# Verifying Nuclear Disarmament

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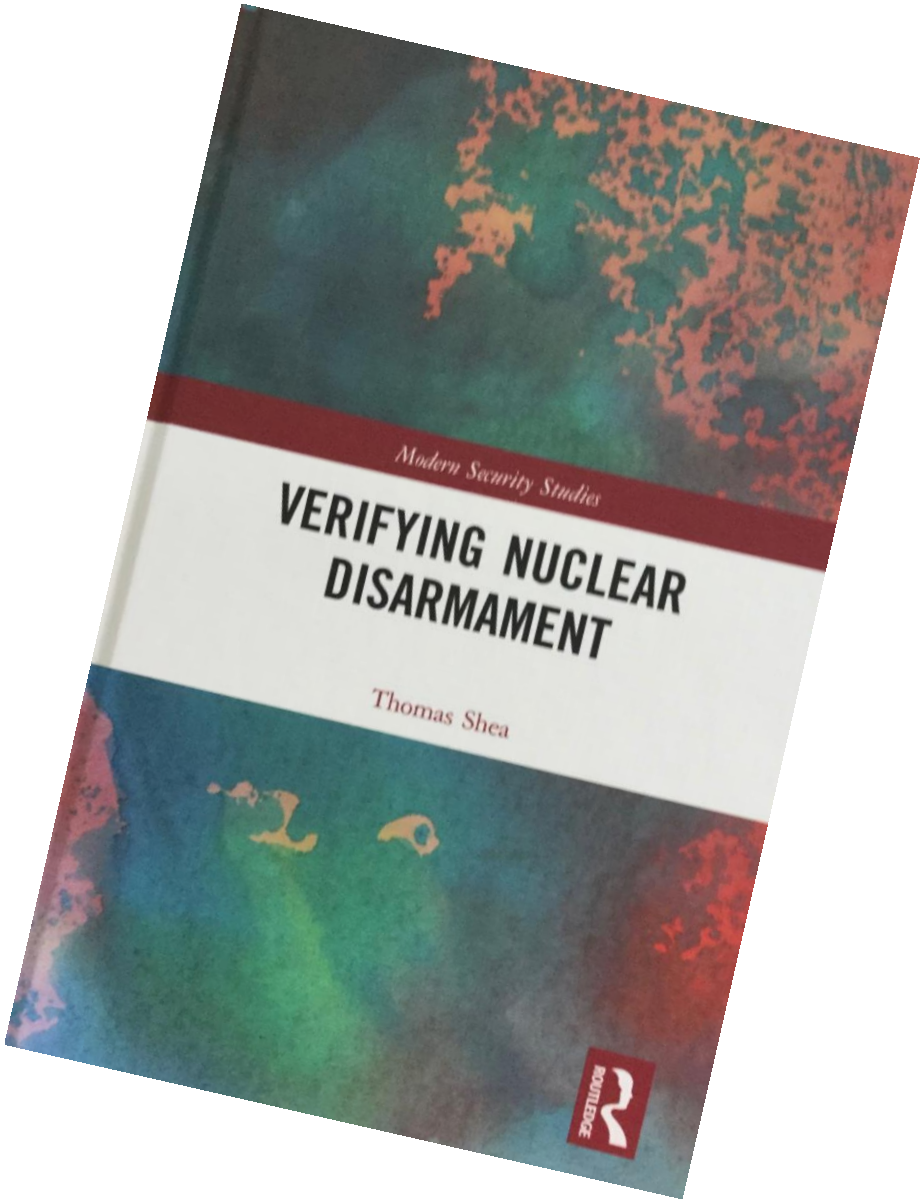


# Treaty on the Prohibition of Nuclear Weapons

TPNW: 69 signatories and 19 States parties (31 more ratifications needed for entry into force).

To Succeed, the TPNW needs:

- A Framework, including institutional, legal, financial, technical and operational mechanisms.
- And, of course, the TPNW needs nuclear-armed States to sign on.

➡ TPNW States Parties will decide all matters related to the implementation of the Treaty.

# When in force, the TPNW will reduce these risks while helping States to disarm.

1. Nuclear war, or threats to use nuclear weapons.
2. Unauthorized use of nuclear weapons.
3. Accidental or sabotage detonation of nuclear weapons.
4. Unauthorized transfers to any unauthorized person, group or State.
5. Theft by a terrorist organization.
6. Proliferation.
7. Nuclear testing.

# My TPNW Institutional, Legal, Financial, Technical and Operational Framework

Supports TPNW by:

- *Encouraging States to Sign & Ratify the TPNW*
- *Providing a Starting Point for Implementation*

# Contents

"All the News That's Fit to Print"

# The New York Times.

LATE CITY EDITION
Partly cloudy, less humid today. Cloudy and warm tomorrow.
Temperatures Yesterday—Max., 72; Min., 66
Sunrise today, 5:37 A. M.; Sunset, 8:06 P. M.



