
# Working Group 1 - Deliverable One

# A Framework Document with Terms and Definitions, Principles, and Good Practices

Working Group 1: Monitoring and Verification Objectives

November 2017

# Principles for Nuclear Disarmament Verification

## General Observations

In the final document of the 2010 Review Conference of the Parties to the Treaty on the Non-Proliferation of Nuclear Weapons, States parties committed to apply the principles of irreversibility, verifiability, and transparency in relation to the implementation of their treaty obligations. With respect to verifiability of nuclear disarmament, WG1 developed a set of seven principles of verification that guide the work of the IPNDV.

Verification principles apply in theory to all verification scenarios and all steps of the dismantlement process.[1] The extent to which each principle is relevant to specific verification scenarios in practice may vary and must be determined by the Partnership. Thus, the verification principles outlined in this document form a general framework for the IPNDV for the examination and assessment of more specific monitoring and verification objectives as outlined in the terms of reference for Working Group 1.

Working Group 1 addressed the rationale of these principles and identified their relevance for nuclear disarmament verification using examples and good practices of organizations such as the Organisation for the Prohibition of Chemical Weapons (OPCW) and the International Atomic Energy Agency (IAEA). The principles outlined in this paper are based on:

- Existing verification agreements, mechanisms, and practice;

[1] See in the appendix the broad flowchart produced by Working Group 1 "Monitoring and verification activities, as identified by the IPNDV, for key steps in the process of dismantling nuclear weapons."

- Work already done by previous disarmament verification initiatives; and
- Existing research and publications.

## 1. Principle 1—Effectiveness: Verification must provide parties to a verification agreement with sufficient confidence of the compliance by other parties to that agreement.

Verification must be effective; any verification mechanism must be able to deter non-compliance with the underlying arms control agreement. In practice, it is not possible to devise a verification mechanism that provides a 100 percent guarantee of detecting non-compliance (constraints due to technology, proliferation concerns, etc.). Thus, the key issue is whether a verification mechanism provides sufficient confidence to the States taking part. How to meet this standard, or what certainty of detecting non-compliance the verification mechanism must provide, in turn depends on its subject matter.

In short, effective verification provides that States have sufficient confidence that non-compliance will be detected and in due time remedied, or that appropriate action is taken to offset any advantages gained by the non-compliant party by its defection. A good illustration of the principle of effectiveness can be found in the IAEA's comprehensive afeguards agreement. Paragraph 28 of INFCIRC/153 (corrected) determines that the objective of IAEA safeguards is the "*timely* detection of diversion of *significant quantities* of nuclear material from peaceful nuclear activities to the manufacture of nuclear weapons or of other nuclear explosive devices (NED)[2] or for purposes unknown." Both the elements of time and quantity indicate a preoccupation with effectiveness: the IAEA aims to detect, through material accountancy, the diversion not of any quantity of material, which would be impossible to guarantee, but of those quantities for which the possibility of manufacturing a nuclear explosive device cannot be excluded. It furthermore aims to detect such diversion at the maximum time that may elapse between diversion of a given amount of nuclear material and detection of that diversion by IAEA safeguards activities.

Effective verification may require assurances for either correctness or both correctness and completeness of declared information. *Correctness* pertains to the verification of information, activities, material, or locations that have been declared by the inspected State. Thus, it will allow the inspecting party only to verify that there is no difference in comparison to what has been declared. For example, if a State designates 20 warheads for dismantlement and a verifying entity is able to confirm such dismantlement indeed takes place, the correctness of the State declaration will have been verified. The correctness objective will be sufficient for initial scenarios in which nuclear arsenals are reduced.

C*ompleteness* includes the verification of the presence or absence of undeclared materials, facilities, or activities that may pose a risk for non-compliance. In this context, completeness

[2] 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.

will play a role if baseline numbers have to be verified—scenarios in which the absence of undeclared nuclear weapons is a requirement for verification to be meaningful. IPNDV will evaluate, using different disarmament verification categories, if and how the objective of completeness will play a role in relation to each disarmament verification category.

