Working Group 4 Deliverable
Part I. Introduction to the Verification of Nuclear Weapons Declarations

Working Group 4: Verification of Nuclear Weapons Declarations

June 2019

Abstract

This paper introduces the work of Phase II of the IPNDV's Working Group 4 (WG4). We put forward the key questions we attempted to answer while working on verifying nuclear weapons declarations. This report includes how declarations fit into the disarmament context and identifies multiple different declarations that will be required during different stages of disarmament. By understanding this context and the requirements for declarations, we provide a more thorough and targeted approach to understanding how they may be verified. We set out the principles and objectives of verifying these declarations, as well as the process of verifying them. We also set out certain types of declarations that will be particularly critical, and their associated data and on-site inspection requirements. Finally, in order to focus the work of the group, we set out a generic scenario under which an initial declaration is made on the number of nuclear weapons in a State. This scenario is used by the group to elaborate in more detail how such a declaration could be verified. The results of this more detailed work are detailed in our other papers. To enable a full understanding of all of our papers, we included a short list of frequently used terms.

Introduction to the Work of Working Group 4

Based on the IPNDV Phase II program of work, Working Group 4 (WG4) has explored how to verify a declaration of a number of nuclear weapons in a State, identifying the different questions and challenges that materialize when attempting to do so. It has also elaborated multiple options relating to verifying nuclear weapons numbers that could be of use to future negotiators.

The challenge of verifying nuclear weapons numbers raises questions such as:

- What types of declarations are necessary to determine the number of nuclear weapons in a State or location, and the differences between declarations to establish a baseline and for long-term monitoring?
- What should be the scope of the required verification regime (including how to ensure balance among the principles of effectiveness, efficiency, confidence building, and non-interference)?
- What types of declarations, documentation, and supporting information should be expected as part of inspection and monitoring under a nuclear disarmament agreement and what challenges do specific nuclear sites have?
- How to confirm items are as declared under an agreement, but even more complicated, can we establish the absence of undeclared nuclear weapons, especially in an entire State?
- How to verify numbers and status when access to all systems may not be timely?
- How to keep track of numbers over many years, including when systems are refurbished and replaced?

To answer such questions, WG4 has looked to existing verification regimes, which offer many valuable lessons and good practices. WG4 analyzed verification mechanisms of the International Atomic Energy Agency (IAEA), as well as relevant security agreements and treaties.[1] The study of all the instruments and models used by the existing regimes has, to varying degrees, contributed to understanding the complex challenges and solutions connected to the verification of nuclear weapons declarations. At the same time, the subject of verification of the declaration of nuclear weapons has not previously been studied in depth, and raises its own unique set of requirements, conditions, point-in-time dynamics, and complications. Thus, although the analysis of existing verification regimes has certainly aided in WG4's endeavors, these models are not directly transferable to the verification of nuclear weapons declarations, but they do contain important lessons and employable experiences.

[1] WG4 consulted the Treaty on Conventional Armed Forces in Europe (CFE), Chemical Weapons Convention (CWC), Brazilian-Argentine Agency for Accounting and Control (ABACC), and the START (Strategic Arms Reduction Treaties) family of treaties.

Defining the Term "Nuclear Weapons"

We began by defining what WG4 means when we refer to nuclear weapons. In the literature, items defined as nuclear weapons can refer to both an individual nuclear explosive device (NED) or a delivery system with one or more NEDs inside. Because the IPNDV is looking at verification through the dismantlement and disposition of nuclear weapons and their associated materials, it made most sense to make the item of account to be the NED. Consideration can then be given to each individual NED from being deployed (possibly within a missile or other delivery system) through to its dismantlement.

In its effort to identify and account for every NED in a State, WG4 in each of its published papers has used the term "nuclear weapon" to refer to any NED. Hence, a delivery vehicle could contain multiple NEDs or nuclear weapons. In principle, nuclear weapons may be categorized in multiple ways according to weapon technology, intended use, means of delivery, and operational status.[2] As part of its declaration, a State will declare how many nuclear weapons it holds, and during inspections such items will be identified to inspectors. These are then designated as items declared as weapons (IDWs)[3] because it is likely that inspectors will have no other knowledge of what these items are and cannot know for certain they are indeed nuclear weapons. Once declared as nuclear weapons, inspectors will treat them as treaty accountable items (TAIs). As there are no technical measurements that completely confirm an item is a nuclear weapon, all items will remain IDWs throughout the verification process.

