Working Group 4 Deliverable
Part II. Potential Options for Declarations on Nuclear Weapons

Working Group 4: Verification of Nuclear Weapons Declarations

Abstract

Declarations are essential to arms control/reduction agreements. The most important objective is to establish a baseline of data such as numerical and locational as well as technical characteristics, photographs, and site diagrams for accountable items that can be used to monitor holdings and progress in reductions to agreed limits.

Based on lessons learned from other regimes as well as Working Group 4 discussions and papers, this deliverable contains potential options for declarations on nuclear weapons as well as information that may be included therein.

Finally, this paper explores several topics, articulating specific considerations deemed pertinent to a future multinational arms control verification regime.

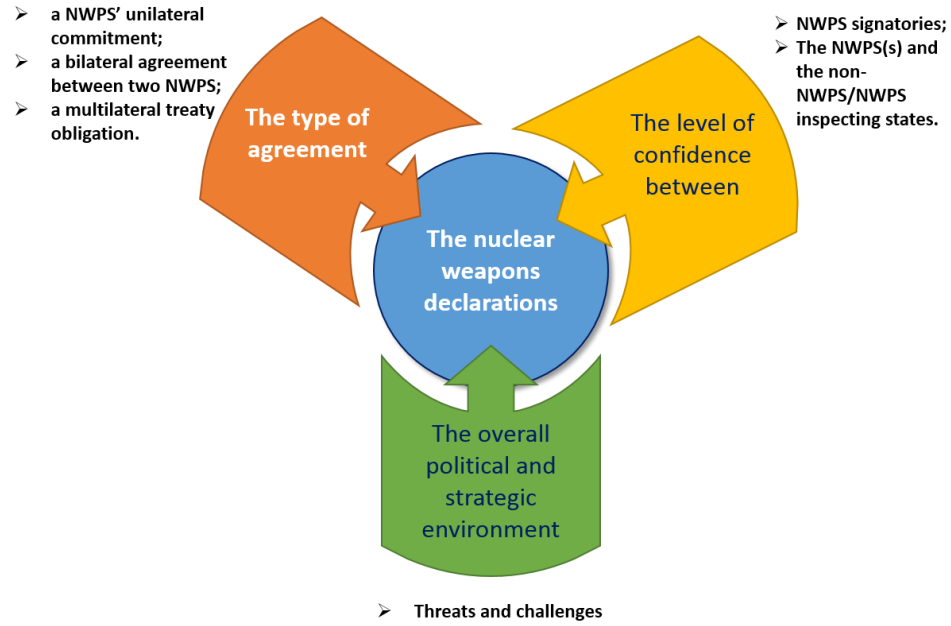
Introduction

During the discussion conducted by Working Group 4 (WG4) on objectives and subjects of nuclear weapon declarations, multiple factors that could influence their final determination were pointed out (see Figure II-1). The nature and content of declarations will largely depend on:

- Whether it is a State's unilateral commitment, a bilateral agreement, or a multilateral Treaty obligation;
- The level of trust between States party to the agreement;

- The overall political and strategic environment.

Figure II-1. Factors That Influence Nuclear Weapons Declarations



Note: NWPS is a nuclear weapon possessor State

For this reason and sake of simplification, WG4 adopted one main scenario for further considerations of objectives and subjects of nuclear weapons declarations:[1]

- **A disarmament scenario.** All nuclear weapons, irrespective of their operational status, will have to be declared. Verification should then rely on two principles:

  (1) Verifying that there are no nuclear weapons in a State that have not been declared as "items declared as weapons" (IDWs); and

  (2) No IDWs exist outside these declared locations. By verifying that there are no NEDs that are not declared as IDWs, either in declared locations or other relevant locations, it is possible to establish a maximum number of NEDs.

Some basic questions arise in relation to this scenario:

- What types of information should be included in a State's declaration?
- How is that information verified?
- How to keep track of numbers over the years?
- How to deal with weapons that are being refurbished or replaced?