Whether such confidence exists, depends in turn on several other questions, such as:

- What are the potential implications (strategic, military, political) of non-compliance with the relevant agreement, and what are the possibilities for adequate individual or collective responses?
- What information is needed to establish confidence in each scenario?
- What is the degree of risk that non-compliance goes unnoticed?
- Is there confidence in the inspecting entity and its procedures, mechanisms, and technological capabilities?
- What degree of information is possible to transfer without violating the principle of non-proliferation, but still contributing to an effective verification? (see also Principle 4)

## 2. Principle 2—Building Confidence: A verification mechanism should help build confidence in the viability of the underlying agreement.

Cooperative aspects of verification mechanisms can help create overall trust and build confidence between the implementing parties. Thus, they can further support the implementation of the underlying agreement. An example of how this can work is provided by the New START Treaty, which established working relations between inspectors and military personnel during on-site inspections (OSI). Furthermore, it must be taken into account that in the case of nuclear disarmament verification mechanisms, the implementing parties may consist of both States with and without nuclear weapons, who do not possess similar levels of knowledge regarding that which is to be verified. In this way establishing a glossary of key nuclear terms and definitions may increase mutual confidence.

The principle of confidence-building is strongly reflected in the Chemical Weapons Convention (CWC). For example, the CWC determines that Organisation for the Prohibition of Chemical Weapons (OPCW) Member States and the organization's Secretariat have the right to request information from each other, and must be willing to engage in consultations to clarify irregularities. Article IX of the CWC on consultations, cooperation, and fact-finding contains specific provisions on conflict prevention. When one State has doubts about the compliance of another State, the provisions of Article IX can address these concerns without leading to major disagreements. Article XIV regulates the peaceful settlement of disputes under the CWC by referring to the UN Charter, which contains means for the peaceful settlement of disputes: "negotiation, enquiry, mediation, conciliation, arbitration, judicial settlement, resort to regional agencies or arrangements, or other peaceful means of [the states'] own choice."

The principle of confidence-building is also reflected in much of the IPNDV's work. The need for adequate dispute resolution mechanisms, for example, is reflected in the overarching considerations for OSI objectives; the resolution of disputes and ambiguities is considered not only in relation to compliance assessment but also to data review and negotiating managed access during and after inspections. In this context, inspection reporting has been identified as

a key element of OSI, as these reports provide a joint frame of reference as the basis for further review and discussion.

An important aspect of confidence-building is transparency. The willingness of States to share information related to their national security policies and/or nuclear capabilities (size of the stockpile, types of weapons, number of nuclear weapons, operational status, deployment, fissile material contents or location), enhances mutual understanding and provides assurances regarding their strategic intentions and capabilities—thus fostering additional confidence between parties to a verification agreement.

As such, confidence-building measures can supplement a verification agreement, building additional trust between parties through their willingness to expose certain types of information, for example relating to strategic goals, doctrines, intentions, capabilities, and deployments. Typical formats include public statements, military doctrines, posture reviews, national reports, official notifications of stockpiles, or the operational status of nuclear components, etc. In terms of limiting and eliminating nuclear weapons, transparency can pertain to different issues, for example reflected by declarations made by the Russian Federation and the United States under the New START Treaty and nuclear-weapon states (NWS) under the Treaty on the Non-Proliferation of Nuclear Weapons (NPT). The reporting forms introduced by the Non-Proliferation and Disarmament Initiative (NPDI) are an additional example.

Key questions:

- Does the verification agreement contain a clear definition of the common objectives of the States parties through nuclear disarmament verification?
- Does the verification agreement contain a clear reflection of the principle of non-interference (see below)?
- Does the verification agreement provide for functioning mechanisms for informal technical exchanges and low-level conflict prevention?
- Does the verification agreement establish conflict management and settlement mechanisms and practices at a non-political level, retaining the possibility of escalating disagreements if necessary but gearing toward resolution at the lowest levels possible?