VOL. XCIV..No. 31,972. Entered as Second-Class Matter, Postoffice, New York, N. Y. NEW YORK, TUESDAY, AUGUST 7, 1945. THREE CENTS IN NEW YORK CITY

# FIRST ATOMIC BOMB DROPPED ON JAPAN; MISSILE IS EQUAL TO 20,000 TONS OF TNT; TRUMAN WARNS FOE OF A 'RAIN OF RUIN'

## HIRAM W. JOHNSON, REPUBLICAN DEAN IN THE SENATE, DIES

### Isolationist Helped Prevent U. S. Entry Into League—Opposed World Charter

### CALIFORNIA EX-GOVERNOR

Ran for Vice President With

## *Jet Plane Explosion Kills Major Bong, Top U. S. Ace*

### *Flier Who Downed 40 Japanese Craft, Sent Home to Be 'Safe,' Was Flying New 'Shooting Star' as a Test Pilot*

By The United Press.

BURBANK, Calif., Aug. 6—Maj. Richard Bong, America's greatest air ace, died today in the flaming wreckage of a jet propelled fighter plane which crashed while he was testing it.

Only 24 years old, he wore twen-

"The plane started to wobble up and down, then went into a left bank and hit the ground," he stated. "It exploded and burned and scattered wreckage over about a block square."

Major Bong was trying to get

## KYUSHU CITY RAZED

### Kenney's Planes Blast Tarumizu in Record Blow From Okinawa

### ROCKET SITE IS SEEN

### 125 B-29's Hit Japan's Toyokawa Naval Arsenal

## REPORT BY BRITAIN

### 'By God's Mercy' We Beat Nazis to Bomb, Churchill Says

### ROOSEVELT AID CITED

### Raiders Wrecked Norse Laboratory in Race for

## *Steel Tower 'Vaporized' In Trial of Mighty Bomb*

### *Scientists Awe-Struck as Blinding Flash Lighted New Mexico Desert and Great Cloud Bore 40,000 Feet Into Sky*

By LEWIS WOOD
Special to THE NEW YORK TIMES

WASHINGTON, Aug. 6—A blinding flash many times as brilliant as the midday sun and a massive, multi-colored cloud boiling up 40,000 feet into the air accompanied the first test firing of an atomic

Before the detonation scientists waited in tense expectancy. Minutes lengthened seemingly to hours. Lying face downward, with their feet toward the steel tower, the watchers waited, nearly breathless.

## NEW AGE USHERED

### Day of Atomic Energy Hailed by President, Revealing Weapon

### HIROSHIMA IS TARGET

### 'Impenetrable' Cloud of Dust Hides City After

## 26,725 days since Nagasaki.

- Since then, no nuclear wars, no unplanned or accidental explosions, no stolen weapons.
- Many States pursued nuclear weapons; most stopped or failed.

## 4 States abandoned nuclear weapons.

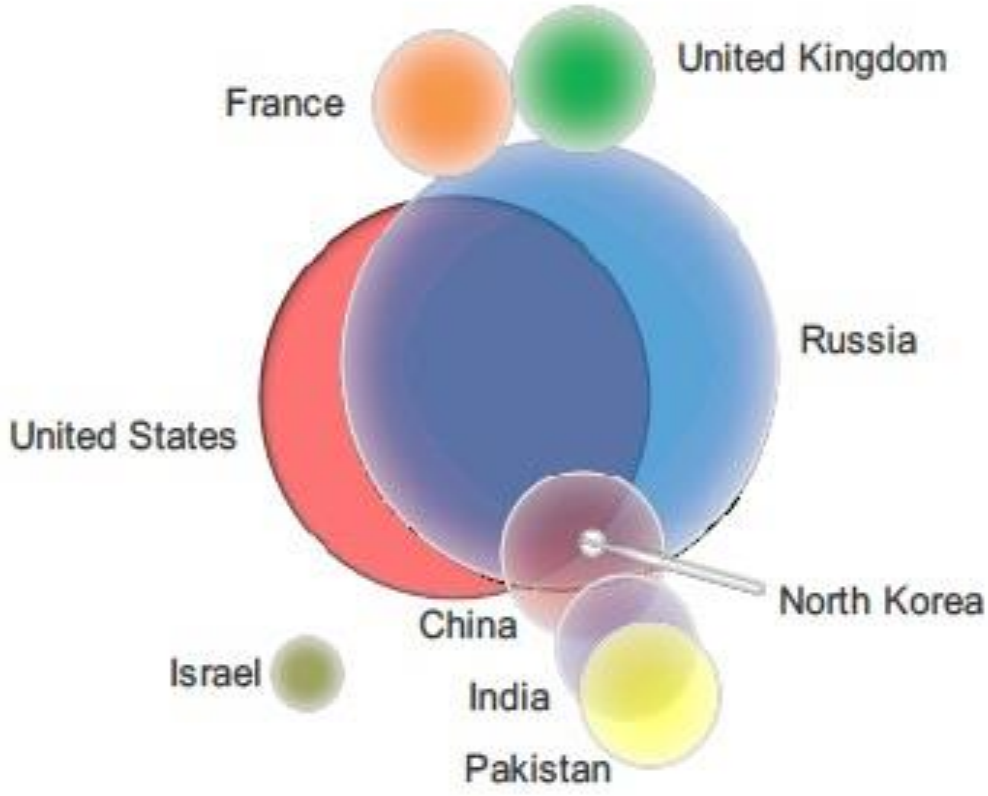
- South Africa, Belarus, the Ukraine and Kazakstan