[1] 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/.

Subject of Declaration and Its Verification

An important question to be resolved by WG4 was related to the subject of the declaration. According to the IPNDV terms and definitions, a "nuclear weapon" is a "weapon assembly that is capable of producing an explosion and massive damage and destruction by the sudden release of energy instantaneously released from self-sustaining nuclear fission and/or fusion."[2]

Alternative options would be a nuclear warhead, a "military device consisting of high explosives and nuclear material in a configuration capable of producing a nuclear yield" or a NED, a generic term for an object containing special nuclear material and high explosives that is capable of producing a nuclear yield.

This paper, however, proposes another idea, which is to leave the subject of the declaration undefined for now, to not pre-empt definitional issues in a future agreement. Instead, **nuclear weapons declarations could be based on the concept of "items declared as weapons" (IDWs)**.

A key characteristic of this approach is that the exact nature of the IDW remains unknown to the verifying entity, although it may be confirmed at some point during the dismantlement process. When it comes to verifying the number of nuclear weapons in a State, or in any given location, there would then be only two options: either an object is an IDW, which requires solely its designation as such by the possessor State, or it is not.

By foregoing the verification of a State's IDW declaration—in other words, by not verifying whether or not IDWs are, in fact, nuclear weapons, nuclear warheads, or NEDs—the difficult issue of non-proliferation concerns involved in measurements on NEDs would be at least partially sidestepped. Verification should rely on two key principles:

- Establishing a closed-off "IDW balance area," consisting of locations and sites where IDWs are present, and verifying that no IDW leaves this area unnoticed by the inspecting entity; and
- Verifying that there are no NEDs in a State/location that have not been declared as an IDW.

This would entail "measuring absence," which has as a benefit that—unless the inspected State cheats—there is a smaller risk of transferring proliferation-sensitive information, because the objects measured should *not* be NEDs. Especially in locations that would not be part of the IDW balance area, this may mean that more technologies could be used for verification purposes. This does not foreclose the options of taking some measurements on certain, perhaps randomly selected, IDWs. Measurements could include for example checking for the presence of nuclear material, and/or the quality or quantity of such material. This may build confidence the items are worth inspectors tracking, and to raise the bar so States are discouraged from cheating. However, such measurements cannot confirm an item is a nuclear weapon, and as such, the items remain IDW throughout the process.

[2] 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/.

Lessons from Other Regimes

From the beginning of the work carried out under the IPNDV, an important activity was the exploration of existing arms control regimes (including those not related to nuclear weapons) in terms of selecting elements that *can be used in the process of nuclear disarmament. In this context, WG4 has reviewed the lessons learned from the* Conventional Forces Europe (*CFE) Treaty,* Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and on their Destruction (*CWC),* Strategic Arms Reduction Treaty *(START), and* Brazilian-Argentine Agency for Accounting and Control (*ABACC)* in terms of the declarations and information provided in the framework of these agreements. Despite the fact that the agreements concern various areas in both the weapons of mass destruction (WMD) and the conventional sphere, a similar approach to the scope of declarations, other related information, and procedures for submitting declarations can be found.

Conceptual Background on Declarations

Declarations are essential to arms control/reduction agreements. The most important objective is to establish a baseline of data, such as numerical, locational, and technical characteristics, as well as photographs and site diagrams for accountable items that can be used to monitor holdings and progress in reductions to agreed limits.

Both the scope of an agreement, its provisions or limitations, and the definitions of certain terms are likely to be agreed prior to the exchange of declarations. The declarations and the data that they contain flow from and are related to the provisions or limits agreed in an agreement. The declarations will incorporate the treaty-accountable items and data about those items, including numbers, types, and locations that, combined with a regime of notifications and inspection activities, will allow parties to monitor treaty compliance and track progress in reaching treaty limits.