## 3. Principle 3—Non-Proliferation: Verification must not lead to the transfer of proliferation-sensitive knowledge.

The principle of non-proliferation in relation to verification activities is unique to the scope of work on nuclear disarmament verification and has major implications for the work of the IPNDV. Generally, satisfying this principle will be a matter of information protection; in addition, the protection of that information will be required by the inspected party based on national security considerations. As such, the principle of non-proliferation is intertwined with the principle of non-interference through the process of managed access.

The most important difference, however, is that the non-proliferation principle does not originate from any national interest but from NWS and non-nuclear-weapon states (NNWS) international obligations under the NPT—respectively Articles I and II of the Treaty. Indeed,

Article I of the NPT provides for NWS not to "assist, encourage, or induce any non-nuclear-weapon State to manufacture or otherwise acquire nuclear weapons" or devices; under Article II, NNWS undertake not to "manufacture or otherwise acquire nuclear weapons or other nuclear explosive devices; and not to seek or receive any assistance in the manufacture" of such devices.

The standards for regulating this type of information are higher than those related to other types of sensitive information, because non-proliferation obligations apply to *any* recipient—including inspecting entities, and NWS and NNWS personnel alike. Considering that the Treaty does not prohibit the mere transfer of information as nuclear proliferation without looking at a wider context, it is important to explore which types of information are so proliferation-sensitive that their mere transfer constitutes the "assistance, encouragement or inducement" of a nuclear weapons effort. It is only natural that the IPNDV's participating NWS take the lead in this exercise.

The IPNDV should identify options to prevent the transfer of such data for some monitoring technologies. For example, protection of NED design information and manufacturing techniques can be managed by preventing physical access to, and sight of, the interior of the NED or its sensitive components as well as certain tooling and equipment. Limitations will also be placed on inspection equipment that could measure or record proliferative data, such as information barriers. The inspected State will also need to prevent the use of unauthorized measurement devices or misuse of inspection equipment to gain such information.

There are few existing good practices relating to the non-proliferation principle to draw on, because no nuclear disarmament verification regime exists under which proliferation-sensitive information may be transferred. Earlier exercises, such as the Trilateral Initiative and the UK-Norway Initiative on Nuclear Dismantlement Verification, however, have explored this issue. Previous work from the United States and later the UK has indicated 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.

There are also practices available in the field of nuclear safeguards, where certain technologies may be shrouded or hidden from inspectors. Another good non-proliferation-related practice stems from peaceful nuclear cooperation between States; this concerns the practice of making the benefits of certain sensitive technologies available to international partners, without transferring knowledge about the technology itself: the so-called "black box" arrangements. This technique may be able to be applied in limited, specific circumstances.

Key questions:

- What is the balance between the imperatives of Articles I, II, and VI of the NPT?
- What are the limits of information transfer under the NPT?
- When does information transfer amount to nuclear proliferation?
- Which information is most proliferation-sensitive, and why? How do we define proliferation-sensitivity?

## 4. Principle 4—Non-Interference: The level of interference of verification activities is moderated by national interests, notably those related to security and safety.

The principle of non-interference in nuclear disarmament verification stems from the basic fact that our international legal system is based on the concept of State sovereignty. Thus, international obligations, including disarmament and verification obligations, are agreed upon by States if their influence on sovereignty in the process is sufficiently minimal and in the best interest of the State. In the context of the work of the IPNDV, this principle will mostly relate to the prevention of interference with, safety, security, and non-proliferation concerns.

- *Safety-related considerations* deal with the protection against possible harmful effects of the inspection environment on the personnel involved and the items of inspection (e.g., special nuclear material (SNM) and high explosives (HE)). These considerations include the physical safety of inspectors on-site, radiation safety, and explosive safety.
- *Security-related considerations* deal with the protection of the items of inspection and the inspection environment from possible abuse or outside interference by the inspection entity. They include general site security, physical security, cyber security, safety checks, transportation, and personnel security.
- *Non-proliferation considerations* are outlined in detail above under Principle 3.
- *Other considerations* include the minimization of the interference by inspection activities with the normal operation of certain facilities.

