way, if the inspected State wants to restrict inspector access to or at a location, including in relation to the types of observations and measurements that inspectors may make, it offers an alternative means to demonstrate compliance and should develop this alternative means in consultation with the inspectors.

- The inspectors should inform the inspected State whether they consider that restrictions on access would prevent (or unacceptably complicate) the achievement of their mandate and consult with the inspected State representatives on alternatives.
- If a satisfactory outcome cannot be negotiated by inspectors, consideration should be given to whether and how knowledge of inspected items can be preserved while dispute resolution is in process, and/or recovered subsequently.
- The verification entity should report to member States on any access restrictions that they consider prevent the fulfillment of their mandate.

In the application of managed access, it is the inspected State that decides on what access is sensitive and why. To aid discussions with inspectors and the verification entity, it could be useful for the State to present a justification for its restrictions in some cases; however, this may not be possible without revealing sensitive information. The role of inspectors or the verification entity is to judge whether the access offered will allow them to accomplish their mandate.

Inspection Access Protocol

Monitoring that involves highly sensitive items such as a NED will likely follow a model under which methodology and tools are strictly defined and approved. The provisions of a verification agreement would include fixed constraints on inspector activities, for example by limiting the measurement techniques that are available for inspectors or by closely defining the areas to which they may go. The verification agreement might require, for example, that inspectors not have visual or direct physical access inside the NED or that some technologies require the use of an information barrier. A model for inspector access that integrates these constraints with an elaboration of the access needed to achieve monitoring objectives would constitute an inspection access protocol.

Managed access is a complementary process that is negotiated on a site-specific basis. Managed access arrangements are developed first in the negotiation of facility arrangements so that inspection activities can be tailored to the situation of a specific site. Managed access principles might also be used to solve problems on the ground during an inspection.

An inspection access protocol would not only be a list of limitations; it would also establish an agreed model for inspector activities that should be effective for achieving verification objectives, but that does not require access of a kind that States agree is sensitive and unnecessary. An inspection access protocol is implicit in instruments such as the CWC and the CTBT; however, it is useful to explicitly define such a protocol for inspections to monitor NED dismantlement and for negotiators of future agreements to consider it as a discrete concept:

- The protocol would help to establish a common verification standard, and is therefore consistent with the principle of non-discrimination;
- All member States would have an interest in ensuring that the protocol is effective for meeting verification objectives; and
- The protocol would assimilate many of the measures needed to protect proliferation-sensitive information.

The inspection access protocol could be part of an overarching treaty (as in the CWC) or could be set out in a model agreement, such as an IAEA model safeguards agreements.

Other Restrictions to Access

A verification agreement for NED dismantlement could include provisions on other access restrictions through which an inspected State might decide, or may need, to restrict inspector access. For example, actions to protect the health and safety of inspectors or facility personnel could affect the conduct of an inspection and thus require provisions to manage the effect of any health and safety risks or events on inspection effectiveness.

A verification agreement should also consider how to balance the need for short-notice inspections with the need to minimize the disruption of facility activities, plans, and schedules. Again, this does not fall squarely within the usual concept of managed access. However, the inspected State and a verification entity would need to negotiate, on a site-by-site basis, how disruption to facilities can be minimized, but the principle that the inspected State must permit the access needed for inspections should be reflected in a verification agreement.

Part IV. Verification Entity

Chapter 17. Composition of Inspection Team: Inspector Functions, Tasks, and Skills

Inspectors monitoring NED dismantlement should be organized into self-supporting inspection teams. Team members and subgroups should be able to complete different tasks based on the team members' expertise. Roles within the team could include:

- "Inspection Team Leader," as well as a "Deputy Team Leader" who can be assigned to lead a sub-team in case some simultaneous inspection activities are required;
- "Verification specialists" capable of conducting NED-focused inspection activities; and
- Other "non-technical specialists" who can conduct supporting tasks for the inspection team.

The inspection team should have the best mix of specialties adapted to the specific type of NED inspection and the specific nature of a given dismantlement facility. The inspection team will conduct its inspection activities using a single designated language, but it will be beneficial for the inspection team to have trained linguists capable of providing official communications using the language of the inspected State.

Inspectors

The inspection team requires sufficient technical expertise and observational skills to accomplish four major tasks: (1) ensure the chain of custody of the NED; (2) confirm that the NED meets the agreed characteristics; (3) confirm the end-point of the inspection activity; and (4) ensure nuclear materials and high explosives remain in monitored storage. Therefore, team members require relevant knowledge and skills to ensure the chain of custody, verify the identity of the designated NED, recognize attempts by the inspected State to spoof or tamper with inspection equipment, and verify that the inspected State properly follows all the steps in the inspection procedures.

Inspection Team Leader and Deputy Team Leader

A team leader or deputy would be a senior inspector, preferably with nuclear weapons-related, or similar inspection experience. Team leaders and deputy team leaders would have:

- Detailed knowledge of the verification agreement and any subsidiary enabling or implementing agreements;
- Negotiation skills; and
- Report-writing skills based on factual findings.

Verification Specialists

Such specialists would be experts with specific knowledge and hands-on skills to properly identify the NED, to ensure that chain of custody procedures are followed, and that all the steps in the inspection procedures have been followed. In addition, the verification specialists should have knowledge and skills pertaining to topics such as:

- Detailed knowledge of the verification agreement and any subsidiary enabling or implementing agreements;
- The agreed NED dismantlement inspection procedures;
- Nuclear physics/nuclear engineering;
- The handling of special nuclear materials;
- Nuclear material and/or explosive material safety;
- Training in use of inspection equipment;
- The ability to perform "on-site radiation signatures measurement" of nuclear material if required by the inspection procedures; and
- The ability to ensure that chain of custody and physical security procedures are followed.