Disarmament Context

The scope, subject, and modalities of any verification arrangement depend heavily on the context and contents of the agreement that is to be verified. Thus, to be able to elaborate realistic options for the verification of nuclear weapons declarations, the applicable disarmament scenario should be clarified. The IPNDV considers four broad disarmament categories that provide representative characteristics for possible disarmament scenarios of a single State or among several States. These categories are (1) reductions in nuclear weapons numbers, (2) limitations on nuclear weapons numbers, (3) reaching global zero, and (4) maintaining global zero.

The role of nuclear weapons declarations in a **reduction scenario** would focus on verifying the relevant information, activities, material, and locations as declared by the inspected State. Because this category consists of scenarios in which a given number of nuclear weapons will be dismantled, this category would not need full stockpile numbers as a whole, only those nuclear weapons or weapon components to be dismantled or destroyed. Initial declarations for a Step 1–14 dismantlement scenario must include the numbers and types of nuclear weapons to be dismantled/reduced, the deployment site or storage facility, the transportation method, the transport of the dismantled components, and the monitored storage facilities. Also important is the location of the deployment site, the dismantlement facility, and the disposition site.

---

[2] An exploration of different categories of nuclear weapons is in WG4 Deliverable Part IV, in this document.

[3] Further explanations on the concept of IDW are in WG4 Deliverable Part II, in this document.

Reduction scenarios that cover only Steps 6–10 will not need information about deployment sites or storage facilities. In addition, the conditions (storage, access, administration, etc.) for the monitored storage facilities, as well as the safety and security requirements are important.

Under a **limitation scenario**, the verifying entity must be able to determine a total or maximum number of nuclear weapons in a State. At a minimum, an initial declaration for a limitation scenario must include the total number of existing nuclear weapons and the number of weapons assigned for dismantlement, including their location and operative status. Depending of the operative status, information about the location would include the deployment, storage, or production site. A key assumption is that the 14 steps of the dismantlement process are verifiable. A key objective of a limitation scenario would also be to verify that there is no undeclared production of TAI, which means at a minimum, weapons production facilities would have to be included in State declarations. These facilities and the production of any new TAI would have to be accounted for in declarations.

In a scenario of **reaching global zero** (or full elimination of nuclear weapons), the assumption is that all nuclear weapons have been declared as TAIs and that States will remove all their nuclear weapons from deployment in order to dismantle and destroy them. A minimum requirement for an initial baseline declaration must include timely information about the number of remaining nuclear weapons to be dismantled, including nuclear-capable delivery systems. Additionally, the facilities/locations of the entire nuclear weapons cycle must be declared. This would also include the dismantlement or conversion of the remaining deployment/storage sites. A verification aim would be to ensure no further production of nuclear weapons is possible or feasible without significant risk of early detection. This would be aided by the eventual dismantlement of all the production and assembly sites. The dismantlement or conversion of nuclear weapons deployment/storage sites will require the development of specific inspection procedures to allow for verification of their status as long as these sites exist. A remaining problem is the nuclear weapons knowledge within former nuclear weapons States, but prospects for preventing States re-arming may need to rely on a sufficiently rigorous multilateral verification and enforcement regime.

The **full civilian nuclear fuel** cycle becomes increasingly important as we approach global zero. The size and capacity of a country's civilian nuclear infrastructure will determine its break-out time. Possible clandestine nuclear weapon activities or permitted non-weapon nuclear-related activities for military purposes (e.g., naval propulsion) can also provide the basis for a potential or real break-out option. Complete safeguards for the civilian nuclear cycle, and any permitted nuclear-related military activities, must be established and effectively maintained. But these can be built on rich experiences from earlier disarmament phases and the IAEA safeguards system, including the Additional Protocol, and regional safeguards systems, such as Brazilian-Argentine Agency for Accounting and Control (ABACC) and Euratom.

Once all nuclear weapons have been eliminated, **maintaining global zero** requires continuing verification of remaining infrastructure that might contain proliferation-relevant fissile material, production capabilities, and knowledge. Existing knowledge of how to build or produce nuclear weapons cannot be verified, but research institutions or development facilities can be notified or monitored (perhaps with lessons learned from the Organization for the Prohibition of

Chemical Weapons (OPCW) monitoring of commercial institutions). The main verification objective is to ensure that no State, including the former nuclear possessor States, can use clandestine or nuclear infrastructure to produce a nuclear weapon. Although nuclear weapons may have been eliminated, much of the former nuclear weapons-relevant infrastructure, potentially containing proliferation-sensitive information, will initially remain in some countries. In these scenarios, it should be determined which verification options are required in former nuclear possessor States beyond conventional safeguards, or indeed, if extra verification measures beyond the current safeguards would be required in all States.