Non-interference therefore dictates that any verification agreement must seek a balance between its objectives and its intrusiveness. It is reflected in all verification agreements, most notably in the field of nuclear non-proliferation. Article III.3 of the NPT states that Safeguards shall be designed to comply with the right to use nuclear energy for peaceful purposes and, in addition, "to avoid hampering the economic or technological development of the Parties or international co-operation in the field of peaceful nuclear activities, including the international exchange of nuclear material and equipment." This principle is further embodied in INFCIRC/153 paragraph 4, which reflects the fact that the Safeguards regime was designed in cooperation with States, attempting to reconcile verification needs with the desire to avoid interference in non-relevant fields.

As a general rule, this means that any information or data sought by the verification entity must be instrumental to establishing the required level of assurance (see Principle 1 on Effectiveness). Thus, when establishing verification objectives, the question that must be asked is not only *Do we need this information to establish a sufficient level of confidence of compliance?* but also *Can we establish such a level of confidence without having to transfer this information?* A simple example: existing verification agreements have proven it is not necessary to have inspectors at a facility 24/7, but have found procedures and technologies that bring down inspection burdens to a minimum (this is also a matter of efficiency—see below).

A key point of discussion for the IPNDV is how to balance effectiveness with non-interference. Managed access is a process that can ensure this balance. Issues of site security or information protection cannot be a "carte blanche" to refuse to allow inspection activities needed for

effective verification. At the very least (1) the inspection entity should be provided with maximum transparency regarding the reasons for the restrictions and (2) the inspected State must provide alternative means to satisfy the inspection entity's need for access. The onus is primarily on the inspected State.

The principle of non-interference, and its delicate relationship with the principle of effectiveness, is a key driver for the work of the IPNDV. It has effects on the procedural level, for example by influencing the determination of verification and inspection objectives, the procedures relating to the use of certain equipment (certification), or the balance between rights and obligations of the inspected State and the inspection entity during inspections. On the other hand, the principle of non-interference also may have significant effects on a practical level, as some of the work of the IPNDV reflects. For instance, the analysis of various technologies and their potential relevance for nuclear disarmament verification activities takes into account factors such as equipment size restraints, the length of measurement times, radiation or other hazards (e.g., the use of liquid nitrogen) involved with using equipment, or the required proximity between equipment and the object to be measured. All these parameters are in some way connected to issues of personnel safety, security, or the protection of proliferation-sensitive information.

We can identify the following questions that may help to determine whether a verification mechanism has sufficiently taken the principle of non-interference into account:

- Does it find a balance between the concerns of the inspected State and those of the inspection team?
- Does it avoid undue interference with the normal operation of facilities, processes, or operations?
- Does it guarantee the protection of information related to matters of national security, such as security measures at facilities, information related to national defense (e.g., delivery systems)?
- Does it avoid interference with physical nuclear security/safety-related measures?
- Does it guarantee the protection of information that is sensitive on industrial or commercial grounds?
- Is it consistent with other national or international legal obligations and commitments?
- Are there procedures in place to accommodate this challenge, e.g., managed access?

## 5. Principle 5—Cost-Efficiency: Verification agreements must be cost/resource-effective.

Efficiency adds an element of practicality, time, staff, and cost allocation to the analysis of what constitutes effective verification. Any verification agreement should not only be assessed based on its capability to prevent the deviation from a norm, but also on its practical feasibility. A verification agreement that would guarantee 100 percent assurance of compliance but would entail unrealistically high costs is impractical.