Non-Technical Specialists

In addition, the lessons learned from various verification regimes indicate that successfully completing inspection activities requires both verification specialists and non-technical specialists who are able to conduct support activities such as the team's administrative work, comply with confidentiality and security rules, are able to effectively communicate with each other and the inspected State, ensure the team has proper logistics support, and maintain health and safety support. It is possible that non-technical skills and functions can be performed by other members of the inspection team. Such non-technical specialists should have knowledge and skills pertaining to:

- Administrative procedures related to the verification regime (i.e., POE/POE exit procedures, setting-up an Inspector Station, etc.);
- Confidentiality and security procedures, including team security and boundary control;
- Information and cybersecurity skills, if remote monitoring instruments are provided;
- Logistics support required to support the team during the course of inspections, including the maintenance of inspection equipment; and
- Supporting the health and safety of the inspection team, including radiation protection.

Other Desirable Knowledge and Skills for Inspectors

The following qualifications could also be useful for members of an inspection team:

- College graduate degree or higher degree in science or engineering;
- Previous experience with other arms control inspection regimes—nuclear inspection experience is desired but not necessary so long as the individual can prove they have the necessary skills and knowledge to support the work of the team;
- Knowledge of physical aspects of NEDs and radiation safety;
- Fluency in the language to be used by the inspection team is essential, additional language skills are helpful, particularly of inspected States;
- Police and crime scene investigators who may have the appropriate mindset for analyzing and recording an inspection as they conduct it, as well as for interacting with inspected State staff;
- Inspectors with diplomatic or legal experience who could be helpful in resolving disagreements during inspection activities;

- Military or other deployed operational experience that enables them to help others operate in an unfamiliar environment;
- Professionals with backgrounds in facility design or operation, not only for NEDs but also for any other military or nuclear processing activities; and
- Health and safety professionals, particularly those from nuclear and high explosives facilities, with a mix of skills that allows them to provide situational awareness to their colleagues, and conduct safety functions as necessary.

Inspected State Escorts

Escort Team

It would be best practice to have verification specialists on the escort team, but that is not necessarily a requirement provided that the escort team has been properly instructed on NED identification and chain of custody procedures in the event questions arise. The presence, however, of verification specialists on the escort team would provide the escort team with their own experts who would be able to address any questions or concerns expressed by the inspection team.

- Professionals with backgrounds in facility design or operation, not only for NEDs but also for any other military or nuclear processing activities; and
- Health and safety professionals, particularly those from nuclear and high explosives facilities, are likely to have a mix of skills that allows them to provide situational awareness to their colleagues, as well as the useful safety functions that they can perform.

The utility of trained inspected State escorts to the successful accomplishment of an inspection cannot be overstated. Many of the skills and the knowledge base that is required of an inspection team member are consistent with those required by an inspected State escort. As with an inspector, an escort requires knowledge of chain of custody procedures, how the designated NED is identified, the ability to assess whether spoofing or tampering of inspection equipment has occurred, and the inspection procedures that the inspection team must follow because they will need to be able to engage with site personnel if the inspection team has any concerns. In addition, escorts must also be aware of the inspection requirements with which the inspected site must comply so that they can address any issues that may arise. Escorts should be able to operate applicable communications systems to allow them to communicate with officials at the dismantlement facility as well as to communicate with appropriate national organizations. Most importantly, escorts must have a firm understanding of health and safety procedures related to the inspection because they will be responsible for ensuring that the inspection team is not exposed to any situation that could endanger their health and safety or that of the people working at the inspection site.

Desirable Knowledge and Skills for Escorts

The following qualifications could also be useful for inspection team escorts:

- Previous experience with other arms control inspection regimes, nuclear inspection experience is desired but not necessary so long as the individual can prove they have the necessary skills and knowledge to support the work of the team;
- Knowledge of physical aspects of NEDs and radiation safety;
- Good working knowledge of the language to be used by the inspection team is essential;

Escort Team Leader and Deputy Team Leader

An Escort Team Leader or deputy would be a senior escort, preferably with nuclear weapons-related, or similar OSI experience, and with:

- Detailed knowledge of the requirements set forth in the verification agreement and any subsidiary enabling or implementing agreements;
- Negotiating skills;
- Report-writing skills based on factual findings; and
- A strong understanding of facility health and safety procedures and requirements.

Headquarters Support Staff of the Verification Entity

Verification officers who will serve as inspection team members and support staff for the verification entity require knowledge, skills regarding chain of custody, and training on confidentiality procedures, the declaration process, inspection procedures, the functioning of an Operations Center, deploying inspection teams, and providing technical and logistics support during the entire inspection period, notification procedures, and health and safety concerns. In addition, technical knowledge and skills relating to dismantling NEDs and radiation measurement technology are also highly desirable. For post-inspection activities, the verification officers require the knowledge and skills to conduct analysis of the results of inspection activities and to revise and maintain training and operations manuals and training courses.

Chapter 18. Technical Capacity of a Verification Entity

Technical capacities for the conduct of inspection activities may include:

- Quantitative measurement equipment as agreed by the verification agreement;
- Qualitative measurement equipment to monitor the flow of the material (e.g., neutron and gamma monitors);
- Surveillance equipment like cameras, or 3D laser equipment, laser curtains, etc. that allow inspectors to follow movements or exclude movements across certain boundaries;
- Sealing equipment;
- Tagging equipment to help identify containers and possibly tools;
- Automatic data acquisition capabilities;
- Data analysis capabilities (manual, semi-automatic, or automatic); and
- Encryption technology to ensure the authenticity of transmitted data (whether on the site from dismantling cave to inspectors' office or beyond the site), or more general cyber security capabilities.