Applicable IPNDV Principles

The principles of verification that were elaborated by IPNDV Working Group 1 apply *mutatis mutandis* to the work of WG4.[4] The following principles are especially relevant in relation to nuclear weapons declarations:

Effectiveness. The objective of the verification of nuclear weapons declarations should provide parties sufficient levels of assurance regarding the number of weapons in the inspected State. Although absolute certainty will not be possible due to the requirement for information barriers to prevent the release of proliferation- or security-sensitive information, sufficient confidence may be achieved through a monitoring and inspection process that is robust enough to deter cheating. In discussing verification options for nuclear weapons numbers, WG4 has contemplated what it considers as significant diversions from the nuclear weapons declaration, and in which timeframe such a defection must be determined. Such margins of error vary with the applicable disarmament scenario.

Confidence-building. Providing certain types of information—for example relating to national security reviews, public doctrines, capabilities, in addition to the information that is to be verified—can signal a willingness to provide transparency and may increase mutual confidence regarding the correctness and completeness of the nuclear weapons declaration. WG4 has considered, under various verification options, to what degree should such types of information be included in a nuclear weapons declaration, and to what degree these types of information can be verified. In addition, the implementation of a verification regime will, over time, contribute to increased confidence among the parties to an agreement.

Non-interference and Non-proliferation. Declarations must seek a balance between achieving verification objectives, minimizing the burden of verification on the inspected party, and achieving the objectives of the inspected party. In this particular context, considerations of national security and safety, including the ability to maintain effective deterrence, and to prevent non-proliferation will be important, and can inform the planning and conduct of inspections.

[4] See IPNDV Phase 1 Deliverable 1, https://www.ipndv.org/reports-analysis/deliverable-one-principles-nuclear-disarmament-verification-key-steps-process-dismantling-nuclear-weapons-14-step-diagram/.

Cost-efficiency. When assessing options relating to the verification of the number of nuclear weapons in a State, options must be feasible in relation to the amount of time, the number of personnel, and the level of resources they would entail. WG4 has, in its deliberations, considered which limits this places on nuclear weapons declarations and the information therein that is to be verified.

Objectives of Declarations and the Role of Transparency

The principle of effectiveness dictates that the primary objective of declarations is to "offer information that provides the basis for the effective implementation of disarmament agreements and to facilitate the detection of non-compliance by establishing the baseline of declared activities and informing specific monitoring/inspection procedures."

Apart from this "core objective," declarations also function to aid verification and the implementation of arms control agreements in various supplementary ways, for example, by:

- Building trust through increased transparency, both between parties to an agreement and more widely within the international community;
- Establishing credibility and data consistency over time, and thereby increasing confidence that Parties are implementing an agreement in good faith;
- Facilitating nuclear material accountancy, including the process of creating an accurate as possible verification baseline of past nuclear weapon related activities on the part of parties to an agreement, and, as agreed, supporting the assessments made by a multilateral verification entity that could be created as part of a future monitoring/inspection regime;
- Facilitating "nuclear cultural anthropology,"[5] that is, helping to understand the ways in which different countries with nuclear weapons undertake their activities and operations across the nuclear weapon lifecycle (from production to disposition) and thereby informing the development of the monitoring and verification regime of specific nuclear disarmament agreements, for example, by compiling over time a more comprehensive "map" of nuclear weapon activities against which it would be easier to detect anomalous behavior or undeclared activities; and
- Providing experience in cooperation that builds trust and increases the prospects for further disarmament agreements between the parties.

The fact that declarations serve multiple primary and secondary verification objectives also means that the different types of information that may be included in such declarations are not necessarily verified with equal levels of scrutiny or intensity; certain types of information may not be verified at all.[6]

[5] "Nuclear cultural anthropology" is further explained in WG4 Deliverable Part IV, in this document.
[6] This distinction is further elaborated in WG4 Deliverable Part IV, Paper 2, in this document.

Transparency plays an essential role in supporting verification of a declaration by increasing confidence that declared information is credible. Transparency measures result in greater predictability regarding the intentions and capabilities of States, thus facilitating mutual understanding, easing tensions, and reducing misperceptions.

Transparency will also influence the design of a verification regime. The degree of transparency provided by parties to an agreement reflects the level of trust between them. Low levels of trust are likely to result in fewer transparency measures, and more rigorous and intrusive processes for verification. However, over time and with experience in the implementation of an agreement, increasing trust between the parties can result in the parties accepting less than the full scope of information obligated in an agreement, and an increase in informal or voluntary exchanges of information related to a State's nuclear weapons enterprise.