For example, when mapping various technologies that may be used in the context of disarmament verification, the IPNDV has also focused on the relative costs thereof. This does not just relate to the cost of the technology itself, but also to the operating costs. For example,

while a video camera is relatively inexpensive, the required effort to review the images may be relatively expensive. The same goes for tags and seals that may be affordable, but require resources and time to be examined. Conversely, it is likely that establishing a chain of custody is in and of itself relatively cost-effective if it eliminates the need to conduct complicated measurements at certain points of the process.

Efficiency provides a limiting factor to the information and data required for effective verification. Its application is more practical than the principle of non-interference and applies to both inspected and inspecting entities.

The IAEA provides some good practices on implementing their obligations in a manner that is as efficient as possible. The Additional Protocol was designed in such a way that, instead of forming an "extra layer" of Safeguards obligations on top of those of INFCIRC/153, they form an "integrated safeguards system" under which the inspection burden may be lowered. For example, under INFCIRC/153 spent fuel rods are inspected every three months, because this is the period established by the IAEA as the minimum for spent fuel to be reprocessed into metal for a weapon. However, if under an Additional Protocol the IAEA can establish that there exists no undeclared reprocessing sites in a State, the inspections of the rods may occur less frequently without compromising the assurance that none of the material is diverted to a weapons program. The IAEA is seeking to increase its efficiency by developing the State-Level Concept. It dictates that the costs of verification must be kept to the absolute minimum required for providing sufficient confidence in the verification mechanism. Key considerations are:

- Is any given verification activity imperative to meeting the stated verification objective?
- Is there any other, more cost-efficient, way to gather the same data or provide the same amount of assurance?
- How much and what resources will be needed for the review of information? What are the costs of the technology involved? What is the inspection burden?
- Is it feasible to use something like an "integrated safeguards" or "State-level" approach (cf., IAEA context)?

## 6. Principle 6—Determinacy: Verification must balance clarity, simplicity and flexibility.

Because agreeing to accept and implement a verification agreement is a sovereign political decision, States will demand a guarantee that, in practice, their interests will be safeguarded by the verification system in question. They will not implement measures that are not clearly agreed to and confirmed in practice. The mandate and powers of the verification entity must be clearly established, the procedures must be predictable, and verification must produce similar results in similar cases: as far as possible, the rules and procedures should be so clear that their application is self-evident. This way, verification establishes shared expectations, predictability, and stability in relations between the parties to an agreement.

However, verification systems should maintain a degree of flexibility. There may be a certain level of unpredictability because of the deterrent effect that it provides. Moreover, the rules and procedures of verification agreements must be adaptable to development and evolution;

there may be room for new and more effective procedures and technologies to maintain the effectiveness of a verification mechanism in the light of, for example, technological developments—that often go faster than multilateral agreements can be formally amended in practice. Education plays an important role: there is an ongoing responsibility of those in charge of selection and training of inspectors to keep up with developments.

Existing verification mechanisms such as the IAEA and the OPCW balance a clear mandate for their inspectors and technical secretariats, long lists of definitions, with the need for such an organization to adapt itself, redefine its procedures and improve its tools and technology. Any potential future disarmament verification entity would have to engage in a similar balancing act. In the context of the work of the IPNDV, this balance is at this point mainly reflected by for example, the discussion on how to combine the need for specific facility arrangements before they can be inspected with the necessity to ensure some consistency to the overall approach to inspections. Another example of this procedural flexibility in the IPNDV-context is the inclusion, among inspection objectives, of the need to incorporate alternative options to demonstrate compliance under managed access if the primary option is, for example, refused by the inspected State.

Some guiding questions in the context of the principle of determinacy:

- Do procedural rules leave as little room for interpretation as possible?
- Are the verification objectives clear and factual?
- Is the object of verification sufficiently measurable?
- Are there clear limits to the mandate and powers of the inspection entity?
- Are there clear agreements on the process of updating the verification agreement?
- Is the verification agreement sufficiently adaptable to keep up with changing circumstances?
- Are inspectors sufficiently trained and prepared for their tasks?

## 7. Principle 7—Structure: The role and position of national authorities in the context of verification must be well-established and balanced.