Chapter 19. Training Requirements (Inspectors/Escorts)

Before assuming responsibilities associated with either inspecting or escorting, those selected to serve as inspectors or escorts must undergo training that prepares them for these duties. Such training benefits both inspectors and escorts and should include, but not be limited to:

- Detailed knowledge of provisions of the verification agreement, including the procedures for inspection, and the roles and responsibilities of inspectors and escorts;
- Health and safety procedures and risks associated with nuclear facilities and NEDs;
- Operation of inspection equipment;
- Operation of applicable communications systems and equipment;
- How to write an Inspection Report and what information should be included; and
- How to address discrepancies and ambiguities found at inspection sites.

Team leaders and deputy team leaders for both inspection teams and escorts should undergo additional training with an emphasis on leadership of teams, working in cross-cultural situations, and handling discrepancies and ambiguities at the inspection site in a diplomatic manner. Team leaders and their deputies would also benefit from meeting with the verification entity to understand their expectations related to inspections and overall implementation of the verification agreement.

Part V. Looking Forward

Chapter 20. Approaches and Topics for Future Development of OSI for Verification of Nuclear Disarmament

In 2016–2017, Working Group 2 considered a framework for, and critical elements of, OSI to monitor the dismantlement of an NED and storage of its SNM and HE components. Further examination of how inspections should support the verification of nuclear disarmament would build on this work, studying the various issues in greater depth to facilitate the development of practical inspection procedures and methods. The many aspects of verification for nuclear disarmament should also be studied more widely. Next steps would include an examination of how to verify the 14 steps in NED dismantlement (see Annex IV).

The scope, role, and implementation of procedures to measure verifiable characteristics of a NED and its relevant components remains at an early stage of development. The usefulness of such characteristics needs to be more closely examined in relation to gaining assurance that an item is consistent with a NED or its components (attribute approach), or an item is the same as, or technically matches, an item already seen by inspectors (template approach). Limitations on inspector access, including information barriers, that are necessary to protect sensitive information, but that are consistent with fulfillment of inspection objectives, will be critical to future verification and need to be considered at the same time.

If some of the sensitive information relating to the design of the NED might no longer be present after dismantlement, consideration could be given to whether a more specific measurement at this time could prove a significant addition to overall confidence.

Given the challenges associated with making reliable and useful measurements of a NED, assurance of dismantlement will rely heavily on an ability for inspectors to apply chain of custody procedures and retain continuity of knowledge with respect to a NED and its components, as well as with respect to critical locations within the dismantlement facility. Closer examination will be required of measures and activities needed to implement continuity of knowledge for dismantlement facilities. Particular work will be needed to examine what design information, or basic technical characteristics, would be available to/needed by inspectors with respect to a dismantlement facility.

Working Group 2's discussion of chain of custody in a dismantlement facility highlighted that inspectors could not expect visual or other direct access to a NED as it is dismantled. Detailed work needs to be done on how a "black box" can be implemented for the room or rooms in a dismantlement facility during the period that a NED is being dismantled.

Working Group 2 has only been able to begin a discussion of the following important aspects of how inspections would work, including:

- Procedures for equipment authentication and certification;
- The objectives, duration, and frequency of different kinds of inspections;
- How facility arrangements would address site-specific inspection procedures; and

- The role and technical capacity of a verification entity and its staff.

In addition to the results of inspections to monitor the dismantlement step itself, strong assurance of NED dismantlement will require assessment of information from various sources. This will be especially important when nuclear weapons remain only in low numbers. A wider verification process would also be likely to include inspections to assess the context in which a NED is first declared (e.g., if deployed), and subsequently handled, both prior to and after dismantlement. This could include measures such as application and checking of unique identifiers for each item declared to be a NED. An ability for inspectors to review relevant records maintained by an inspected State on the history of each NED should be examined.

Monitoring of the post-dismantlement disposition of SNM and other critical NED components will be important for ensuring the irreversibility of dismantlement processes, and could provide additional assurance that a dismantled item was in fact a NED.

In addition to confirming declared actions such as dismantlement of NEDs, the verification of nuclear disarmament will also need to include "completeness" mechanisms through which States can gain assurance of the absence of undeclared activities. Future work should examine how such mechanisms could work, including a possible role for on-site inspections.

The process through which member States of a verification agreement gain assurance of compliance by others will be an important topic for future work. Compliance determinations under a future nuclear disarmament agreement will require the amalgamation of information from different types of inspections at different types of facilities as well as monitoring activities and recurring reporting of data. An examination of what types and forms of data and information would be required to determine compliance with an agreement that spans a nuclear weapon's lifecycle should be conducted.

The IPNDV should explore different modes of working. In addition to the development and discussion of working papers, consideration should be given to conducting practical exercises and demonstrations. These could be a useful way to coordinate work on OSI procedures with the work undertaken on inspection technologies.

ANNEXES

Annex I. Terms of Reference for Working Group 2

International Partnership for Nuclear Disarmament Verification (IPNDV)
Working Group 2: On-Site Inspections (OSI)
Terms of Reference
Finalized November 18, 2015

On-site inspections are a powerful tool to ensure that States are complying with the terms of a given treaty or agreement. Successful OSI relies on detailed and agreed-upon objectives and procedures, as outlined in specific treaty provisions.

The Working Group on On-Site Inspection (WG2) will explore the lessons learned from various on-site inspection regimes and identify fundamental OSI principles common across various regimes. Working Group 2 will assess the applicability and utility of these principles to potential future nuclear arms control agreements, and identify potential new inspection activities and techniques that could effectively verify compliance with future agreements.

