IPNDV Phase III Quad Chart Report

December 2025

Quad Chart Diagrams for the Ipindovia Scenario

During Phase I of the IPNDV, the Partners developed a 14-step model of the nuclear dismantlement process. They also began to explore potential monitoring and inspection processes, procedures, technologies, and techniques (PPTT) available to verify the different steps in that process along with the types of declarations and notifications that form the foundation of effective verification. This "toolkit" was refined and tested through a series of exercises and technical demonstrations throughout Phases II and III.

Missing from this early work was a method to assess the verification measures (PPTT) in the toolkit, and their relationships to each other in any given context. This led to the development of a "Quad Chart" that grouped applicable PPTT and the ways in which they could be used to verify activities carried out in each of the 14 steps. By grouping together related options in this way, the Quad Charts provided an effective way to organize and visualize these options for assisting more detailed analysis. The charts defined verification objectives and then the specific options to achieve those objectives.

The initial Quad Chart design built on the earlier work of the IPNDV in developing its initial verification toolkit. The basic diagram also enabled users to explore the possible connections between the different PPTT in any given category and the readiness status of each PPTT option that was identified.

The specific charts below are not intended to provide a complete answer to all elements of nuclear disarmament verification. They focus only on verification of the declared activities covered by the 14-step model. In addition, they also address the elements of a challenge inspection mechanism that would be essential to the verification of the absence of undeclared activities in violation of a nuclear disarmament agreement, whether retention of undeclared nuclear warheads or undeclared production of nuclear warheads. Examples of this include confirmation of site diagrams during on-site inspections, radiation measurements, and portal monitoring. This report highlights the development and evolution of the Quad Chart analysis approach and provides an analysis of the potential PPTT applicable across the 14-steps of the dismantlement lifecycle.

Structure of the Quad Chart

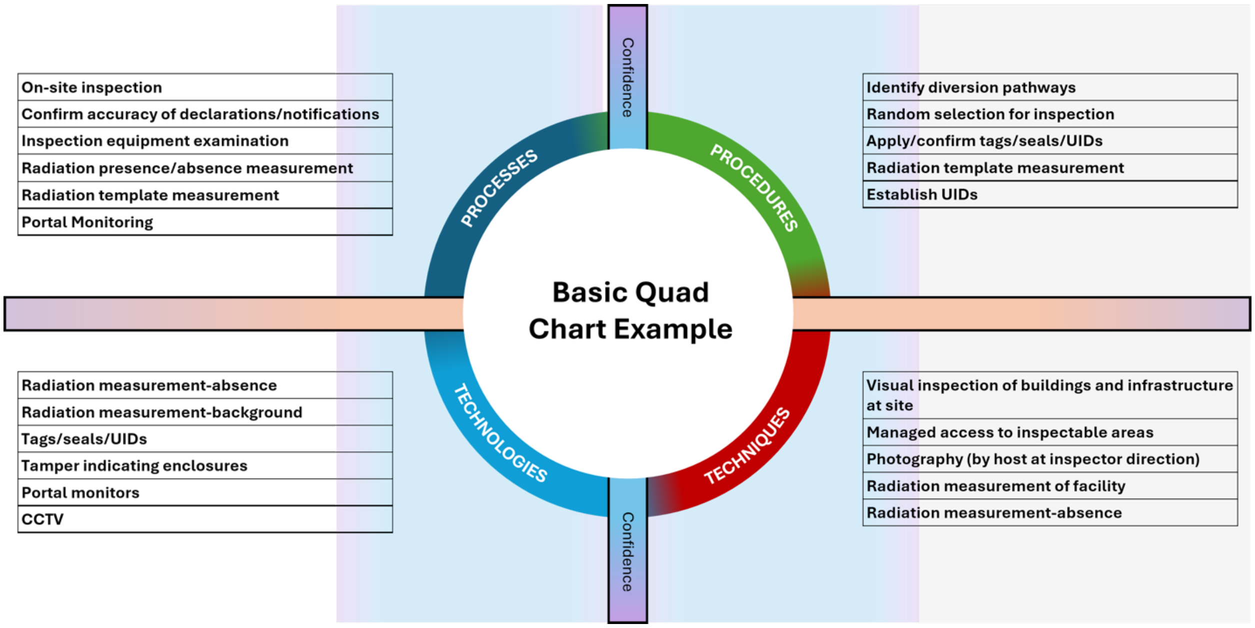
Most important to the effective use of these charts for analysis of specific combinations of PPTT is the relationship among the four quadrants (Figure 1) and the specific monitoring and inspection activities in each.

Advantages of the Quad Chart Approach

- Effectively organizes the *Processes, Procedures, Technologies, and Techniques* (PPTT) in the IPNDV verification toolkit.
- Groups together comparable monitoring and inspection activities for a specific scenario identified in the 14-step dismantlement process model.
- Enables users to visualize relationships among PPTT and discuss their applicability and effectiveness.
- Focuses attention on PPTT gaps, inspiring future work/capability development.

- The **Processes** quadrant shows activities needed to achieve specific verification objectives.
- The **Procedures** quadrant identifies the procedures needed to deliver those processes.
- The **Techniques** quadrant comprises operating manuals, user guides, etc. necessary to operate the technologies and carry out other monitoring and inspection activities identified.
- The **Technologies** quadrant identifies technologies necessary to fulfill the needs of the procedures.

Figure 1. Understanding the Relationship Among the Quadrants



Processes comprises the verification activities that **procedures, techniques,** and **technologies** need to enable. This can include anything from the verification of a declaration to the confirmation of a facility's design, or the validation of an inventory change notification.

In turn, the type of process that exists suggests the types of procedures that are necessary to accomplish it.

Procedures are the documented ways that processes are to be accomplished. Some processes may involve several procedures dependent upon the complexity of actions required to complete the process. If a process is a singular activity, setting up a stand-alone detector for example, it may only require one procedure. More complex activities, such as those that require multiple individual pieces of inspection equipment to be integrated, may require multiple procedures to prepare individual system components for integration. Procedures by their very nature also describe the types of technologies that are needed based upon the functions that the procedure must fulfill.

Techniques are the key to assuring that monitoring and inspection activities, and associated technologies, are carried out correctly to deliver the specific technical information necessary to address the needs of the process, as detailed in the procedures. Techniques may include operating procedures, checklists, and other tools to assure that the technology is operated as agreed and the necessary data are collected. Techniques also would be needed for carrying out inspection activities (e.g., managed access).

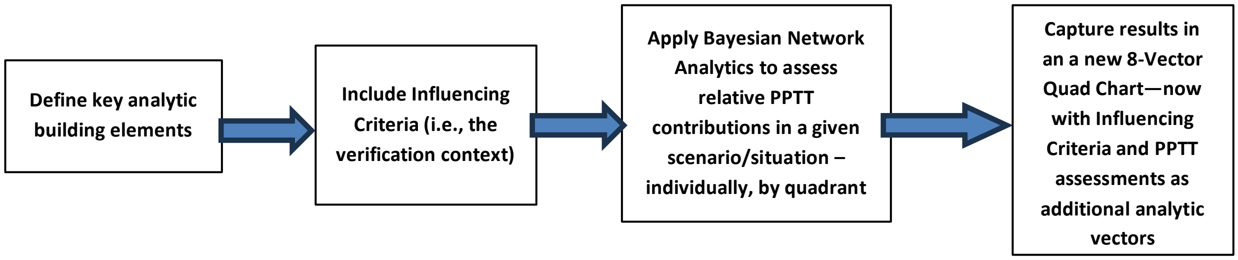
Technologies can be very specific depending upon the needs of the procedure or may be more general, for example, calling out the Trusted Radiation Identification System (TRIS) specifically or more broadly recommending tags and seals or unique identifiers (UIDs). Whether or not procedures identify specific technologies directly, they will identify functional capabilities that are needed. If diverse technologies can serve that same purpose, this may leave the actual inspection equipment selection up to inspectors based upon a variety of in-field, readiness, or other factors.