Three levels of verification may be distinguished: unilateral, bilateral, and multilateral verification. The objectives of verification are always the same, whereas the legal basis and implementation differ.

Under a unilateral verification system, States use National Technical Means (NTM) for data collection and carry out a national review and assessment of that data.

Bilateral verification began during the Cold War, with the United States and the Soviet Union agreeing to measures aiding the other party's use of NTM (Open Skies Treaty or agreements not to interfere with the other party's NTMs, for example by use of camouflage). Gradually, such verification was expanded to include bilateral reporting, OSI, and bilateral consultative committees.

Multilateral verification puts, to some extent, a multilateral entity "above" the parties, even though it cannot be expected of States, whether they are NWS or NNWS, to completely relinquish all national prerogatives to a multilateral body for confidentiality and national

security reasons. As a result, even multilateral verification agreements are never entirely multilateral in the sense that there will always be a role for elements of national verification (e.g., the use of NTMs).

Multilateral verification is generally considered as the preferable option for certain disarmament scenarios. The IAEA and the Comprehensive Nuclear-Test-Ban Treaty Organization (CTBTO) practice shows that in terms of data collection and technical review, multilateral verification has great benefits, keeping in mind that each organization operates differently. A legal framework provides greater clarity about the selection, privileges, and mandates of inspectors; the scope of verification activities; and both formal and informal avenues for consultation and low-level dispute resolution (see Principle 2 on Confidence Building). Objectivity and impartiality of inspectors is another advantage of a multilateral body.

However, in cases of non-compliance, the UN Security Council is often considered as the "final" multilateral option, but the possibility of a deadlock needs to be taken into account. In the context of enforcement, too, unilateral approaches can play a complementary role to multilateral verification. One may think of unilateral sanctions and the suspension of the underlying agreement. Alternative compliance mechanisms considered by IPNDV members are intended to complement, rather than question, the existing models.

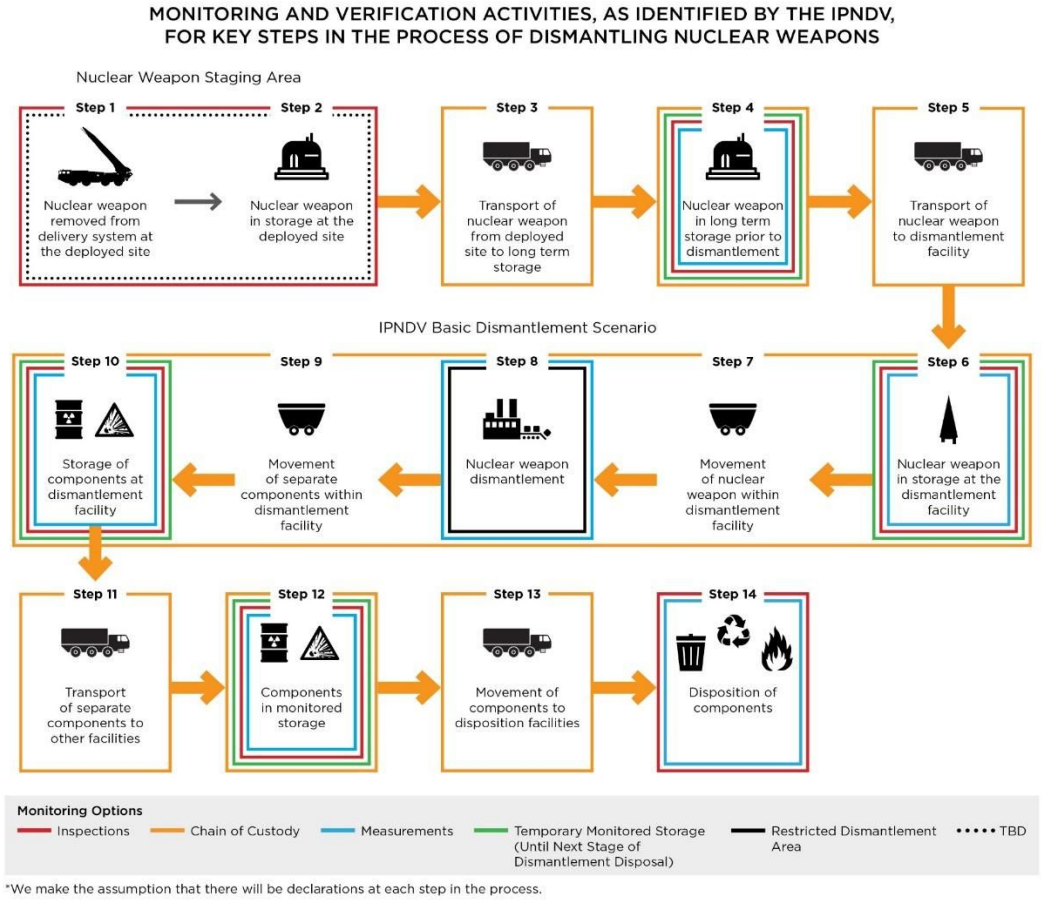
Beyond multilateral verification, tailor-made options should also be considered as viable options, such as the Agreed Framework or the Joint Comprehensive Plan of Action (JCPOA).