Key Questions and Assessments

Consistent with the objectives of assessing monitoring and verification issues: (1) across nuclear weapons lifecycle; and (2) focusing on nuclear warhead dismantlement and the disposition of the resulting nuclear material to ensure irreversibility of the dismantlement process, Working Group 2 will identify:

- The roles and objectives of OSI in verifying future nuclear disarmament undertakings, including by identifying parts of the lifecycle where OSI will be of value;
- The lessons learned from existing regimes related to conventional and non-conventional weapons and their non-proliferation, wherever OSI is used as a verification mechanism. A list of options will be compiled for comparison and contrast by the Group with the needs of nuclear disarmament verification. Relevant options will serve as a "pool," or set of activities and tools related to the different types of facilities, which could be included in future OSI templates/proposals;
- Ways in which verification objectives can be achieved notwithstanding limitations related to safety, security, national interests, and non-proliferation inherent in the operations of different types of military, nuclear, and explosive facilities, including through the application of managed access; and
- Desirable knowledge and skills for inspectors, escorts, and support staff at facilities and sites where inspection and/or monitoring activities occur, as well as considerations relevant to the capability and composition of inspection teams.

Expected Activities and Output

- A document outlining the key elements of OSI for verification of nuclear disarmament undertakings, potential new inspection activities, and techniques that could effectively

verify compliance with future agreements, as well as options for managed access and their applicability at different types of facilities and sites;

- A "best practices" document highlighting skills, training requirements, and lessons learned from inspectors and facility operators who have OSI experience in diverse environments as well as objectives and broad outline for an inspector training course that would serve as a basis of future capacity building; and
- Proposed approaches and topics for future development of OSI for verification of nuclear disarmament.

Outcomes from the foregoing could be examined through a tabletop exercise if time permits. During the course of its work, Working Group 2, as it deems necessary, may expand on the tasks listed above. Close cooperation with Working Group 1 and Working Group 3 is required, in order to avoid duplication and secure cohesion.

Leadership

Poland and Australia will serve as co-chairs for Working Group 2.

Timeline

The initial program of work will take place over the course of approximately 18 months. Completed work will be briefed to the IPNDV Plenary in late 2017.

Annex II. Basic Dismantlement Scenario

One State will dismantle the first of many NEDs, and put the resulting components into temporary monitored storage at the dismantlement facility. The inspecting team will consist of members from a single "entity" representing the interests of all member States. Confidence in the completion of these activities is required by both the verification entity and member States. This will cover activities on a single site starting from the NED in temporary storage, through physical dismantlement of the device, and ending with the resulting key components in monitored storage.

Objectives

1. To ensure chain of custody of the SNM and HE, from the agreed point prior to dismantlement, until both the SNM and HE are in temporary monitored storage.

This will need to consider times when inspectors cannot be present, including overnight and during the actual dismantlement process. The dismantlement process may take place over several days; for simplicity purposes the dismantlement process should initially be considered to be confined to one facility. Confidence will be needed that no SNM can be added or removed during the dismantlement process, and that all material from the declared NED is placed within temporary monitored storage.

2. To confirm the NED meets the agreed characteristics.

As an initial starting place, these could be taken from the UK-U.S. work as an item containing more than a quantity X of either Pu or U, with an isotopic composition of more than Y% Pu-239 or Z% U-235, and explosive material.

The values of X, Y, and Z will vary depending on the NED, what the inspected State is willing to reveal and on the accuracy of the equipment to be used to confirm this value. Equipment therefore needs to be flexible to deal with different values and an arbitrary value could be assigned for testing purposes.

3. To confirm the dismantlement of the NED.

Again as an initial starting point this could be considered as the separation of the SNM and HE. This will lead to the need for technology that could confirm the presence of SNM and absence of HE in certain containers, and the reverse of the presence of HE and absence of SNM in others.

4. To ensure the SNM and HE remain within temporary monitored storage until the next stage of the dismantlement (or disposal) process.

Arrangements for how containers are moved to and how the temporary component storage will be monitored will also need to be developed.

Annex III. Terms Used in This Document

Working Group 2 has adopted specific understandings in relation to the meaning of the following terms:

Dismantlement facility: A building or buildings where inspectors conduct activities to monitor dismantlement of a NED.

Dismantlement site: The larger installation within which a dismantlement facility is located.

Dismantlement station: A "black-box" room or cell in a dismantlement facility in which a NED is disassembled by separating special nuclear material from high explosives.

Equipment authentication: A mechanism by which a verification entity obtains confidence that the information reported by monitoring equipment accurately reflects the true state of an item that is subject to verification, and that the monitoring equipment has not been altered, removed, or replaced, and functions such that it provides accurate and reproducible results at all times.

Equipment certification: A mechanism by which an inspected State assures itself that an inspection or monitoring system meets safety and security requirements and will not disclose sensitive information (including proliferation-sensitive information) to an inspector.

Monitoring: The technical process of confirming declared data and gathering data relevant to whether an inspected State is in compliance with the provisions of an agreement.

Nuclear explosive device (NED): A generic term for an object containing special nuclear material and high explosives that is capable of producing a nuclear yield.

Special nuclear material (SNM): Refers to nuclear material contained, in or removed from, a NED. Its specification corresponds with *special fissionable material* as defined in Article XX of the IAEA Statute.

Verification: The processes of gathering, analyzing, and assessing information, to enable a determination of whether a State party is in compliance with the provisions of an international treaty or agreement.

Annex IV. Types of Inspection Activities and Techniques in Existing Verification Regimes

A Safeguards Agreements—Inspectorate IAEA[1]

A.1 Types of Inspections

A.1.1 Item-Specific Safeguards Agreements (INFCIRC/66)

- Initial inspections
- Routine inspections
- Special inspections

A.1.2 Comprehensive Safeguards Agreements (INFCIRC/153) & Voluntary Offer Agreements (INFCIRC/263, /288, /290, /369, /327)

- Ad hoc inspections
- Routine inspections
  - Annual PIV inspections
  - Interim inspections (e.g., MOX receipt, CASTOR loading/sealing, etc.)
- Random inspections
  - Unannounced inspections
  - Short-notice random inspection (SNRI)
  - Limited frequency unannounced access (LFUA)
- Special inspections

A.1.3 Additional Protocol (INFCIRC/540)

- Complementary access

A.2 NPT Inspection Activities and Techniques

A.2.1 INFCIRC/66

- Audit of records and reports
- Verification of the amount of safeguarded nuclear material by physical inspection, measurement, and sampling
- Examination of principal nuclear facilities, including a check of their measuring instruments and operating characteristics
- Check of the operations carried out at principal nuclear facilities and at research and development facilities containing safeguarded nuclear material

A.2.2 INFCIRC/153 (and, to some extent, INFCIRC/263, /288, /290, /369, /327)

- Accountancy verifications
- Design information verifications (DIV)
  - Visual observation
    - Item counting
    - Item identification (e.g., by serial number)
    - Tag checking (labelling)
  - Drawings
  - High Performance Trace Analysis (HPTA)
  - 3D laser scanner

[1] IAEA Safeguards Glossary, Edition 2001, International Nuclear Verification Series No. 3.