Initial Declarations

Initial declarations have previously been provided mainly before the entry into force of the agreement or contained in the text of the agreement itself (e.g., Strategic Arms Reduction Treaty (START) Treaty). These declarations referred directly to the most important data related to the accountable items and includes information on:

- Reduction liabilities;
- Current holdings or possession of the accountable item;
- Technical characteristics and photographs

Baseline Declarations

Baseline declarations were provided in most cases immediately after the entry into force of the agreement. These declarations referred directly to the most important data necessary to prepare for and conduct verification activities:

- Updated version of initial declarations;

- Locations of accountable items as well as the production, storage, and maintenance facilities associated with these items;
- Site diagrams;
- Locations of reduction sites.

Periodic Updates

To be effective in monitoring compliance or progress toward agreed limits, declarations cannot be a one-time occurrence. As time passes, the information in the declarations requires updates to reflect the new information. For example, if the status of an accountable item changes through its movement to a different facility or to a different location within the same facility, its elimination, production of a new item, or when a new type of accountable item is added, the change in the status of that item should be notified in an update.

Updates to data declarations are made through an agreed notification system that uses agreed formats and content or by periodic (annual) information exchange. Passing periodic updates enables more effective monitoring and easier tracking of changes.

Ad Hoc Declarations

Information that may affect the verification of the correctness of delivered declarations and characterized by high dynamics of changes, is transmitted using appropriate ad hoc declaration systems in a short interval from the change taking place.

Different types of declarations covering data updates relate mostly to movement, conversion, or elimination of agreement-accountable items.

Verification of Baseline Declarations

Although parties are responsible for ensuring the accuracy and completeness of the declarations/data that they provide, confidence comes from the ability to confirm that the exchanged data are correct.

Baseline inspections (e.g., START, CFE) represent the most useful method to determine accuracy and completeness of the data in the initial exchange. The initial period, after the entry into force of the agreement, is characterized by a large number of inspections as compared to a further period of “normal” functioning of the agreement. Confirmation of the accuracy of the information obtained during inspections conducted in the initial phase plays an important role in building mutual trust between the parties to the agreement.

However, because of inspection cost and intrusiveness concerns, it is not possible to verify 100 percent of the information provided in a short period and instead a selection of a reasonable sample is used to confirm the declared data. The parties simply agreed on the number of allowed inspections for any one type of inspection based on what they believed would allow for effective monitoring activities, verification, and a deterrent to cheating; something that will also have to be taken into account in any future nuclear disarmament/dismantlement treaty.

Another important aspect in the initial phase is an exhibition. Exhibitions of accountable items and facilities and a chance to view their distinguishing characteristics allow parties to conduct more efficient inspections and accurately confirm the items of inspection as different, but similar, types of weapons and delivery systems.

Exhibitions could include treaty-accountable items existing at the time of entry into force of a treaty/agreement and new types of accountable items and new facilities introduced afterward.

Options for Declaration Elements

Types of Declarations

In general, verification mechanisms entail different types of declarations to be made by the inspected party. Although more detailed analysis of existing mechanisms is necessary, at this point we can roughly distinguish four types of declarations/notifications:

Initial declarations. An initial declaration mainly contains the data needed in the negotiation process to determine the necessary parameters of the agreement.

Baseline declarations. A baseline declaration by a State to the verification entity sets out plans and data necessary to prepare for and conduct verification activities.

Periodic. Time-driven declarations. At least annually a State 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.

Ad hoc declarations. Incident-driven declarations. Reflecting the changes that have occurred in the relevant data.

Note that ensuing inspections may differ in nature, frequency, and intensity. Discussions of the CFE and CWC Treaties by WG4 also reflected the importance of challenge inspections, which would be aimed at undeclared locations.

Verification "Layers" and Categorizing Information in Declarations

Lumping together all possible types of information would be rather unworkable for analytical purposes. Not all information provided by the inspected party is to be verified with the same level of scrutiny. This would mean that for some types of information, the level of assurance that is required is higher, necessitating more rigorous verification and a different inspection regime, than for others.