Although the basic Quad Chart design provided a more detailed and comprehensive method for assessing different PPTT in given scenarios, it was relatively static. It did not explicitly focus on the relationships among the different types of PPTT, particularly in terms of what depended on what.

A Next Step: Transform the Basic Quad Chart into an Analytic and Planning Tool

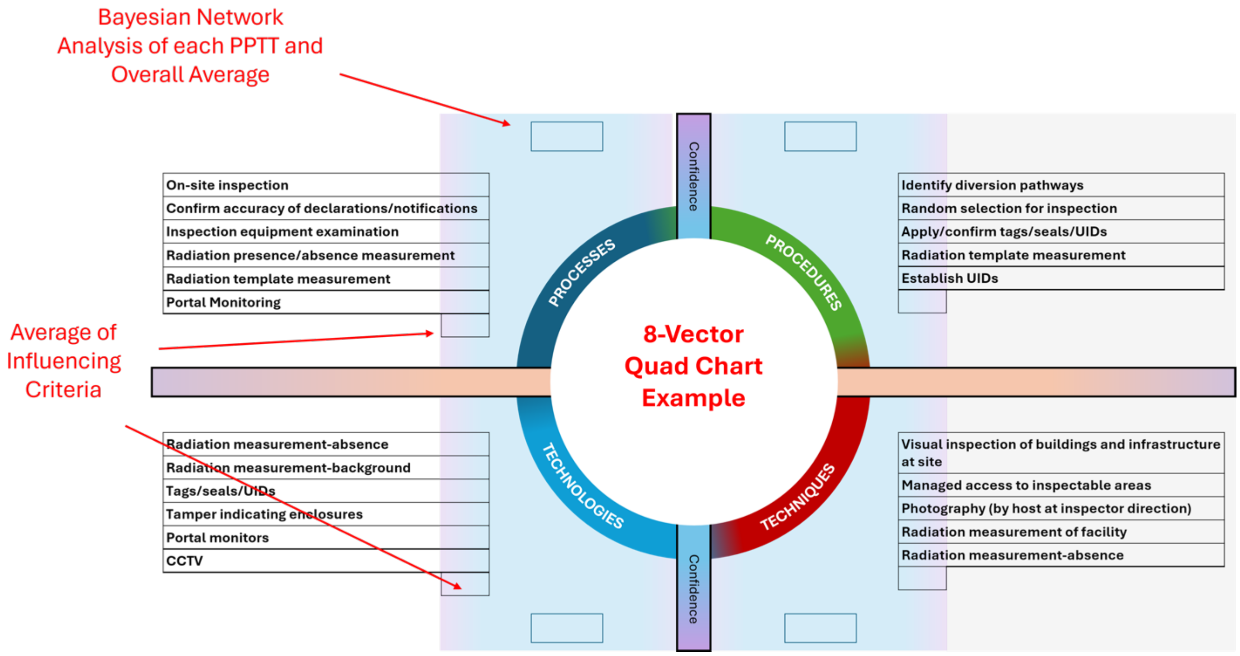
Building on the initial Quad Chart, it became possible to develop a new analytic and planning tool that could be used to stimulate thinking and discussion of the relative contributions of different PPTT (and PPTT quadrants) to achieving the verification objectives across the different steps of the 14-step model. This new planning tool would use the analytic elements already included in the Quad Chart design, then add consideration of the context of verification, or "influencing criteria" (IC). This allowed for application of a simplified Bayesian analytic approach to estimate the relative contributions both of individual PPTT and overall quadrants to achieving verification objectives in a given scenario (Figure 2). The results would be captured in an 8-Vector Quad Chart.

Figure 2. Simplified Bayesian Analytic Approach



The new chart (Figure 3) now has eight vectors for analysis: each of the four quadrants (Processes, Procedures, Techniques, and Technologies) is combined with an assessment of Influencing Criteria for that quadrant as well as the PPTT evaluation for it (both by individual PPTT and as an overall average of the PPTT contributions).

Figure 3. 8-Vector Quad Chart Example



However, it must be stressed that the goal of taking this step is not to provide a final answer to how much different PPTT options contribute to nuclear disarmament verification. The goal is to use this tool to stimulate more rigorous discussion of such contributions, to combine sets of PPTT most effectively, and to identify possible gaps and responses to unexpected limits on what PPTT are available.

Key Analytic Elements Defined

- **PPTT Component.** Individual items listed in the PPTT quadrants.
- **PPTT Quadrant.** The Quadrant's purpose (Processes, Procedures, Techniques, or Technologies) contains the items that serve that category's purpose.
- **Functional Scenario or Situation.** The focus of each chart.
- **Regime.** The approach to verification applied over the entirety of the functional scenario/situation (periodic inspections, permanent inspector presence, autonomous verification, etc.).
- **Influencing Criteria.** A series of factors that define the context in which verification is taking place.

Influencing Criteria: Defining the Context of Verification for a Given Scenario/Situation in the Ipindovia Scenario

When considering what verification measures to incorporate into a verification regime, judgments of the relative importance of different PPTT and of overall quadrants in a given scenario will be shaped by the context of verification, or the IC (Table 1). These criteria are conditions/situations unique to the relationships within each regime, specifically, for the Ipindovia scenario:

1. **History of the Relationship Among Treaty Parties.** If this is an in-force agreement, or one in a series of agreements and the relationship among parties has been positive and without unresolvable concerns, this criterion would be rated **positive**. If the relationship among parties had been challenging, involving numerous unresolvable concerns, it would be rated **negative**. If the relationship was brand new (so no baseline experience with the treaty parties), it would be rated **none.**

2. **Stability of the Treaty Parties' Political Systems.** If a state's government is stable, this criterion would be rated **positive.** If the government is unstable, involving significant political challenges that could impact the success of verification or inspire bad actors to attempt diversion or other acts to undermine the treaty, it would be rated **negative**.

3. **Transparency of the Treaty Parties' Nuclear Weapons Enterprises.** If the party's declaration of the entirety of their enterprise and its history are transparent, this criterion would be rated **positive**. If clear gaps exist in declared infrastructure, this criterion would be rated **negative.**

4. **States' Approach to Disarmament and Verification.** If the state is actively engaged in assuring the success of the disarmament verification process and forward leaning in its approach to improve that process, this criterion would be rated **proactive**. If passive, not enabling the verification to be more effective, or resistant to improved collaboration, this criterion would be rated **reactive.**

5. **Approach to Enterprise Operations.** If the state has well-defined protocols, processes, and procedures that are followed the same way every time, this criterion would be rated **systematic**. If the treaty partner does not seem to have set ways of doing things, or if different people do processes different ways each time, this criterion would be rated **haphazard**.