- Physical verification
  - Visual Measurements Weighing (operator balance)
  - NDA Gross defect (attribute test—qualitative)
    - Cerenkov (ICVD)
    - Gamma measurements
  - NDA Partial defect (quantitative)
    - Gamma measurements
    - Neutron measurements
    - G/N (Ion-fork)
  - NDA Bias defect (future)
    - Passive gamma emission tomography
  - Destructive analysis (DA) sampling
- Containment and surveillance
  - Seals
    - Passive Sealing Systems
      - Metal seals
      - Passive fibre optical seals (COBRA)
      - Adhesive paper seals
    - Active Sealing Systems
      - Active fibre optical seals (VACOSS)
      - Electro optical seals (EOSS)
      - Underwater ultrasonic seals
  - Optical surveillance (DCM-14, DCM-C5)
  - Nuclear material flow monitoring systems
  - Gamma and neutron detectors
  - Remote data transmission
- Special measurements

A.2.3 INFCIRC/540

- Collection of environmental samples beyond declared locations
- Making use of internationally established communications systems, including satellite systems and other forms of telecommunication
- Other objective measures which have been demonstrated to be technically feasible and the use of which has been agreed by the Board of Governors

B Euratom Treaty—Inspectorate DG Energy (Euratom)

B.1 Types of Inspections

B.1.1 Euratom-Only Inspections

- At installations under Euratom safeguards only and under joint safeguards with lower IAEA frequency

B.1.2 Joint Inspections with IAEA[2]

[2] INFCIRC/193.

- Ad-hoc inspections
- Routine inspections (see 2.1, INFCIRC 153 & 540)
- Random inspections (see 2.1, INFCIRC 153 & 540)
- Special inspections

B.2 Euratom Inspection Activities and Techniques[3]

- Euratom-only inspections at EU NWS
- Joint inspections with IAEA,[4] see "Safeguards Agreements—Inspectorate IAEA" above

C Comprehensive Nuclear-Test-Ban Treaty (CTBT)—Inspectorate CTBTO

C.1 Types of Inspections

- On-site inspection; managed access

C.2 CTBT Inspection Activities and Techniques[5]

- Remote sensing
  - Position finding from the air and at the surface
  - Visual observation, video and still photography, and multi-spectral imaging, including infrared measurements
  - Overflights
    - Field glasses
    - Passive location-finding equipment
    - Video cameras
    - Hand-held still cameras
  - Additional overflights
    - Multi-spectral (including infrared) imagery
    - Gamma spectroscopy
    - Magnetic field mapping
- Geophysical monitoring and mapping
  - Gamma radiation monitoring and energy resolution analysis
  - Passive seismological monitoring
  - Resonance seismometry and active seismic surveys
  - Magnetic and gravitational field mapping, ground penetrating radar, and electrical conductivity measurements
- Environmental sampling
  - Analysis of solids, liquids, and gases
  - Drilling to obtain radioactive samples

D Chemical Weapons Convention—Inspectorate OPCW

D.1 Types of Inspections

- Initial inspections
  - First inspection of a Schedule 1 or Schedule 2 declared facility or plant site

[3] Comprehensive Nuclear-Test-Ban Treaty, Protocol II.
[4] INFCIRC/193.
[5] Comprehensive Nuclear-Test-Ban Treaty, Protocol II.

- Routine (industry) inspections
  - At Schedule 1 and Schedule 2 facilities: all inspections conducted after the initial inspection
  - For declared Schedule 3 and Unscheduled Discrete Organic Chemicals (UDOC) plant sites: all inspections conducted
- Challenge inspections
- Investigations of alleged use of chemical weapons

D.2 CWC Inspection Activities and Techniques

- Interviewing facility personnel
- Inspecting documentation and records; carrying out an inventory
- Having photographs taken
- Requesting clarification in connection with ambiguities
- Collecting, handling, and analyzing samples
- Destruction of CW Production Facilities:
  - Installing temporary seals
  - Using tamper-indicating seals and other agreed equipment

E New START Treaty

E.1 Types of Inspections

- Type One inspections
  - Confirm the number of warheads declared to be on a designated, deployed ICBM, SLBM, or heavy bomber
- Type Two inspections
  - Confirm the number, type, and technical characteristics of non-deployed strategic offensive arms

E.2 New START Inspection Activities and Techniques

- Counting and confirming (by reading the unique identifier)
- Linear measurements
- Photography and printing of photographs
- Position finding using satellite system receivers
- Radiation detection

Annex V. Managed Access Examples

Source: IC2 (FR-AU-DE March 15, 2017)

Example 1: The UK-Norway "Focus Exercise" (2010)

The UK-Norway Initiative (UKNI), which involved countries with nuclear weapons and countries without nuclear weapons, is a good example of the challenges associated with the verification of the dismantlement of a NED, especially regarding managed access. Since 2007, the UKNI has undertaken three exercises[6] designed to elucidate the technical and procedural issues surrounding managed access of inspectors to sensitive facilities.