For analytical and discussion purposes, we can distinguish three "layers" of verification:

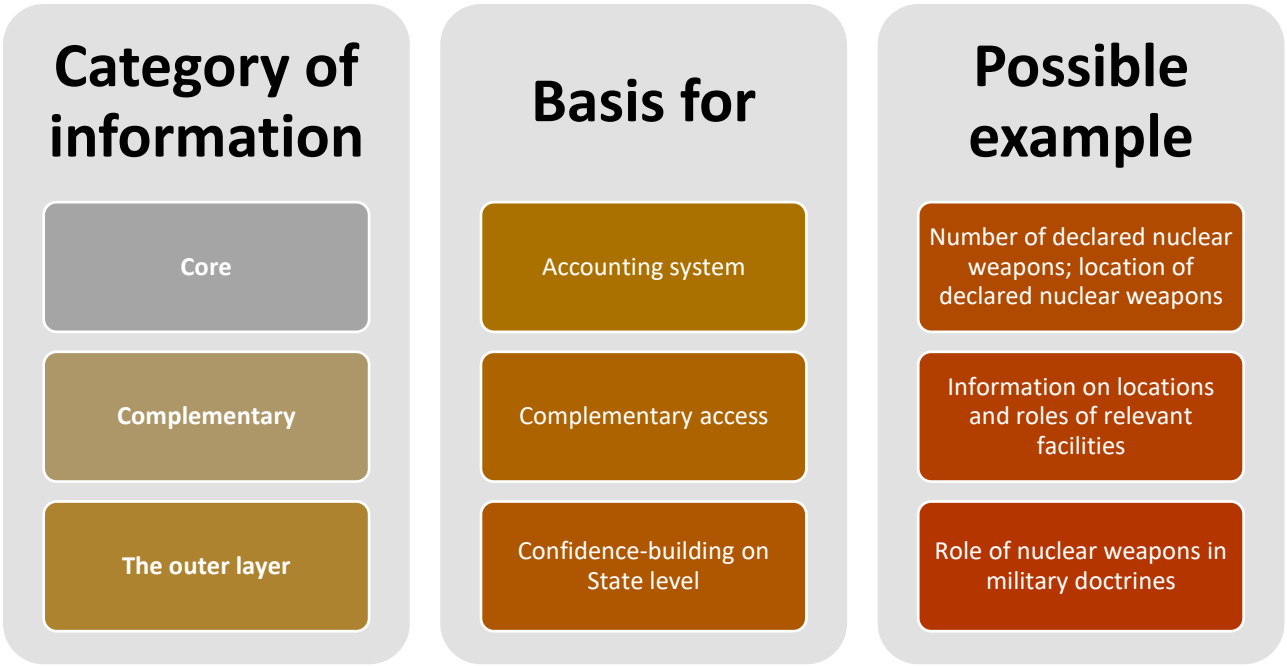
- A "**core**" system is a layer of verification formed by the most sensitive information and involving the highest level of scrutiny. The verification of this information provides a high level of assurance, for example by being subject to a system that keeps track of numbers of declared items within declared locations.

- **Complementary** information forms a second layer around this core, increasing the level of assurance of non-diversion. This kind of information does not have to be mechanically or systematically verified, for example, the IAEA Additional Protocol and its complementary access provisions.
- **The outer layer** is formed by all other types of information, for example open-source information that may be considered relevant, because it helps to establish a better picture of a State's capacities or policies as a whole.

Note that not all information will, or should, be treated equally in terms of corresponding verification effort. For instance, some of this information may be required only in the case of suspected non-compliance. This links to the principles of efficiency and non-interference but also effectiveness—the notion that verification consists of cumulative efforts that may yield varying levels of assurance on their own.

Therefore, WG4 suggests categorizing the information to be included in nuclear weapons declarations, as illustrated in Figure II-2.