Key questions:

- What are the advantages of a multilateral inspection body compared to a bilateral approach?
- Under which conditions should NWS be prepared to include inspectors from NNWS in a verification agreement? Would these NNWS have to meet stricter requirements than their NWS counterparts?
- Which parts of the verification process could be implemented at the supranational/intergovernmental level and which parts should remain the primary responsibility of the States involved?
- What role should remain for unilateral verification efforts? To what extent should it be acceptable, for example, that NTMs are used for national assessments and/or to support international verification efforts?

# Annex 1: Flowchart

Below is a broad flowchart identifying potential monitoring and verification activities for key steps in the process of dismantling nuclear weapons. This 14-step process provides an analytic framework of various dismantlement-related activities. Within the 14-step framework, IPNDV initially focused on the monitoring and inspection of nuclear weapon dismantlement (Steps 6–10), or what is also referred to as the "Basic Dismantlement Scenario."



# Annex 2: General Terms and Definitions

**Active Measurement:** A measurement of emitted radiation taken following stimulated emission, e.g. neutron or photon induced fission. (P5 Glossary)

**Chain of Custody:** The procedures and documents for confirming the identity and integrity of an item by tracking its storage and handling from its entry into the verification or monitoring process to its final disposition. (IPNDV definition)

**Continuity of Knowledge:** The confidence provided by chain of custody and other measures to confirm the identity and integrity of an item during movement and periods between inspections, to allow inspectors to confirm that the item has not been diverted, modified, or otherwise subjected to tampering. (IPNDV definition)

**Dedicated Dismantlement Area:** A "black-box" room or cell in a dismantlement facility in which a NED is disassembled by separating special nuclear material from high explosives. (IPNDV definition)

**Dismantlement:** The process of physical separation of high explosives from special nuclear materials so that a NED can no longer produce a nuclear yield. (IPNDV definition)

**Dismantlement Facility:** A location, dedicated or not, where a nuclear warhead is disassembled. A building or buildings where inspectors conduct activities to monitor dismantlement of a NED. (IPNDV definition)

**Dismantlement Site:** The larger installation within which a dismantlement facility is located. (IPNDV definition)

**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. (IPNDV definition)

**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. (IPNDV definition)

**High Explosive**: A powerful chemical explosive that generates gas with an extreme rapidity and leads to very high pressure after detonation. (IPNDV definition)

**High Explosive in Sensitive Forms:** Explosive material that is in a shape or form that reveals classified information about a nuclear warhead. (IPNDV definition)

**Information Barrier:** A system of procedures, devices, and or software used to protect sensitive information from unauthorized disclosure. (NTI Glossary)