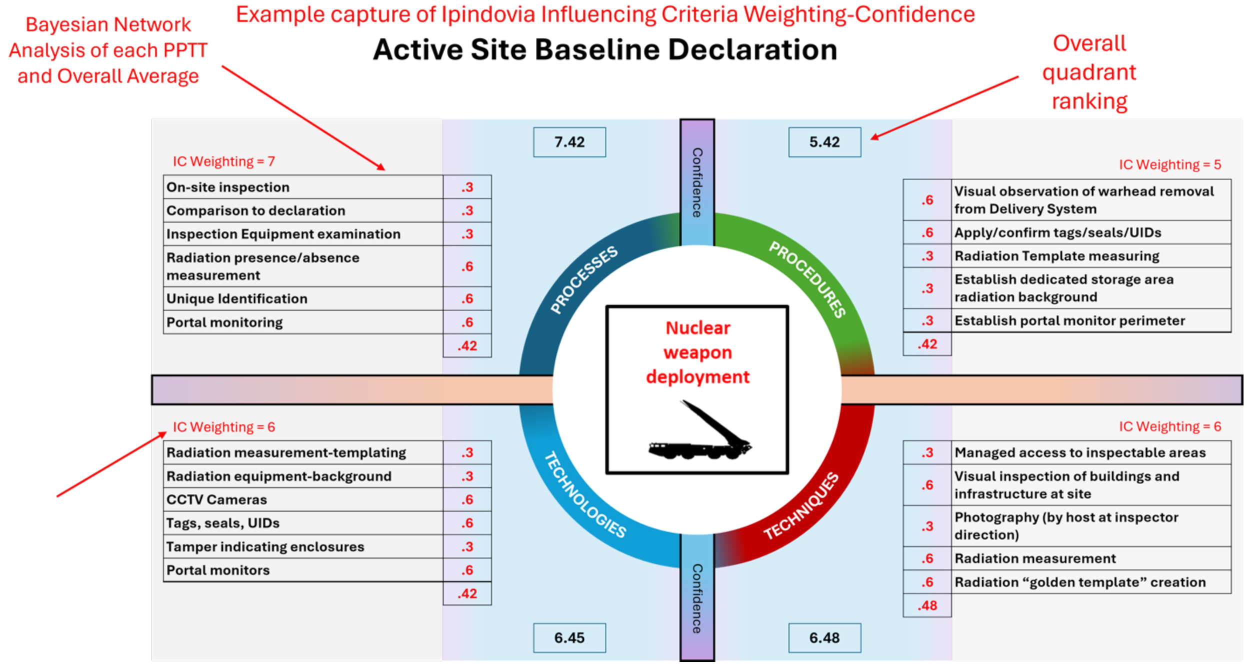
6. **Developmental Status of the PPTT (this includes all four quadrants of PPTT).** If the processes, procedures, techniques, and technologies are modern, readily available "off the shelf," reliable, familiar, and easy-to-use by all treaty parties, then this criterion would be rated **+1**. If the PPTT are old, unfamiliar to the inspectors or hosts (including prototype designs and new technology), no validated procedural applications can be validated by the partner, or those that are available are no longer consistent with upgrades to the technology or applicable to the application, this criterion would be rated **-1**.

Table 1. Influencing Criteria for the Ipindovia Scenario

Criterion	Rating		
1. History of treaty relationships with the partner(s)	positive = +1	negative = -1	none = 0
2. Stability of the partner country's politics	stable = positive +1	instable = negative -1	unknown = 0
3. Size/complexity of the partner's weapons enterprise	well-defined and identified = positive +1	ill-defined or questionable = negative -1	unknown = 0
4. Partner's approach to disarmament and verification	proactive = +1	reactive = -1	neutral = 0
5. Approach to enterprise operations	systematic = +1	haphazard = -1	informal but consistent, or unknown = 0
6. Familiarity of PPTT: is the PPTT modern, readily available, and understood?	available, reliable, and/or ready = +1	older tech or prototype development = -1	totally new to PPTTs = 0

Based on a review of each quadrant, it is possible to provide a total IC ranking for that quadrant in the given scenario. Because some criteria will not be applicable to some quadrants, the remainder that are applicable will still provide an IC affect weight. Thus, the weight of IC may vary across quadrants. Figure 4 provides one example of such overall IC rankings for given quadrants.

Figure 4. Capture of Ipindovia Influencing Criteria Weighting-Confidence Example



Applying Bayesian Network Analytics to Assess Relative Verification Contributions

The application of Bayesian analysis in the case of the IPNDV toolkit involves a series of steps. First is to define the IC for the given verification scenario. For each PPTT option within a quadrant, make an independent assessment of the degree to which that option benefits its quadrant—in effect, its relative benefit value or weighting for that scenario.

Next, capture the individual PPTT benefit values in each quadrant and the average of their values to determine an overall contribution (vertical box provided). Individual incremental values will be weighted by the degree to which the individual PPTT option makes a direct contribution to achieving the verification objectives in that scenario. A strong relationship, for example, would be calculated as a .9, a moderate relationship a .6, and limited relationship .3. If no relationship exists, that PPTT would be weighted as 0.

Assess the relative contribution of each PPTT quadrant to achieving verification objectives by adding the average value of the individual PPTT component rankings and the value of the IC (horizontal box provided).

Bayesian Network Analytics: A Quick Overview

- Focused on understanding the relationship between an item and an assessed topic.
- Assessment topics may include but are not limited to confidence, readiness, resilience, deployability, cost effectiveness, ease of use, availability, and even effectiveness at deterring diversion.
- Bayesian analysis could be used to assess the relative contributions of different PPTT and PPTT quadrants to verification.
- The results are illustrative and not a definitive judgment as to the relative importance of different PPTT or PPTT quadrants.

Using the Ipindovia scenario, with the influence criteria determined, a first step is to evaluate the contribution of each PPTT component within each quadrant to judge, given the scenario and IC. Those values begin at 0 (no relationship), and move through a stepped approach; .3 (limited relationship), .6 (moderate relationship), and .9 (significant relationship).

In this example, this is the first time inspectors will have been to the site; although you have technologies available, you will probably be putting those technologies in place and assuring that they work correctly; neither measurements nor Closed Circuit Television (CCTV) data will have been reviewed.

Once the Bayesian Network relationships are captured, compile the values in each of the inside vectors, the total value of the vector, in probabilistic relation to the situation. For example, in the Processes vector, the total of relationships and influence results in a score of 7.42 for its average connection to achieving confidence plus IC score, whereas the Procedures vector only results in a 5.42 connection. The technologies vector receives only 6.45 because the equipment has been set up and deployed since the original visit, so information will have been captured regarding activities that have occurred between inspections.

Techniques may include things like checklists, functional analytics documents, etc. that allow the user to interpret and validate the product of your technology's application in the intended situation. These are commonly drafted ahead of time and used to validate technologies in-field and then conduct follow-up verification, as baseline performance expectations can be captured before fielding. As such, after reviewing data, those techniques will be revisited to assure that they still bring benefit now that they have been fielded and are operating. Any corrections to those techniques will require approval by all treaty parties.

Using a Bayesian statistical process, it also is possible to do an estimated overall verification confidence assessment for a specific verification functional scenario by combining the values of each of the four quadrants to determine an overall average. In turn, the relative expected confidence for verification of different functional scenarios can be compared.

Applying Bayesian Network Analytics to Assess Estimated Impacts and Responses to "What If" Events

In an iterative process, it also becomes possible to use the 8-Vector Quad Chart to judge the impacts of changes in the use of specific PPTT (their absence or presence) or changes in IC and the verification context. In addition, this approach can help to explore the impacts of situational changes, such as a technology failure that would require substitution with other technologies from the approved list, increasing complexity or even effecting the end result, potentially requiring adjustment of validation measures.