Figure II-2. Recommended Categories of Nuclear Weapons Declarations



Information to Be Included in Nuclear Weapons Declarations

Based on lessons learned from other regimes as well as WG4 discussions and papers, Table II-1 sets out an inventory of information that may be included in a nuclear weapons declaration. It also distinguishes between the different categories this information may belong to, as well as the different declarations (initial, periodic, updates).

The elements listed thereafter are indicative. Their possible inclusion in a declaration will largely depend on the type of agreement (limitation, reduction, elimination).

Table II-1. Possible Inventory Information to Include in a Nuclear Weapons Declaration

Information	Category	Declarations Featured
Locations/designation/diagrams of nuclear facilities • **Production/refurbishment** • **Storage** • **Military bases (air, naval, ground, mobile)**	CORE	Baseline, periodic, updates
Sites of interest[3]	COMPLEMENTARY	Baseline, updates
Nuclear sites within facilities • **Storage** • **Process facility** • **Hangers/docks** • **Reactor facilities**	CORE	Initial, baseline, updates
Non-nuclear sites within facilities • **Workshops** • **Administration** • **Non-nuclear storage** • **Former nuclear facilities**	COMPLEMENTARY	Baseline, updates
Nuclear weapons numbers on territory, in jurisdiction, and under control	CORE	Initial, baseline, periodic, updates
Number of IDW • **Total aggregate/per location** • **Deployed/non-deployed; active/inactive stockpile** • **Types (see WG4 Deliverable Part IV)** • **Reserve/maintenance** • **In storage prior to dismantlement** • **Dismantled**	CORE	Initial, baseline, periodic, updates

[3] Voluntary presentation of information on sites where infrastructure may allow for nuclear weapons storage (e.g., former military sites, auxiliary military bases/storage sites).

Movement of IDW	CORE	Periodic, updates
IDW reduction liability	OUTER LAYER	Updates
Upkeep/modernization/refurbishment programs	OUTER LAYER	Periodic, updates
Unique identifying characteristics (subject to limits set by need to protect proliferation-sensitive and other classified information) • **Type (fission/fusion)** • **Serial numbers** • **Names, model designations** • **Size, shapes**	CORE/ COMPLEMENTARY	Baseline, periodic, updates
Delivery systems	CORE	Initial, baseline, periodic, updates
Reduction/dismantlement sites	CORE	Baseline, updates
Reduction/dismantlement procedures	CORE	Periodic, updates
Past production of weapons and materials	OUTER LAYER	Baseline
Nuclear anthropology (see WG4 Deliverable Part IV)	OUTER LAYER	Baseline, periodic
Nuclear-related R&D facilities	COMPLEMENTARY	Baseline, periodic, updates
Nuclear-related R&D activities (ongoing, planned, ceased)	COMPLEMENTARY	Baseline, periodic, updates
Equipment (possibly) related to production of nuclear weapons; import/export thereof	COMPLEMENTARY	Baseline, periodic, updates
Sites/materials covered by other verification arrangements (IAEA safeguards, CTBT, FMCT, etc.)	OUTER LAYER	Baseline, updates
National policy on nuclear disarmament	OUTER LAYER	Periodic, updates
Nuclear doctrine	OUTER LAYER	Periodic, updates

Challenges and Possible Solutions for Verification during an Inspection

When considering developing a verification regime, additional issues should be considered to assure a regime that takes into account the differing needs and perspectives of each treaty

partner. These concerns include complex specific issues such as safety and security requirements based upon the unique requirements of each site and the broader influence of the country's national and regional cultural history, weapon-specific issues and concerns, as well as key lessons from other regimes that have similar applications or context. This paper explores several such topics, articulating specific considerations deemed pertinent to a future arms control verification regime.

A comprehensive understanding of the unique operational cultures and the corresponding perspectives on safety and security, allowable or unallowable work practices, and behavioral and performance expectation of a country's nuclear weapons workers across different sites and different States will be important to developing a successful verification regime. This is discussed further in WG4 Deliverable Part IV, Paper 4. Nuclear Cultural Anthropology.