The lessons learned from the 2008 and 2009 exercises were wide ranging, but two in particular were discussed. First, national security and proliferation concerns permeate everything; second, the implications of Health and Safety (H&S) regulations must not be underestimated. The Norwegian facilities used to host the 2008 and 2009 exercises were not "high security" facilities; therefore the security aspects of the scenario could only be played lightly. H&S regulations were included in the scenario, but again it was felt that these did not match the level that would be experienced in an actual nuclear weapons complex. For these reasons, it was decided that a "focus exercise" was required that would more realistically explore the effect of inspected State security measures on the inspection regime and demonstrate some aspects of the safety regulatory environment associated with a nuclear weapons complex. In order to achieve the level of realism required, it was agreed the exercise would take place at the UK's Atomic Weapons Establishment (AWE)—with the UK taking the role of the inspected State and Norway the role of the Inspecting team.

The 2010 exercise focused on a familiarization visit to an initial storage/receipt facility involved in the dismantlement process for one of ten remaining "Odin" class nuclear weapons. The inspected State team was given the same primary objective as in 2008/2009: to demonstrate compliance with their obligations under the Treaty while protecting national security and proliferation of sensitive information. However, the 2010 managed access exercise was set up to maximize inspected State security intrusion. Run over a three-day period, Day 1 was set aside for negotiation activities with the on-site visit planned for Day 2. During Day 3 the players and planners would review the exercise and discuss observations.

On Day 1, the inspection team arrived at the meeting facility with prepared procedural documentation and a structure for the Inspection Report. The team anticipated that the inspected State would provide a full, detailed briefing on the facilities and processes prior to the visit. A Health and Safety plan had been developed and a request was made for a side discussion to agree on the contents—the inspected State team agreed to this request. In order to fully understand the role of the facility within the dismantlement process, the inspection team also requested details of the operations that would take place within the facility, including any

[6] Familiarization Visit Exercise, Norway, 2008; Monitoring Visit Exercise, Norway, 2009 and Focused Exercise, UK, 2010.

associated transport phases. Furthermore, they wished to confirm the location of the site and relevant facilities by GPS.

The inspected State pointed out that the facility was a high security facility and that it had a responsibility to maintain the physical security surrounding assets, staff, and operations. The host regarded the exact layout and design of the facilities as an integral part of the physical security of the site, therefore, maps and schematics could not be released. The host also pointed out that no one, including inspection team personnel, would be allowed to take GPS readings on-site. The physical security surrounding transport phases was particularly sensitive for the host party. Consequently no information was provided regarding the transport vehicles or timetable for transport phases; inspectors would not be allowed to witness transport phases.

The inspected State team pointed out that the storage/receipt facility was subject to both explosive and radiological safety regulations. As a result, the inspected State intended to limit the time within the facility to a maximum of 75 minutes with only four inspectors per visit. The inspected State briefly mentioned some of the managed access methods that would be deployed but provided no details other than to clarify that the use of notepads would be controlled, and that all equipment would be provided and operated by the inspected State staff. By insisting that the inspected State supply, and inspected State team members operate all equipment, the inspected State could ensure that it would not be possible for the inspectors to take covert measurements within the facility.

The inspecting team turned to a consideration of a future monitoring strategy and the potential need to make radiation measurements to confirm the information provided in the inspected State's declaration. The inspectors felt that additional confidence would be gained by deploying measurement techniques as early as possible in the dismantlement process. A radiation measurement system behind an information barrier was being developed by the two parties that could be used for this purpose. The inspectors also suggested a counting activity to confirm the declared number of "Odin" class weapons that would be entering the dismantlement process. Therefore, the inspectors requested access to see all ten of the "Odin" weapons scheduled for dismantlement, obtain background radiation readings from the facility and take dimensional measurements to ensure the correct placement of the measurement equipment. In order to understand the effect of the container design on a radiation measurement, a request was made for information about the construction of the container and dimensions.

The inspected State could not provide any more information other than that specified in the declaration with regard to the design of the "Odin" class weapon, as design information is proliferation-sensitive under the Article I of NPT. The inspected State agreed that an information barrier (IB) is required to protect against the release of sensitive information. Dimensional measurements would have to be tightly controlled to ensure that no data could be gathered about the size of the facility and the size of the container. The inspected State declared that the container formed part of the physical security plan for the weapon; therefore, no construction information could be released. The inspected State was concerned that background radiation measurements might release sensitive information with regard to operations within the facility, so suggested that the issues be discussed as part of ongoing joint technology development activities.

On Day 2, in addition to "guards, guns, and gates," the inspected State deployed several supplementary levels of security to manage the inspectors' access to the weapon storage/receipt facility:

- Initial entry into the protected area involved identification checks, searches, and the removal of prohibited items (such as cameras, phones, and recording devices);
- Shrouding was used to ensure that inspectors only viewed parts of the facility and equipment directly related to the inspection process and to conceal items that could provide sensitive or proliferation information;
- The inspectors were escorted and monitored at all times;
- Entry into and egress from the high-security area involved additional identity checks and the deployment of search and detection equipment;
- Entry into and egress from the storage/receipt facility was via a "change barrier" (that is, a change into a protective clothing) both to meet Health and Safety requirements and to provide an added layer of security assurance;
- Movement within the facility was restricted to prescribed walkways; the Inspection team was not allowed to approach the container (with one exception described below) or the walls of the facility;
- Additional escorts were deployed within the facility;
- Notepads were issued upon entry to the storage/receipt facility and retained by the inspected State on exiting the facility; the notepad content was checked by the inspected State security team and photocopies of cleared documents were provided to the inspectors.
- All equipment was supplied by the inspected State;
- All equipment was operated by the inspected State. One inspector was allowed to approach the container to check the integrity of the deployed seals.