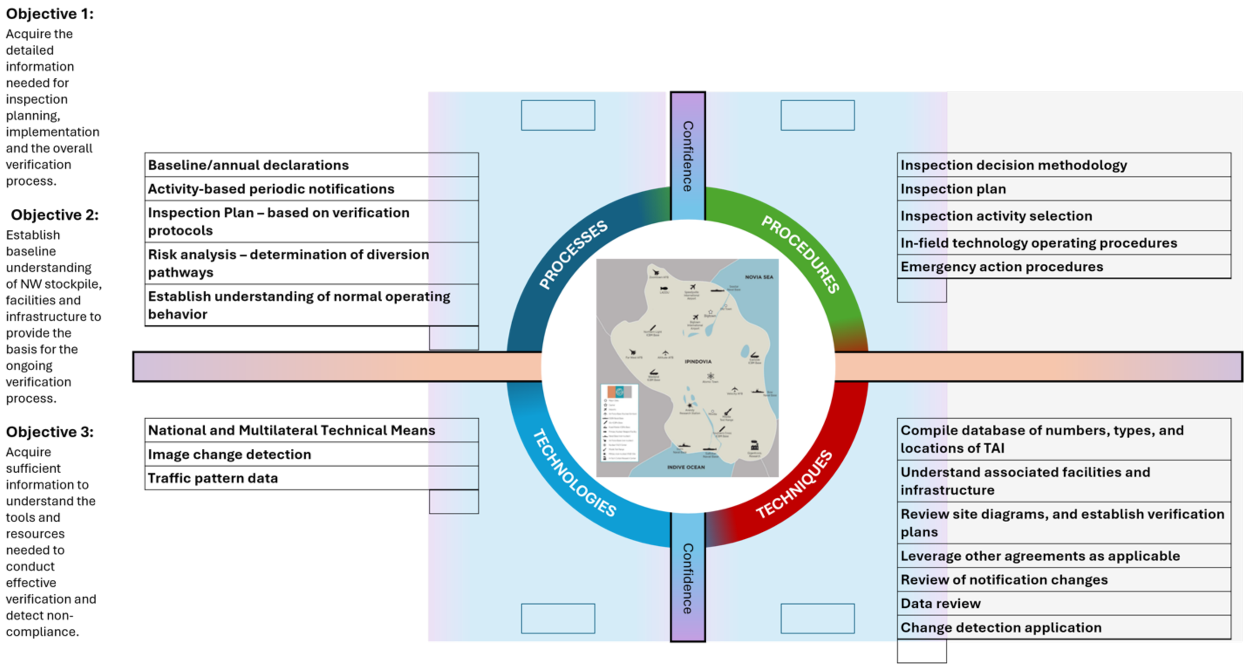
Conclusion

With the incorporation of decision-making tools, including Bayesian Analytics, the 8-vector Quad Chart becomes an analytic and decision-making tool that can help users to determine which PPTT options are most to least applicable in a given scenario for meeting their verification objectives. Leveraging the monitoring and inspection options already provided for by a nuclear disarmament agreement, it can be an effective tool for pre-planning inspection activities or for responding to unexpected developments once inspectors are in-country.

Annex: Verification of Nuclear Warhead Dismantlement Activities

The following appendix sets out Quad Charts for each of the activities of nuclear warhead dismantlement. The specific entries on each Quad Chart are intended to be options that could be applied for that activity. They are not “the answer” to how to carry out a given activity. Together, they demonstrate that the IPNDV has identified a robust set of PPTT options for nuclear disarmament verification.

Figure A-1. Declarations and Notifications



Declarations and Notifications (Figure A-1) are the foundation of verification. Their purpose is to provide specific information that can be confirmed by use of monitoring and inspection PPTT. Of particular importance, the baseline declaration occurs after the entry-into-force of an agreement and contains the specific information to be verified based on the agreement, including, for example, data on all treaty-accountable items, their locations, and related sites. Verification of the baseline declaration will be performed at all sites subject to the agreement within a specified timeframe.

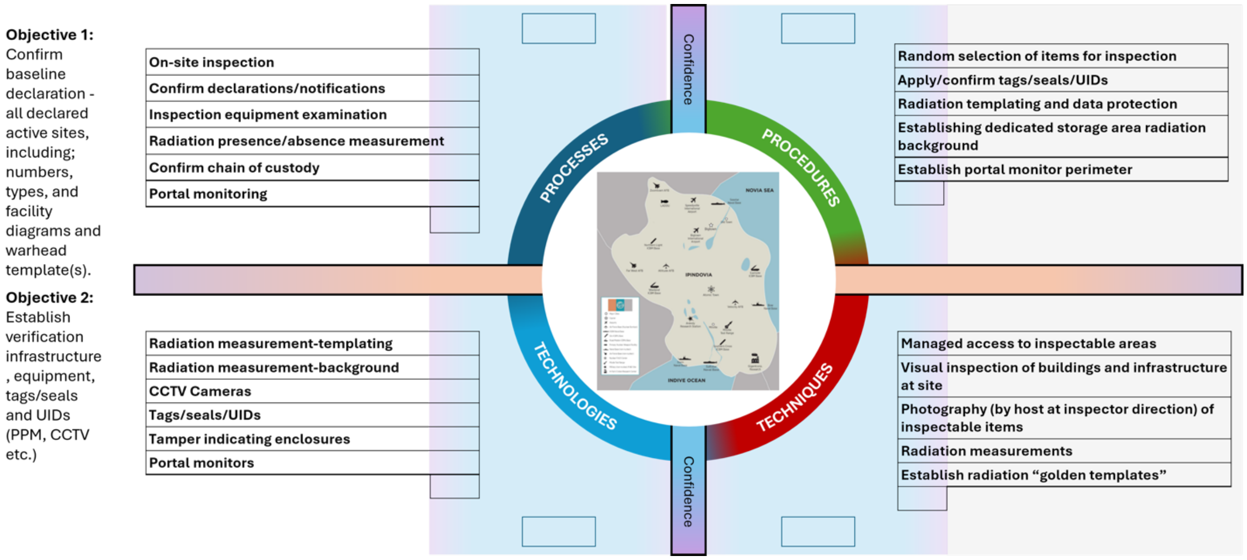
Notifications provide more time-sensitive information about day-to-day activities that impact the accuracy of the baseline declaration (e.g., the movement of nuclear warheads between locations). Different types of notifications include:

- Activities that may trigger planning for and implementation of the types of inspections examined in the slides that follow;
- Transport of nuclear warheads, nuclear warhead components, special nuclear material (SNM), or delivery vehicles as provided for by an agreement;

- Carrying out activities subject to the disarmament agreement; and
- Breaches of chain of custody detected by the host state (e.g., a broken seal on a container) as soon as detected.

Once notifications are received, the inspecting entity may conduct inspections to confirm the accuracy of that notification or take account of it and verify it as part of a later inspection activity.

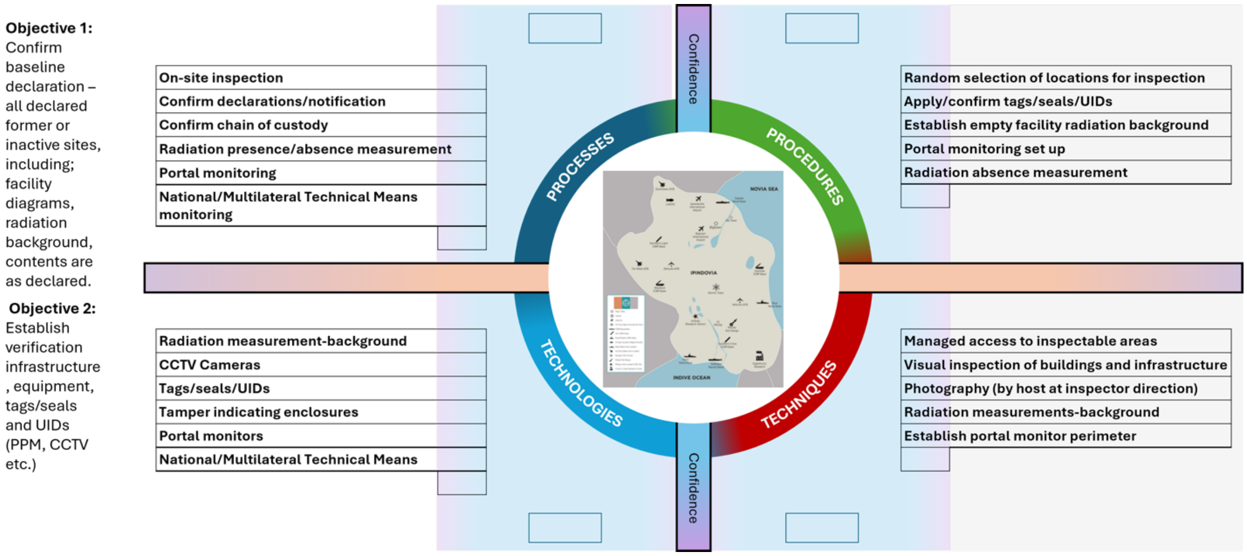
Figure A-2. Active Site Baseline Declaration