Different sites may host differing safety and security environments depending on the function of each site and the overall culture of that facility. Additionally, national or regional culture may also influence decisions regarding where facilities are established, who works in those facilities, and decisions regarding the overall design and distribution of a State's nuclear infrastructure.

Finally, lessons from previous successful treaty regimes may help define how a future, multinational arms control verification regime could be structured, and provide process elements that could be leveraged and adapted. This paper is based in part on key lessons taken from the CFE Treaty and considers applying those lessons to the development of a future arms control verification regime. The CFE Treaty is discussed in further detail in WG4 Deliverable Part V.

Deployed Items Not Present

One or more road mobile missiles and submarine missiles may be routinely deployed outside their bases at any given time and therefore not be available for inspection. Confidence building must then take place over time because new inspections will verify different subsets of the total number of IDWs. Reliable unique identifiers on each IDW would make it possible to trace them all over time; however, this may not be practicable for all weapon types. Further confidence may be created, for example, by also making it possible to identify each of the missiles, as well as any transporter-erector-launchers (TELs)[4] or submarines. If there are no unknown delivery vehicles, then unknown, unaccounted for weapons cannot be deployed.

Limited Inspection Time

Verifying that an IDW indeed satisfies the declared criteria for a specific nuclear weapon will most likely require several hours of work for inspectors. Obviously, verifying the actual presence of a large number of nuclear weapons may take days or weeks to carry out, that is, much longer than the fairly short inspection visits permitted under other relevant treaties. Just visiting all relevant buildings and facilities at a base may exceed the time limit.

It is not possible to see, let alone measure, everything everywhere during an inspection visit. However, much may be achieved by collecting information over time through repeated visits.

[4] TELs are road mobile vehicles from which missiles may be launched.

Over time, inspections would naturally move from questioning everything to looking for anomalies. Furthermore, one may choose to randomly select a low number of missiles for verification and build confidence based on statistical analysis.[5] In any case, nuclear disarmament treaties may have to allocate more time to verification inspections than has been customary under other treaties. It is not preferable to spend several years performing a baseline verification; if necessary, other inspections—for example to monitor the dismantlement of weapons—may need to be carried out simultaneously.

Monitoring Delivery Vehicles

Monitoring IDWs over many years is not straightforward because in general different weapons may be deployed, and therefore missing from the base, at different visits. The necessary checks and balances may be easier to achieve by also keeping track of the delivery vehicles and which IDW(s) are at any given time associated with each delivery vehicle. Because deployed weapons may not be inspected and their existence therefore not verified, adding information about delivery vehicles is a confidence-building measure that to begin with may appear to have little added value, but that over time should provide the inspectors with a better overview and thereby make it increasingly harder for the inspected State to cheat.

Safety and Security

Both safety and security issues may seriously complicate the work of the inspection team. Health and safety regulations are generally strict regarding radiation and explosive hazards, and they are not negotiable. This may limit physical access, tools, and methods available to the inspectors. Ideally, some inspectors should have the necessary training and certification to work under such hazardous conditions.

Proliferation security is another obviously non-negotiable obstacle, but also various national security issues may complicate the verification process. For example, some areas or some equipment may be considered too sensitive to be seen by the inspecting team under a confidentiality agreement. Furthermore, just the process of getting access to sensitive sites and sensitive facilities may be very complicated and time-consuming as demonstrated, for instance, by the IPNDV NuDiVe exercise.[6] Some security issues may be addressed in the treaty and the relevant protocol(s) governing the work of the inspectors. For example, select non-proliferative information not available to the public might still be shared with the inspection team.

Both safety and security issues generally lead to more elaborate processes, which in turn will reduce the amount of time available for the actual inspection work. It is important that the inspectors receive as much information as possible about any restrictions early in the process, for example as part of an advance “familiarization visit” to the site where the activities to be inspected will take place.

---

[5] See WG4 Deliverable Part IV, Paper 1. Evaluating Confidence in Compliance for further details on the statistical approach.

