

**Information Barrier Technology
For
Warhead Dismantlement Transparency**

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Abstract

This study identifies an information barrier methodology, formulated under a Sandia National Laboratories contract with the Zababakhin Russian Federal Nuclear Center (ZVNIITF), for possible application under a monitored warhead dismantlement regime. Under a bilateral warhead dismantlement treaty or agreement both parties would require a high level of confidence that the nuclear weapon is irreversibly dismantled and sensitive information is not disclosed. This study explores the need for multiple solutions to the information barrier issue based on the type of technology used to monitor the dismantlement process and type of data to be collected. In addition this study also noted that a verification measure may not only be associated to an electronic measurement but to also human review of procedures, physical observation of rooms, equipment and containers. Because of the multiple pathways that information can be collected, as part of treaty activities, the information barrier concept is a very complex issue. This initial study focused on an information barrier methodology for a radiation measurement technique used to monitor portions of a Russian warhead dismantlement process.

Introduction

Within the context of the Helsinki Summit Agreements, both the United States and the Russian Federation committed to "measures relating to the transparency of strategic nuclear warhead inventories and the destruction of strategic nuclear warheads ". To help achieve a better understanding of those objectives within the Russian Federation, Sandia National Laboratories under the auspices of the DOE's Office of Arms Control and Non-Proliferation (NN-42) Russian Lab to Lab Program, initiated a series of contracts with the Russian Nuclear Institutes to examine the topic of Warhead Dismantlement and Transparency. A primary contributor to the Information Barrier study and analysis is the Zababakhin Russian Federal Nuclear Center of Technical Physics (VNIITF).

This study identified technical requirements and conditions that would be necessary to meet an information barrier design. Verification measures should provide data such that conclusions can be drawn by the inspecting country and provide a high confidence that the negotiated process is consistently being conducted without any loss of sensitive information.

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Information Barrier Results:

Under a bilateral treaty or agreement scenario for warhead dismantlement monitoring the parties would want to verify that:

- The item being dismantled is actually a nuclear weapon
- The item being dismantled is a declared item
- The item was dismantled, and
- The item was irreversibly dismantled

In the process of developing an information barrier system to support this scenario special technical requirements must be met, for example:

- High system reliability for data handling and processing
- Inability to transfer or store sensitive information
- Inability to acquire sensitive information on nuclear weapons design, materials and technology
- Tamper protection and physical security for the information barrier system to prevent unauthorized access
- Hardware must be easy to use and maintain
- Inability to modify information barrier hardware or software with out detection
- Information system design principles should be comprehensively documented and inspectable
- Engineering design data for the information barrier methodology, hardware, and software would be required to be certified by all parties
- Inability to falsify data being collected - data authentication
- Protection of data from unauthorized deletion

Other conditions that this study identified requiring evaluation in the design of an information barrier include:

- What kind of data is being presented?
- How is the data acquired?
- What form is the data acquired in?
- Where will the data be transferred to and in what form?
- How long will the data be stored?
- Will the data need to be processed?
- What is the frequency of the data transfer?
- How will data discrepancies be evaluated and corrected?

Based on these conditions and requirements an information barrier is a device, designed not to allow intrusive or sensitive information to be transmitted from a measurement or electronic device to a processor or recorder. Specifically, an information barrier design for a radiation measurement system would consist of an integrated methodology that would include both technical and administrative management measures. VNIITF proposes the development of an anti-intrusive device (AID) which would be located between the detector and the processor of a radiation measurement device. An AID is a boundary between the "dirty zone (sensitive)" and the "clean zone". The AID should be a dedicated unit that receives data from the processor in digital form, filters it, and again in digital form transmits it to the processor/recorder.

This study considered a gamma-ray spectroscopy unit used to differentiate between weapon and reactor grade plutonium. In this case separating information is a relationship between amplitudes of certain gamma-lines corresponding to different isotopes of plutonium. However, this relationship is considered intrusive since it gives quantitative characteristics of isotope composition of the nuclear material. An AID design would be placed between the detector and the processor to prevent the raw flow of data to the inspecting party. VNIITF proposes that an AID design could be based on an artificial neural network concept, which uses a series of mathematical techniques to transform data into a non-intrusive form.

Continued advanced studies in information barrier technology and assessment will continue with VNIITF in the future.