Inspectors would confirm the declared data provided, including diagrams of the site. Inspection techniques would include visual observation with managed access,[1] possible use of radiation measurement equipment, other measurements, and photos of treaty-accountable items (TAIs) located at that site. During the baseline inspection, the inspectors would establish needed verification infrastructure, including for example, any deployment of monitoring equipment, determination of UIDs on TAIs (containerized nuclear warheads, delivery vehicles, etc.) and application of tags/seals to containerized nuclear warheads subject to the agreement (Figure A-2). Baseline inspections also would provide an opportunity for inspectors to identify credible diversion pathways by which a TAI could be removed in violation of the agreement.

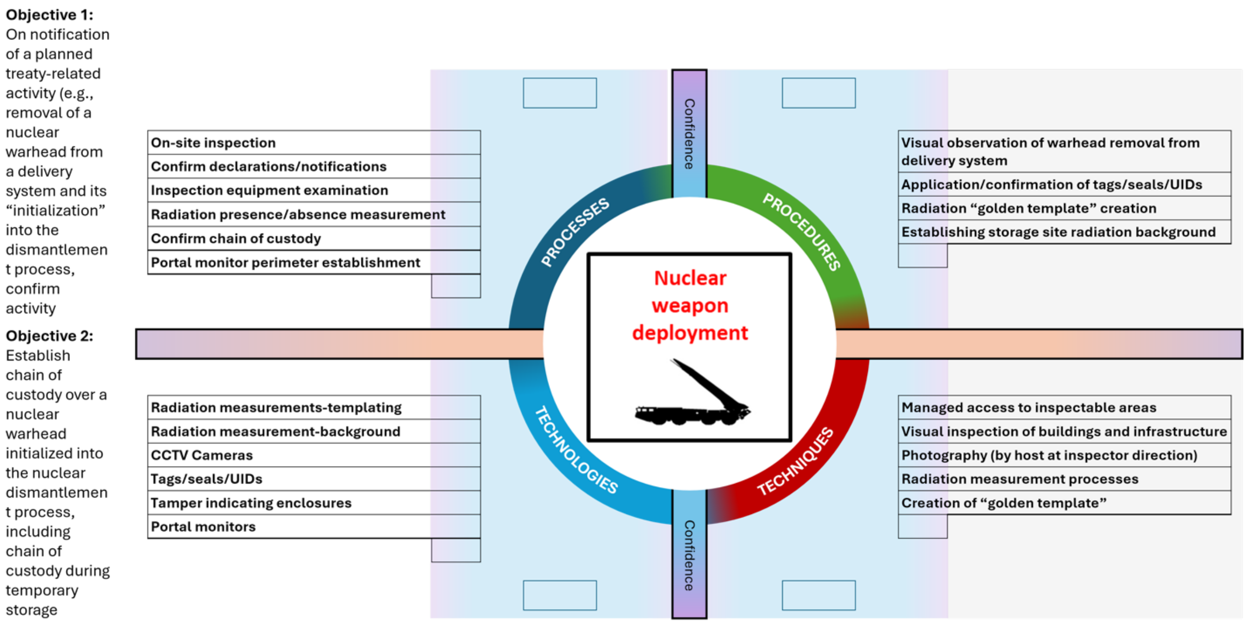
[1] Managed access procedures oversee inspectors’ access to a given site and how their activities are conducted. They are rooted in the principle of nonproliferation and non-interference. A few examples include using specially designated areas for some inspection activities, restrictions on what inspectors can observe and from what locations, and inspectors to be escorted at all times.

Figure A-3. Former/Inactive Sites Baseline Declaration



Inspectors would confirm the data provided, including site diagrams. Inspection techniques would include visual observation with managed access, possible use of radiation measurement equipment to confirm absence of nuclear warheads, other measurements, and photos taken by hosts on behalf of inspectors (Figure A-3). During the baseline inspection, inspectors would also establish needed verification infrastructure, equipment, UIDs, and tags/seals. Once again, inspectors would identify credible diversion pathways.

Figure A-4. Active Nuclear Deployment Sites



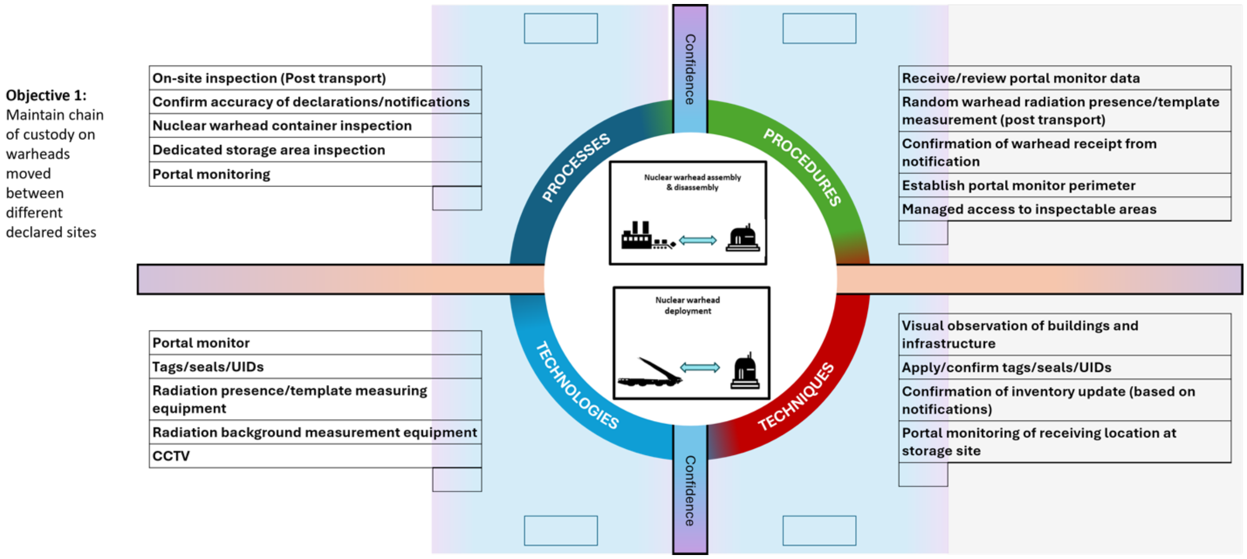
During this step, TAIs (nuclear warheads or delivery vehicles) would be initialized into treaty accountability (Figure A-4). A warhead could be removed from a delivery system or from storage at the deployment site.

In principle, many monitoring and inspection options exist for this step. In practice, the primary emphasis would be establishing chain of custody over accountable items as warheads are removed from delivery systems and placed in temporary storage at the active deployment site. Doing so would begin with visual observation by inspectors, of the process of removal from a delivery system, placing the warhead in a container for transport, the application of a UID for accountable items, and the application of tags and seals on warhead containers—all carried out under managed access provisions.

Radiation measurement also is identified as an option to confirm that a nuclear warhead was present in containers presented for inspection, or to acquire a template of such warheads for later comparison. Radiation measurements of nuclear warheads will be conducted using an appropriate information barrier.