[6] See https://www.ipndv.org/news/ipndv-experts-gather-in-julich-germany-for-nuclear-disarmament-verification-nudive-exercise/.

Rules and Restrictions for Inspections under New START

Provisions and restrictions under the CFE Treaty are discussed in detail in WG4 Deliverable Part V. It is also relevant to study the inspection rules under New START, which is a bilateral treaty between the Russian Federation and the United States limiting the number of strategic nuclear weapons in the two States.

New START permits 10 "Type One" inspections per year at intercontinental ballistic (ICBM)/ submarine-launched ballistic missile (SLBM)/air bases to confirm accuracy of the declared data on deployed and non-deployed items and to confirm that converted items have not been re-converted. The Treaty further permits eight "Type Two" inspections per year at declared and formerly declared facilities to confirm declared data on non-deployed items and conversions and eliminations.

The general rules for carrying out a Type One inspection are as follows:

- Party declares intent to conduct inspection with at least 32 hours' notice before arrival.
- Inspection team enters through an east or west Point of Entry of other country.
- Inspection team declares type of inspection and inspection site within four hours of arrival at Point of Entry—pre-inspection restrictions at the designated inspection site start one hour later.
- Host informs inspection team of currently deployed fraction of weapons at site within two hours. If less than 50 percent of deployed ICBMs based at a base are present, less than 30 percent of deployed SLBMs contained in SLBM launchers are present, OR less than 70 percent of the deployed heavy bombers based at the air base are present, the inspection team has the option to (1) continue with the inspection, (2) designate another inspection site, or (3) decline to inspect and leave (note: if the inspecting party chooses to decline the inspection, then the inspection will not count in the total of annual inspections).
- Inspection team transported to inspection site within 24 hours of arrival at Point of Entry.
- Host provides pre-brief updating site deployment information and site diagrams.
- Inspection team designates precise items to be inspected within one hour of arrival.
- Host transports inspection team to the items for inspection within three to 12 hours depending on item.
- Inspection time limits range from 12 to 30 hours depending on the activities to be completed.

In addition, for Type One inspections, the following rules apply:

- At ICBM bases, the inspection team can inspect one loaded launcher to confirm number of warheads, one empty launcher or fixed structure to confirm it is empty, and the maintenance facility.
- At submarine bases, the inspection team can inspect one loaded launcher to confirm number of warheads, one empty launcher to confirm it is empty, converted launchers, and the inspection site within boundaries.

- At air bases, the inspection team can inspect three designated deployed heavy bombers to confirm the number of nuclear armaments loaded on them, heavy bombers equipped for non-nuclear armaments, and structures declared not to contain a heavy bomber.
- Inspection team can read the UIDs on all designated items.

For Type Two inspections, these rules apply:

- At loading, storage, repair, and training facilities and test ranges, the inspection team can inspect non-deployed ICBMs and SLBMs, first stages, and launchers to confirm number and type.
- At formerly declared facilities, the inspection team confirms disuse for purposes inconsistent with the Treaty.
- At ICBM and SLBM bases, the inspection team confirms declared eliminations were performed.
- At conversion or elimination facilities for ICBMs, SLBMs, and mobile launchers, the inspection team confirms declared eliminations were performed.
- At conversion or elimination facilities for heavy bombers, the inspection team confirms declared conversions were performed.
- At storage facilities for heavy bombers, the inspection team confirms number and type and number of nuclear armaments located on heavy bombers.

Confirmation of non-nuclear status of objects is carried out by using radiation detection equipment:

- Measurements are made in coordination with the host at the request of the inspecting party using the inspecting party's radiation detection equipment.

The Treaty includes observation periods for use of National Technical Means (NTM) to confirm some conversions and eliminations and prohibits parties from interfering with the use of NTM.

There is an opportunity for a sequential inspection either immediately after the conclusion of an inspection or at Point of Entry.