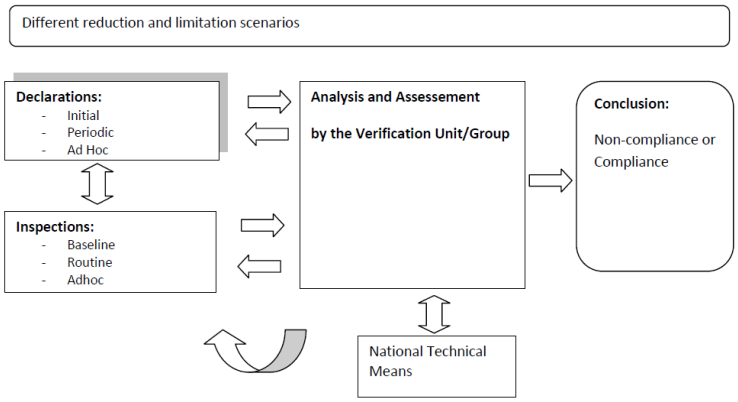
Declarations as They Apply to Verification

"Verification" is the iterative and deliberative 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.[7] In the context of the work of WG4, the goal of this hypothetical verification process or mechanism is to enable one or more States party to an agreement to determine the number of nuclear weapons present in another State—or, possibly, in any given part of that State's territory.

WG4 has focused on declarations and inspections as the main sources of information used in the process of verification of nuclear weapons numbers. These sources of information are interlinked in several ways: the data provided in declarations are often confirmed by inspections, or serve to enable or facilitate inspections; conversely, the information yielded through inspections may prompt subsequent declarations (see Figure I-1).

[7] IPDNV Phase I Deliverable 1, *A Framework Document with Terms and Definitions, Principles, and Good Practices*, p. 12.

Figure I-1. Verification Process Diagram with Data Flow



There are different types of declarations and inspections. Although these go by various designations depending on the regime of which they are part, general distinctions can be made between initial declarations, which are intended to establish baseline information, and periodic declarations and updates, which are time- and incident-driven, respectively.[8] Similarly, inspections will differ in terms of nature, frequency, and intensity. IPNDV Working Group 2 identified three types of inspections: initial, ad hoc, and inspections carried out under managed access arrangements. In the context of the work of WG4, so-called "challenge" inspections aimed at undeclared locations, for example as included in the Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and on their Destruction (CWC) and Conventional Forces Europe (CFE) Treaty regimes, also have a significant role.

Types of Declarations

A declaration is a formal provision of information required under the terms of a negotiated disarmament agreement after entry-into-force. The content of declarations depends on whether a disarmament treaty has unilateral, bilateral, or multilateral obligations. The most important objective of a declaration is to establish a baseline of data that can contain numerical, locational, or technical information based on the agreed requirements for future inspections and other activities such as surveillance, dismantlement, conversion, etc. This information can include photographs of inspection objects, site diagrams, or technical drawings. The documentation forms the basis of inspection activities to monitor treaty compliance with high confidence. Additionally, elaborated declaration documents can be used

[8] The New START verification regime, for example, obliges the States parties to provide data current as to the entry into force of the treaty (initial/baseline); periodic data after the expiration of every six-month period following the entry into force of the treaty (periodic); and five days after the occurrence of certain changes in the relevant data (updates).

to contain special or advanced data. The IAEA has developed expertise concerning site declarations, as have the U.S. and Russia through bilateral treaty arrangements. Depending on the specific scenario, other categories could include special declarations about delivery systems or the operational status of nuclear weapons.

A key aspect is the use of declarations over time, which determines the scope, frequency, intensity, and monitoring to build high confidence and to reach the treaty objectives. This is important for inspection procedures such as managed access, monitoring, surveillance, etc. The first part of an agreed verification cycle is always an initial declaration that obliges the States parties to provide baseline data, such as the number of nuclear weapons or the location of relevant sites containing IDWs. Baseline inspections are activities conducted by States parties to confirm exchanged baseline data of a treaty-limited item. During a defined period (weekly, annually, etc.) regular or routine inspections are aimed to verify the baseline data to reach the inspection objectives. Updates are possible during a defined period. The New START Verification regime is based on this model. Challenge inspections, which are aimed at undeclared sites, have been introduced by the CWC and the CFE Treaty where agreement has been reached on the absence or limited presence of Treaty-accountable items or activities. During latter stages of the disarmament process, ad hoc inspections can be introduced regarding the conversion of storage or production facilities.