Initialization into the treaty accountability process could also take place at a later step (e.g., at a long-term storage site). Under most conditions, the same PPTT options would apply.

Figure A-5. Inter-site Movement of Nuclear Warheads

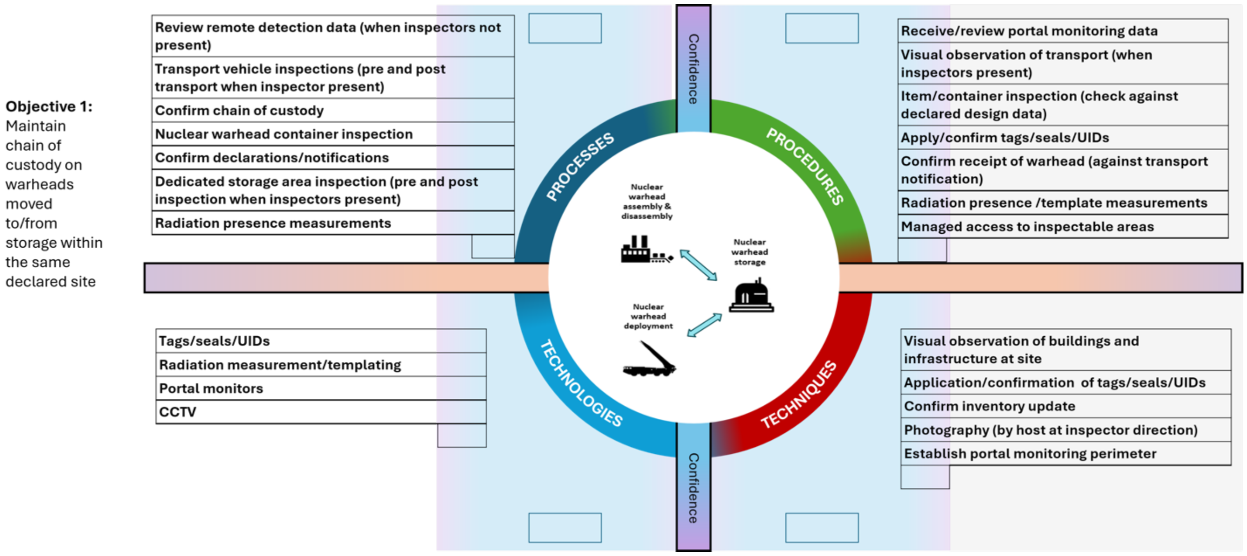


Given security concerns, inspectors will not be notified of an intended move prior to it happening. Historically, inventory change notifications occur at some agreed duration after the move has been completed and inspectors are not present during departure or arrival (Figure A-5).

Upon completion of the movement, inspectors would receive a notification of an inventory update that includes locations of origin and destination, and time of arrival at destination (this updates the inventory of TAI). Inspectors would note that inventory location change and be able to confirm it during a future inspection. To do so, they would rely on visual accounting of inventory changes and verifying the UIDs, tags, and seals on containers with items transported between declared sites.

Inspectors would determine if further verification measures were necessary. For example, random use of radiation measurements to confirm the presence of SNM or radiation measurement using a previously made template after transport has occurred.

Figure A-6. Intra-site Movement of Nuclear Warheads



Intra-site movement of a nuclear warhead subject to a nuclear disarmament agreement would take place between facilities all within a single site (Figure A-6). Examples from the Ipindovia scenario include movement from an intercontinental ballistic missile silo to the maintenance building on an operational base or from a central storage facility to the dismantlement building.

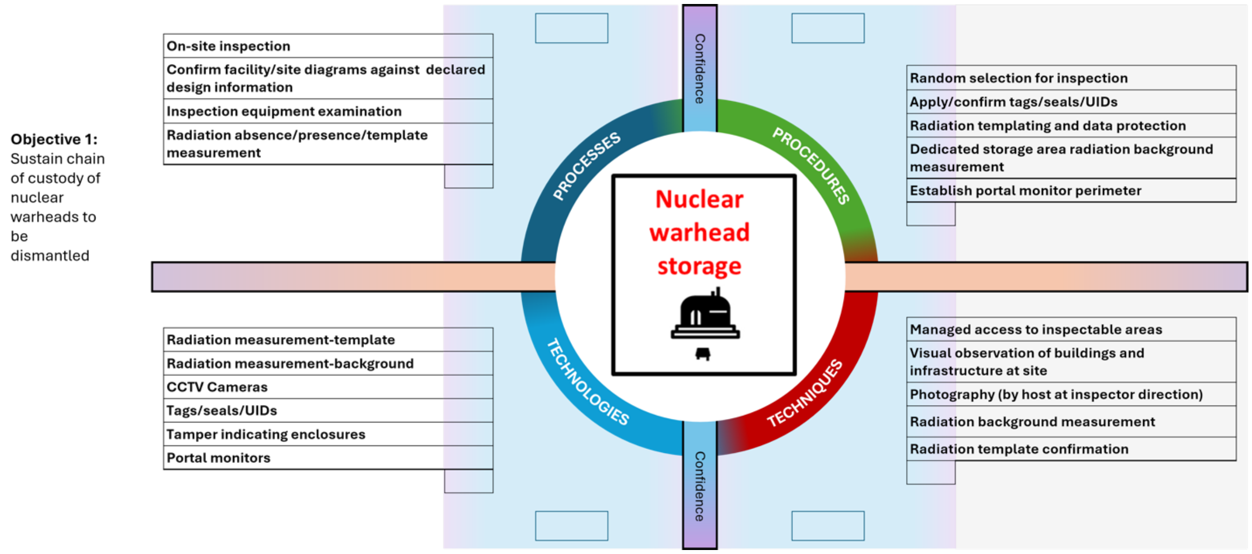
If inspectors were present during transport, visual observation could confirm the transport vehicle is empty prior to loading of the TAI and that storage containers to be used for transport also are empty and consistent with declared design criteria and photos of containers provided by hosts. UIDs, tags, and seals on containers would also be confirmed (or applied when inspected for the first time). Under managed access, inspectors could confirm the removal of the warhead from its initial location, placement in a container, and its loading for intra-site transport. In this case, inspectors would never visually observe the warhead directly. Inspectors would maintain continuous visual observation of the warhead transport vehicle throughout its travel.

Random use of radiation measurements to confirm the presence of SNM or to do template matching would provide an option to verify that an item declared to be a warhead is a warhead. However, in the absence of a problem with chain of custody (a damaged tag or seal on a container) such measurement could be deferred until a later step in the dismantlement process.

Inspectors would confirm the removal of the warhead container from the transport vehicle and its arrival at the destination location.

Notifications would provide information on the locations of origin and destination and time of arrival of the TAI at the destination. The resulting changes of the location of inventory would be subject to confirmation during a future inspection.