The inspectors were based in a meeting room and escorted to the storage/receipt facility, one group at the time. The level of security came as a surprise as the briefing on Day 1 had not given full details of the managed access procedures that would be used. As a definition of the function and extent of the facility had not been agreed, there was a misunderstanding with regard to the time allotted to each visit.[7] In addition, the "change barrier" process took a significant amount of time away from the agreed inspection activities. However, the inspectors did successfully gain entry to the facility and visually assessed the container.

Day 3 was primarily "out of play" and was viewed as an opportunity to review the exercise and discuss observations.

Although lessons could be learned from past experiences with other regimes (e.g., safeguards), the scenario of the 2010 "focus exercise" also revealed some unique challenges for the inspection team, for example the difficulties from the viewpoint of a country without nuclear weapons of inspecting such an unfamiliar environment and process. Opportunities for countries without

[7] The inspectors defined the facility as the room in which the container was housed whereas the inspected State defined the facility as the whole building including the "change barrier" area.

nuclear weapons to discuss the challenges of nuclear warhead verification would assist in preparing for a potential verification regime. Clear terminology and definitions and the unambiguous communication of relevant information would also have aided inspected State–inspector team interactions. This is particularly important when the inspected State is unable to discuss certain elements of the process because of proliferation and national security concerns.

Managed access builds trust through cooperation in an area that presents significant technical and political challenges for both parties. The 2010 exercise provided a common understanding within the UK-Norway framework of the affect that inspected State security and safety could have on an inspection regime. This is also essential for ongoing technology development. Specific lessons learned that might be relevant for future IPNDV work include:

- State or facilities' specific legal requirements may restrict activities. Similarly, if we can learn from different experiences related to "managed access" provisions (i.e., CWC or Safeguards), each verification scenario raises unique challenges;
- By negotiating and agreeing all aspects of the visit in advance, issues can be discussed and eventually resolved;
- Beyond these considerations, confidence-building is crucial and allowed both parties to cooperate under good conditions, and even to show some flexibility.

Example 2: Managed Access under the JCPOA

In the negotiation of the Joint Comprehensive Plan of Action (JCPOA), the issue of inspector access to sites in Iran, both civilian and military, was discussed intensively. For a long time, opinions were greatly divided. Although some of the E3/EU+3 States insisted on being entitled to carry out inspections "anywhere, anytime," some Iranian officials demanded ruling out access to military bases.

However, by signing the JCPOA, Iran has agreed to provisionally apply the Additional Protocol, pending ratification by the Iranian Parliament. The complementary access provisions of the Model Additional Protocol (Article 5 and 7) allow IAEA inspectors access to all areas of a site, whereby the term "site" includes the areas described in the relevant design information for a facility (or in the information about a location outside facilities) (Article 18). The term "facility" refers to a nuclear plant (such as a reactor or enrichment plant) or any location where nuclear material in amounts greater than one effective kilogram is customarily used. In the case that weaponization activities are situated on a site, with or without the involvement of nuclear material, the IAEA has the right of access.

Moreover, while Article 2.a.(i) of the Model Additional Protocol requires States to declare any nuclear fuel cycle-related research and development activities that do not involve nuclear material, the complementary access provisions also allow for inspecting the corresponding locations. Finally, the Additional Protocol gives the IAEA the right to take environmental samples anywhere in the country, not excluding military sites.

The complementary access provisions include the procedure of managed access arrangements (Article 7), which can be requested by a State in seeking to, inter alia, protect proprietary or commercially sensitive information.

The JCPOA contains some specific access provisions (Annex 1—Nuclear Related Commitments, Part Q), including an escalating process to resolve concerns about undeclared nuclear materials or activities, or activities inconsistent with the JCPOA, at locations that have not been declared under the Comprehensive Safeguards Agreement or Additional Protocol.

1. In case of concerns of this type, the IAEA will provide a reasoned request for clarification.
2. If Iran is not able to address these concerns adequately, the IAEA will send a reasoned request to get access to the location in question and make relevant information available.
3. Iran can propose alternative means of resolving the IAEA's concerns, which should be given due and prompt consideration.
4. If the concern still cannot be resolved within 14 days of the IAEA's original request for access, then
    a. Either Iran and IAEA, in consultation with the members of the Joint Commission, agree on necessary means, or
    b. In the absence of an agreement, the members of the Joint Commission, by consensus or by a vote of five or more of its eight members, would advise on the necessary means to resolve the IAEA's concerns.

It was agreed that the process of consultation with, and any action by, the members of the Joint Commission would not exceed seven days, and that Iran would implement the necessary means within three additional days.

Example 3: Managed Access during the CTBTO PrepCom's 2014 Integrated Field Exercise (IFE14)

The objective of OSI under the CTBT is to search an area of up to 1,000 square kilometers to gather facts to enable States Parties to determine if a nuclear explosion has been carried out in violation of the Treaty. The 1,000 square kilometers of the inspection area for IFE14 included some populated areas and some difficult to reach areas. Access to military sites and some industrial activities (such as quarrying) needed to be carefully managed. The presence of roaming tribes' people, and some sharp-teethed fauna posed a risk for the security of inspection equipment left unattended in the field. Although the kinds of access sought by inspectors during such an OSI would be quite different to that needed to monitor dismantlement of an NED, useful lessons can still be derived.