The objects and locations earmarked for inspections are also important (see Table I-1). Information to fulfill the verification objectives must be clearly defined, well-structured, and applicable for the IPNDV verification principles. Not all information provided by the inspected party is to be verified with the same level of scrutiny. The level of scrutiny necessary will be related to the level of assurance required to fulfil verification objectives within the overarching disarmament scenario.

Table I-1. Types of Declarations and Inspections and Required Data[9]

Type of Declarations	Trigger	Inspections	Provided Data
Initial	Conclusion of Agreement	Baseline Inspections	Baseline data
Periodic	Time-Driven Declaration	Routine Inspections	Periodic updates of required data
Ad hoc	Incident-Driven Declarations	Ad hoc inspections	Notification of changes in inventory, locations, etc.

[9] WG4 Deliverable Part II expands on these suggested declaration types, including under certain scenarios the need to distinguish between initial and baseline declarations and inspections.

Disarmament Scenario Used by Working Group 4

To aid its work on the verification of declarations, WG4 identified a specific nuclear disarmament scenario in which a possessor State declares its full stockpile of weapons in preparation for further disarmament steps. The primary focus of this scenario is to explore verification of a baseline declaration and the evolution of confidence over time.

In this scenario, State "A" has declared all of the nuclear weapons in its stockpile and agreed to keep its total stockpile below an agreed number.

The declaration was considered to be the first action by State "A"' in a process that would lead to significant reductions and eventual disarmament. This process would be lengthy and hence robust and efficient verification would be required to monitor the total number of weapons in the State.

To develop a full range of potential verification options, it was important to ensure the scenario encompassed all locations within the State where nuclear weapons may sensibly exist. As such, State "A" was envisaged to have some weapons deployed at sea on naval submarines, in fixed ground-launched silos, on road mobile launchers, and in storage for deployment by land-based aircraft. Further systems were located in central storage and at a production and dismantlement site. The replacement or refurbishment of old systems was possible; however, the total number in the State would not exceed the set value at any time.

Consistent with the Partnership's key judgement from Phase I regarding multilateral verification,[10] the verification process in this scenario involves a multilateral group comprising members from both nuclear possessor States and non-possessor States. Although not prescribing how this group formed, WG4 will examine issues such as the group's resourcing, capabilities, and equipment, as well as mandate, logistics, and ability to resolve ambiguities, with a view to contributing to future discussions and recommendations on the organization of the verification body.

Frequently Used Terms

Following is a short list of terms frequently used by WG4. This list is to aid the reader in understanding the terminology used in these Deliverable papers published by WG4 as part of Phase II of the IPNDV. This list is not intended for use beyond these papers.

Declaration. The formal provision of information required under the terms of a disarmament agreement.

[10] See Phase I Summary Report: Creating the Verification Building Blocks for Future Nuclear Disarmament, www.ipndv.org/reports-analysis/phase-1-summary/.

IDW (Item Declared as Weapon). Any object that is declared by a nuclear weapon possessing State as a nuclear weapon or treaty-accountable item for reasons of establishing an initial potential maximum baseline declaration.

NED (nuclear explosive device). A generic term for an otherwise undefined object containing special fissionable material and high explosives.

Nuclear cultural anthropology. The study of culture (practices and protocols) within nuclear enterprises. These cultures may have some variability within a State, depending on the mission of the site and roles and responsibilities of its assigned workers. Nuclear culture may also be influenced by a State's unique cultural perspectives on safety, security, responsibility, accountability, and authority structure.

Site. A specified geographical area delimited by a State party to an international treaty or agreement according to the provisions of that agreement's verification regime.

State-wide verification. A verification mechanism, which covers the entire territory of a State (minus the parts that are not under its control or jurisdiction) but also any dependent territories, areas under its de facto control, surface ships, submarines, or overseas military bases.

TAI (Treaty Accountable Item). The subject of an arms control treaty.

UID (unique identifier). A distinct sequence of characters, bar code, or other identifying feature applied to track an individual item limited by a treaty or agreement, or a unique feature of that item.

Verification. The iterative and deliberative 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.

This is a product of the IPNDV Working Group 4: Verification of Nuclear Weapon Declarations. For more information on the IPNDV Working Groups, please see www.ipndv.org/working-groups.

About the IPNDV:

The 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.

The IPNDV is working to identify critical gaps and technical challenges associated with monitoring and verifying nuclear disarmament. To do this, the Partnership assesses monitoring and verification issues across the nuclear weapon lifecycle.

The IPNDV is also building and diversifying international capacity and expertise on nuclear disarmament monitoring and verification. Through the Partnership, more countries understand the process, as well as the significant technical and procedural challenges that must be overcome. At the same time, the Partnership is highlighting the importance of verification in future reductions of nuclear weapons.