Figure A-7. Nuclear Warhead Storage

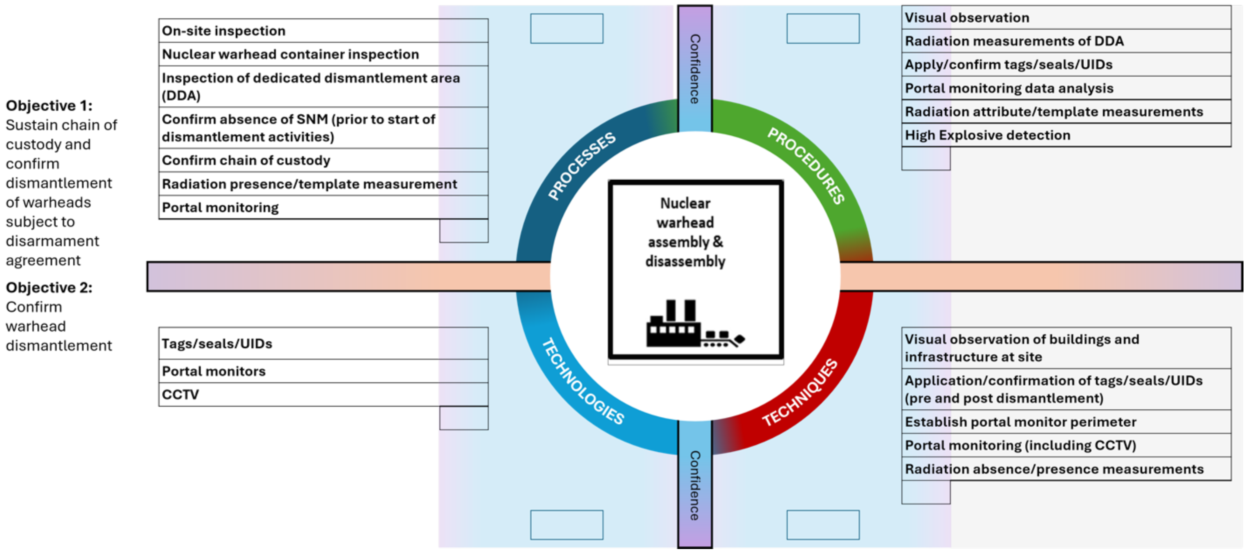


Several of the steps in the 14-step model entail inspections to verify storage of nuclear warheads prior to their dismantlement or of nuclear warhead components (SNM and high explosives, HE) resulting from dismantled nuclear warheads (Figure A-7). A multi-layer set of options can be used to sustain and confirm chain of custody.

A starting point would be on-site inspections to confirm that the site diagrams and other aspects of the facility are consistent with the declared design information and to identify any potential diversion pathways. Application or confirmation of the placement and condition of tags, seals, and UIDs, with verification of numbers against documentation, is another measure. Storage containers could be visually checked for consistency with declared design criteria and previously provided photos. Deployment of portal monitors around storage bunkers (at identified access/egress points) with nuclear warheads to be dismantled and periodic review of portal monitor data (during inspections for example) would reinforce other chain of custody measures.

Random radiation measurements could be used to confirm that storage containers contain nuclear objects and as a basis for future checks. Simple radiation detectors would provide a means to confirm the absence of additional, undeclared nuclear objects in the storage area.

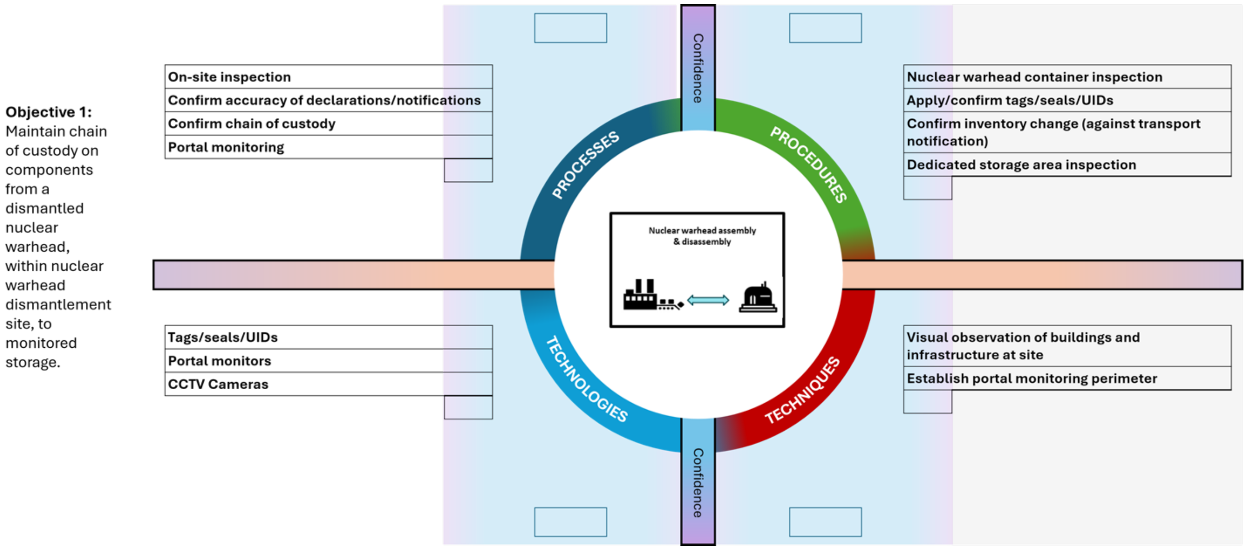
Figure A-8. Nuclear Warhead Dismantlement



Verification of the dismantlement of nuclear warheads is the centerpiece of nuclear disarmament as defined by the 14-step model (Figure A-8). Given the need to protect nonproliferation and other sensitive information as well as to ensure safety and security of nuclear warheads/components, inspectors would not be able to directly observe dismantlement operations. The actual dismantlement process would be treated as a "black box."

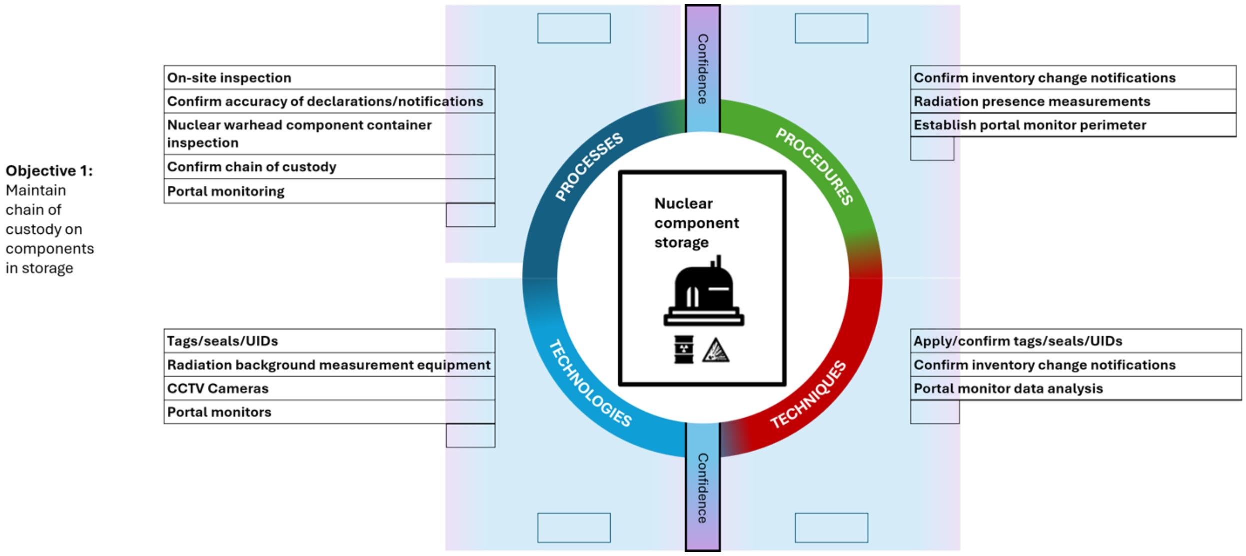
Verification would be based on two key concepts: ensuring the integrity of the dedicated dismantlement area, with no undeclared or unauthorized access or egress from that area, and ensuring chain of custody over nuclear warheads prior to their dismantlement and of the separated SNM and HE components after dismantlement. To do so, a comprehensive set of verification options exists. With regard to ensuring integrity of the dedicated dismantlement area, for example, inspectors could check the area prior to and after dismantlement (including both visually and with inspection equipment) and rely on portal monitoring and CCTV during dismantlement operations. With regard to ensuring chain of custody, options include confirming/applying tags, seals, and UIDs on containers before or after dismantlement, visually check storage containers, including for consistency with declared design criteria, and random radiation measurements of the presence or absence of SNM (including possible use of a template made prior to dismantlement and for presence measurement with use of an information barrier).