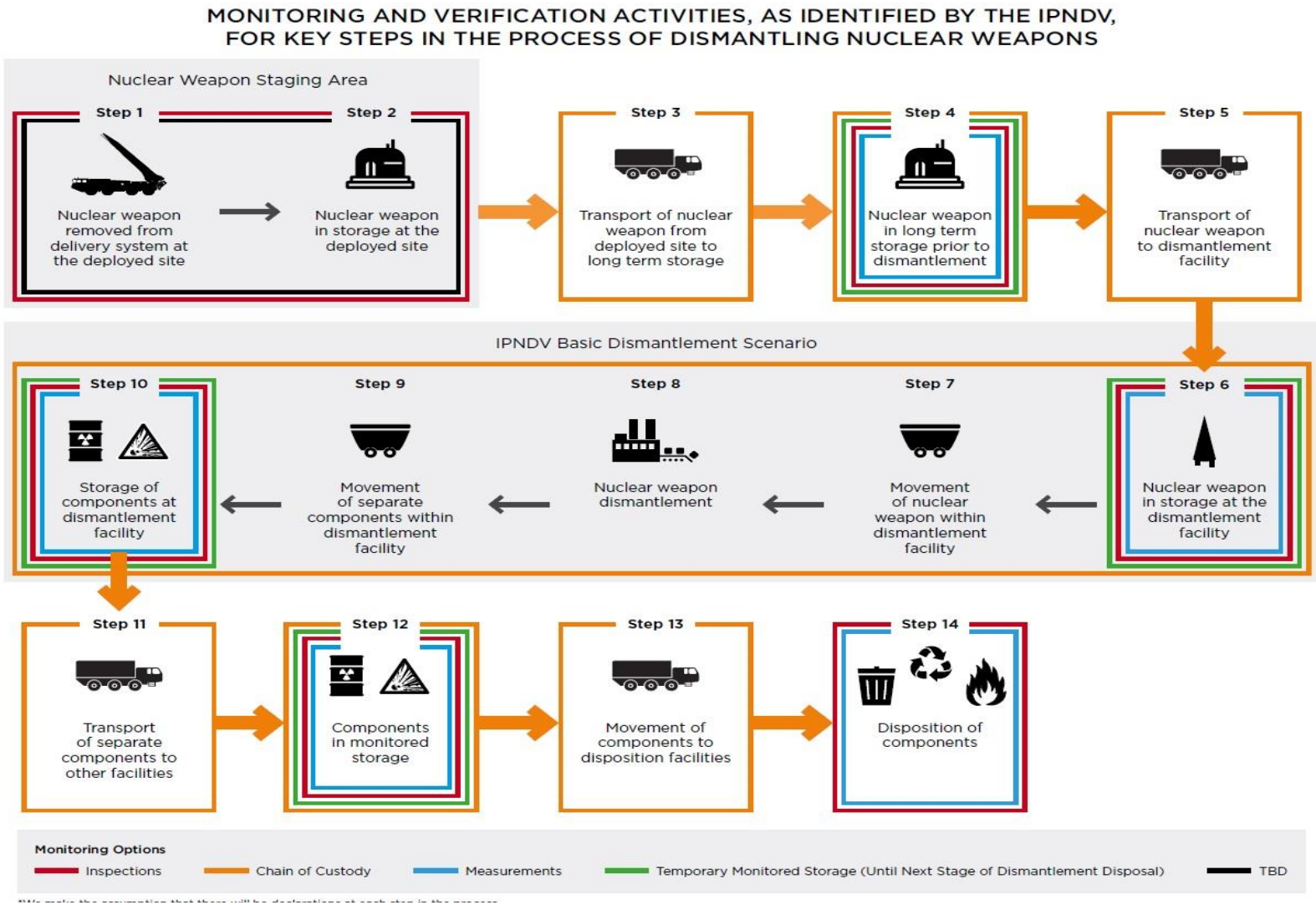
During the early days of IFE14, the surrogate Inspected State Party (ISP) applied strict managed access requirements—for example, by requiring inspectors to remain on paved roads while searching the inspection area. As the main sites of interest to inspectors became clearer, additional access was provided at those sites. This demonstrates the concept of layering in application of managed access. For the case of dismantlement verification, an equivalent would be that inspectors might be given access allowing only a general assessment of a facility in the first instance. But closer access at specific points could be negotiated as necessary to meet inspection requirements.

IFE14 demonstrated also that considerations such as health and safety placed constraints on inspection activities—for example, by limiting the hours of the day when field activities could take place. Each day multiple convoys of vehicles set out from the inspection team's base of

operations, initially to search the inspection area and identify locations that might require closer examination. Inspectors traversed many thousands of kilometers of roads and trails to conduct vital reconnaissance, to take radiation measurements and samples, and to install aftershock seismic monitoring arrays. Each convoy, or field team, included ISP drivers and escorts whose job it was to facilitate and manage access for inspectors, and to help ensure the safety of all involved. These included negotiations for inspection equipment to be installed on private land and secured against any interference. If health and safety related constraints on inspection activities are a decision of the inspected State, alternative means of demonstrating compliance (or providing sufficient access) need to be negotiated. Health and safety must be paramount in any activity, but it should not be used as a reason to avoid the obligation of an inspected State to demonstrate compliance.

Managed access rules set by an inspected State might not always be fully effective for preventing the disclosure to inspectors of sensitive information. If sensitive information that is not relevant to the inspectors' task is inadvertently disclosed, a negotiation mechanism may be used to secure return of the information. Such a mechanism was implemented at IFE14 so that photos of civil defense facilities that were inadvertently taken from an aircraft were returned once it was clear to the inspection team that they had no relevance to the purpose of the OSI.

Annex VI. Monitoring and Verification Activities for Key Steps in the Process of Dismantling of Nuclear Weapons



About IPNDV the International Partnership for Nuclear Disarmament Verification

The International Partnership for Nuclear Disarmament Verification (IPNDV), is an ongoing initiative that includes more than 25 countries with and without nuclear weapons. Together, the Partners are identifying challenges associated with nuclear disarmament verification, and developing potential procedures and technologies to address those challenges. Learn more at www.ipndv.org.

About Working Group 2: On-Site Inspections

Throughout Phase I, the IPNDV On-Site Inspections Working Group has explored lessons learned from various on-site inspection regimes and identified a number of common principles and inspection procedures that can be applied to the Partnership's work. This group is co-chaired by Australia and Poland.