**Inspection Report**: A jointly signed report containing factual information regarding the conduct of an inspection including observations, during the course of the inspection, any ambiguities or disagreements that arose during the inspection, and how they were or were not resolved along with clarifying comments or responses from the Inspected State regarding concerns included by the Inspection Team. (IPNDV definition)

**Irreversibility**: The result of a disarmament process or step that cannot readily be reversed. (IPNDV definition)

**Managed Access:** Arrangements to prevent the dissemination of classified or sensitive information or to meet safety or physical protection requirements during an inspection. Ideally, such arrangements should not preclude inspectors from conducting activities necessary to provide credible assurance of compliance with the provisions of an agreement. (IPNDV definition)

**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. (IPNDV definition)

**Nuclear Disarmament:** The process leading to the realization of the ultimate goal of a world without nuclear weapons and any measure contributing hereto. Nuclear disarmament may also refer to the end state after nuclear weapons are eliminated. (P5 Glossary)

**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 (IPNDV definition).

**Nuclear Material in Sensitive Forms:** Nuclear material that is in a shape or form that reveals classified information about a nuclear warhead. (IPNDV definition)

**Nuclear Safety:** The achievement of proper operating conditions, prevention of accidents and mitigation of accident consequences, resulting in the protection of workers, the public and the environment from undue radiation hazards. (IAEA Safety Glossary concepts and terms)

**Nuclear Security:** The prevention of, detection of and response to criminal or intentional unauthorized acts involving or directed at nuclear material, other radioactive material, associated facilities, or associated activities. (IAEA Nuclear Security Fundamentals, Nuclear Security Series No. 20)

**Nuclear Warhead:** A military device consisting of high explosives and nuclear material in a configuration capable of producing a nuclear yield. (IPNDV definition)

**Nuclear Weapon**: 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. (P5 Glossary)

**Nuclear Weapon Delivery Vehicle**: A ballistic missile, cruise missile, or bomber that carries one or more nuclear warheads through its flight to a target. (IPNDV definition)

**Nuclear Weapon Design Information:** Technical information that is typically considered sensitive and classified and made available only to trusted individuals within a nuclear weapon state. (IPNDV definition)

**Nuclear Weapon Safety:** The collection of measures designed to minimize the possibility of an inadvertent nuclear detonation and to limit the potential for the dispersal of nuclear material in the event of an accident. (IPNDV definition)

**Nuclear Weapon Security:** The collection of measures employed to protect a nuclear warhead from unauthorized access as well as loss to or physical damage by a malicious actor. (IPNDV definition)

**Passive Measurements:** A measurement of spontaneous emissions of radiation, or of the total decay energy of nuclear material. (P5 Glossary)

**Proliferation-Sensitive Information**: Information that if acquired by a country, entity, or individual could result in the spread of nuclear weapons or their delivery systems. (IPDNV definition)

**Radiation Detection Equipment (RDE):** An instrument that is used to detect the presence of radiation (most commonly neutron or gamma rays) utilizing either passive or active measurement methods. (P5 Glossary)

**Special Nuclear Material (SNM):** refers to nuclear material contained in, or removed from, a NED - plutonium-239; uranium-233; uranium enriched in the isotope 235 or 233; any material containing one or more of the foregoing. (IPNDV definition)

**Transparency measures:** The type of voluntary information about a state's nuclear capabilities concerning the size of its stockpile, types of weapons, the number of nuclear weapons, their operational status, their deployment locations, as well as its fissile material contents or their location that is provided to enhance predictability and build confidence. (IPNDV definition)

**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. (P5 Glossary)

**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. (IPNDV definition)

# 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 1: Monitoring and Verification Objectives

Throughout Phase I, the IPNDV Monitoring and Verification Objectives Working Group has examined key objectives for monitoring and verifying the dismantlement of a nuclear weapon, including the information, skills and expertise needed to support this process. This group is co-chaired by The Netherlands and the United Kingdom.