Figure A-9. Inter-site Movement of Nuclear Warhead Components After Dismantlement



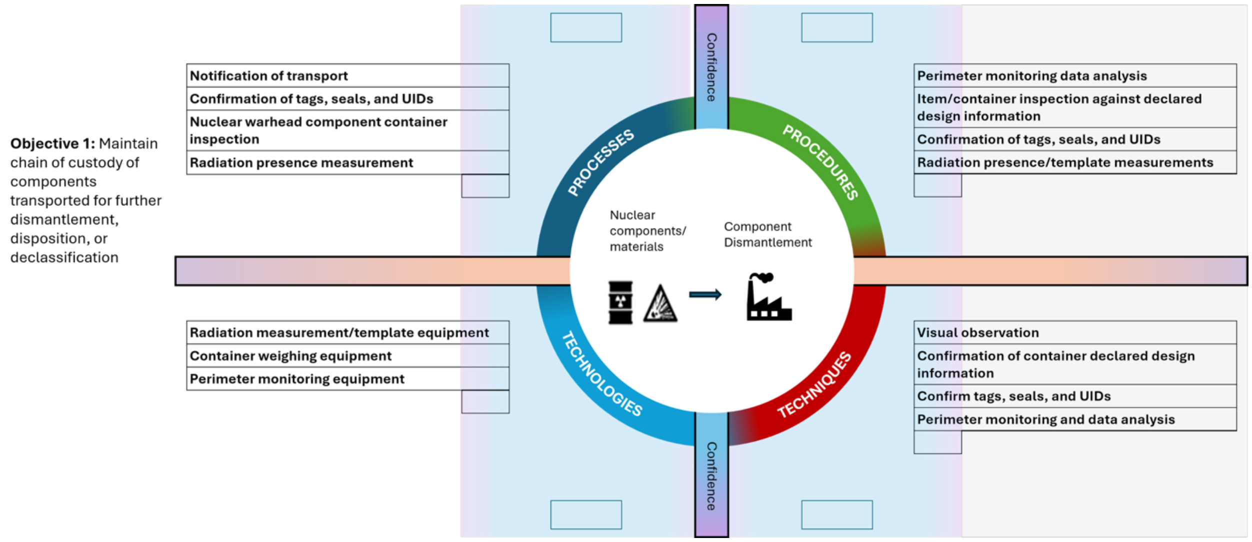
Maintenance of chain of custody of the separated SNM and HE components of dismantled nuclear warheads during their transport from the dismantlement area to a designated storage facility draws on the options for inter-site movement in earlier steps (Figure A-9). Whether inspectors are present or not will again be an important variable. If present, inspectors would be able to visually observe many parts of transport, from host placement of tags and seals on containers with components from dismantled nuclear warheads through the removal of containerized components from the transport vehicle and their placement in the designated storage facility. If inspectors are not present, based on notifications of transport, they would be able to carry out other monitoring and inspection activities to confirm transport, including confirming tags, seals, and UIDs on containers with components against applicable documentation.

Figure A-10. Separated Nuclear Warhead Component Storage



Verification of storage of nuclear components from dismantled nuclear warheads would draw on options identified for storage of nuclear warheads at earlier steps. Options identified include visually checking the integrity of the storage site, confirming tags, seals, and UIDs on containers as documented, random use of radiation detection measurement to confirm that storage containers contain a nuclear object and as a basis for future checks, use of portal monitoring and other facility access monitoring to identify undeclared entry/egress of nuclear objects during storage (Figure A-10). Active radiation detection means could confirm that a container holds a nuclear component rather than a fully assembled nuclear warhead.

Figure A-11. Transport of Separated Nuclear Weapons Components to Disposition

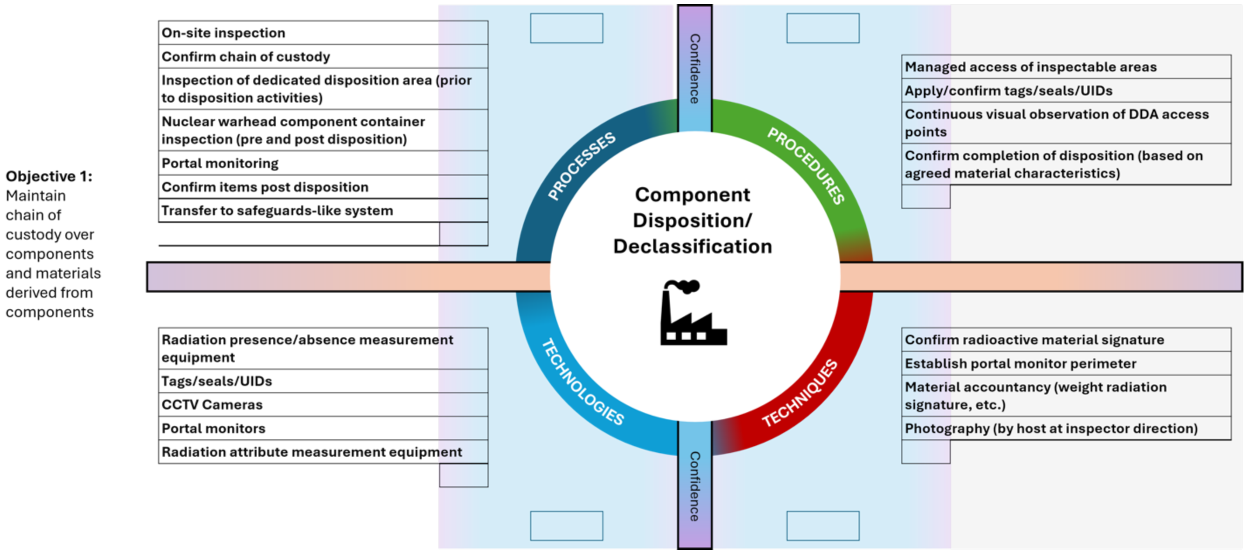


Verification of transport of nuclear weapon components from dismantled nuclear weapons to a disposition site draws on the options for intra-site movement of nuclear warheads (Figure A-11). There are several specific issues to be considered.

First, is whether inspections could take place both prior to transport and after arrival. Such prior verification could be part of the preparation for transit to intra-site storage if there is a permanent presence of inspectors on-site.

Second, is whether to undertake random inspections or radiation measurements after notification of arrival at the disposition site.

Figure A-12. Separated Nuclear Weapons Component Disposition



In this scenario, disposition is defined as the processing of SNM components from dismantled nuclear warheads to remove their classified characteristics (Figure A-12). With some modifications to reflect dealing with separated components rather than nuclear warheads, the basic approach mirrors that applied to verification of the dismantlement of nuclear warheads: treating disposition as a "black box" operation, inspector access and use of portal monitoring means to confirm the integrity of the site, and ensuring chain of custody over the empty containers entering the dedicated disposition area. That approach draws on comparable options like visual observation, confirming tags, seals, and UIDs, radiation measurements, and use of portal monitoring and CCTV during disposition operations.

About IPNDV the International Partnership for Nuclear Disarmament Verification

The International Partnership for Nuclear Disarmament Verification (IPNDV) convenes countries with and without nuclear weapons to identify challenges associated with nuclear disarmament verification and develop potential procedures and technologies to address those challenges. The IPNDV was founded in 2014 by the U.S. Department of State and the Nuclear Threat Initiative. Learn more at www.ipndv.org.