New START includes detailed counting rules for the number of launchers, heavy bombers, and warheads. Regarding warheads, Article III specifies that "for ICBMs and SLBMs, the number of warheads shall be the number of reentry vehicles emplaced on deployed ICBMs and on deployed SLBMs and that one nuclear warhead shall be counted for each deployed heavy bomber."

One may note that under New START, the parties keep track of the missiles and heavy bombers and verify the number of IDWs on each of them by randomly selecting a few delivery vehicles. Nuclear disarmament verification will require keeping track of each individual IDW.

Confirmation of Absence

Nuclear disarmament inspectors will likely need to verify the absence of nuclear weapons in several situations, such as when inspecting an item that is *not* declared to be an IDW, or when inspecting buildings, areas, and entire sites declared *not* to contain IDWs or nuclear material.

The challenge has two aspects. First, measuring a quantity of zero is practically and philosophically impossible, but the measurements may establish an upper limit for the amount of nuclear material present. Second, the number of items and the areas of interest may be far too large to permit proper measurements of them all.

Verifying the absence of nuclear weapons at undeclared locations, that is, outside all sites covered by the formal declaration of the host party, in the State as a whole, is discussed in WG4 Deliverable Part III.

Any item that is not an IDW and that does not contain proliferation-sensitive materials may in principle be inspected in detail with radiation detection equipment and other relevant tools. It is therefore fairly straightforward to verify that such an item is indeed *not* a nuclear weapon. However, there may be many such objects and not sufficient time available to examine them all. As discussed earlier, it may then be necessary to randomly select a few objects for further study and collect information over several inspections. Statistical analysis may assist in deciding how many items should be investigated (further elaborated in WG4 Deliverable Part IV). Note that several items in a closed space may be inspected collectively by determining the absence of certain radiation from the room as such instead of from each item separately.

When it comes to verifying that no nuclear weapons exist within large areas of a base, or at locations outside of declared bases, the inspectors are left with a similar approach. That is, selecting items or buildings to inspect at selected areas. The selection process may be random or guided by the inspectors' knowledge, suspicion, and intuition.

The general rule would be to intelligently select objects for inspection, while holding "everything at risk" in all areas of interest.

Conclusion and Recommendations

This paper presents and discusses different types of declarations and some of the challenges involved in verifying nuclear disarmament declarations. Some key points:

- There is much to be learned from existing verification regimes, including non-nuclear related arms control treaties. Specific techniques and procedures from these regimes will in general have to be modified—including from previous nuclear treaties (e.g., START) because the treaty-accountable item is now the weapon itself, not just the delivery vehicle.
- Verifying and monitoring delivery vehicles still remain very important tools for keeping track of the weapons as they are moved around over time.
- Any regime for verification of disarmament of nuclear weapons will likely have to depend on statistical methods. Even though some work has been done in this area (see WG4 Deliverable Part IV), this topic needs further exploration.

- Nuclear disarmament verification inspectors must be well prepared for their important work. To assist in their preparations, it is recommended to carry out early familiarization visits to the sites that will later be inspected. This should include understanding the physical layout of the sites as well as the activities undertaken and safety and security requirements. Some existing regimes have also demonstrated the benefits of special exhibitions of weapons, tools, etc.
- Confirmation of the absence of nuclear weapons becomes more important as a State is approaching zero nuclear weapons (see WG4 Deliverables Part III and Part V).

Further, detailed elaboration related to some of these key points are found in WG4 Deliverable Part IV, which contains four papers:

- Paper 1. Categorization of Nuclear Weapons
- Paper 2. Evaluating Confidence in Compliance: Methods to Evaluate Random Selection Approaches and Confidence-Building Statistics
- Paper 3. How to Resolve Inspection Ambiguities
- Paper 4. Nuclear Cultural Anthropology: An Exploration of the Influence of Cultural Norms and Changing Cultural Behaviors on Nuclear Cultures

WG4 notes the usefulness of scenario-based studies of nuclear disarmament verification and recommends this approach, when possible, for future work in the field.

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.