## Today, 9 nuclear-armed States:

- 5 NPT* Parties (Britain, China, France, Russia, United States)
- 4 additional (DPRK, India, Israel, Pakistan)

**NPT = Treaty on the Non-Proliferation of Nuclear Weapons*

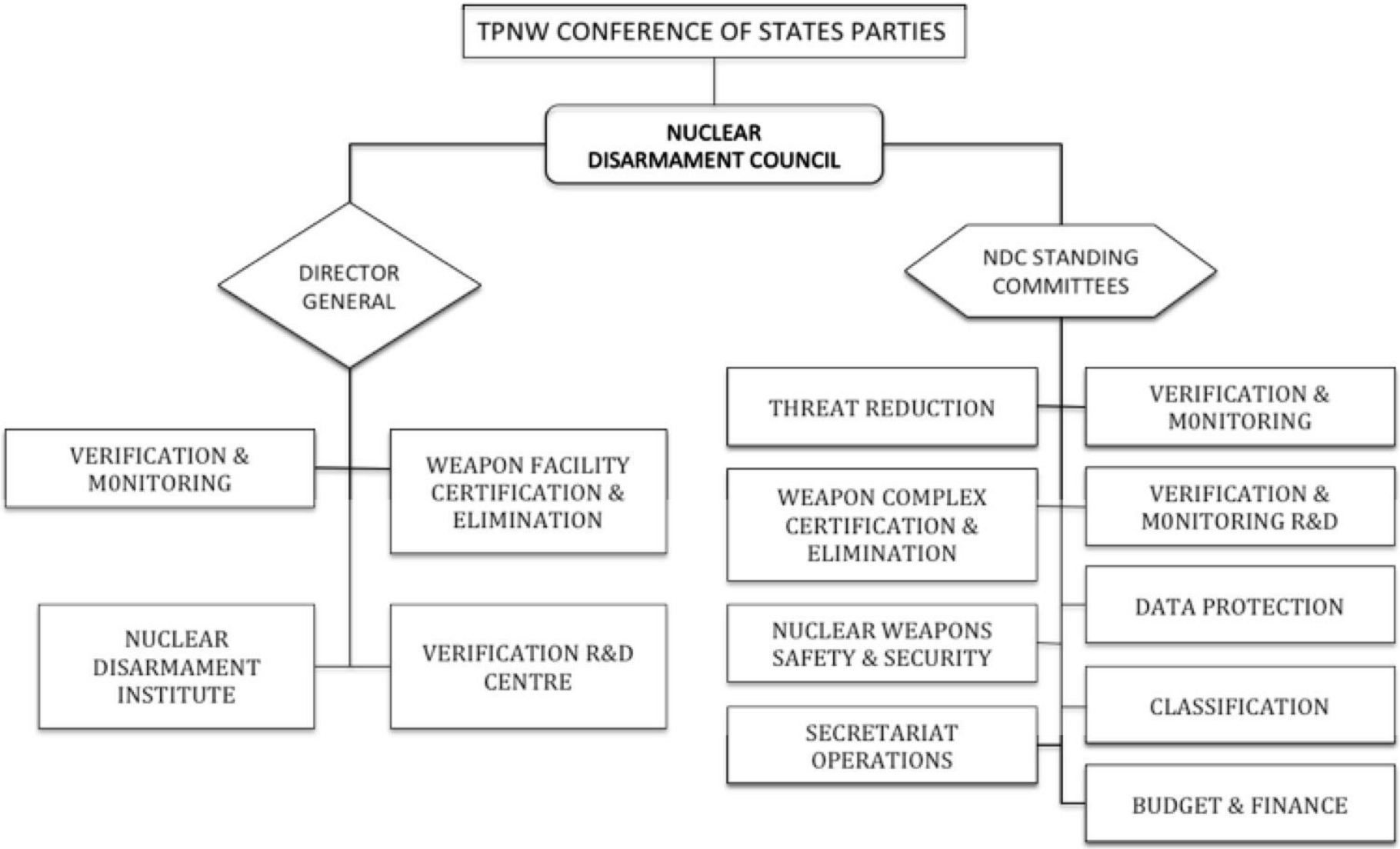
# Nuclear Arsenals, Adversaries & Allies



# Verification Approach

1. Apply a “Theatre-Centric” verification approach for success.
2. Establish priorities for each nuclear-armed State based on prevailing circumstances.
3. Create new International Nuclear Disarmament Agency to address phased elimination of nuclear arsenals. Include an International Centre for Verification Research and Development for classified forms of fissile material.
4. Implement appropriate IAEA safeguards to prevent rearmament.
5. As appropriate, verify elimination or irreversible conversion of mission-critical nuclear weapon facilities to peaceful use, or non-explosive military use.

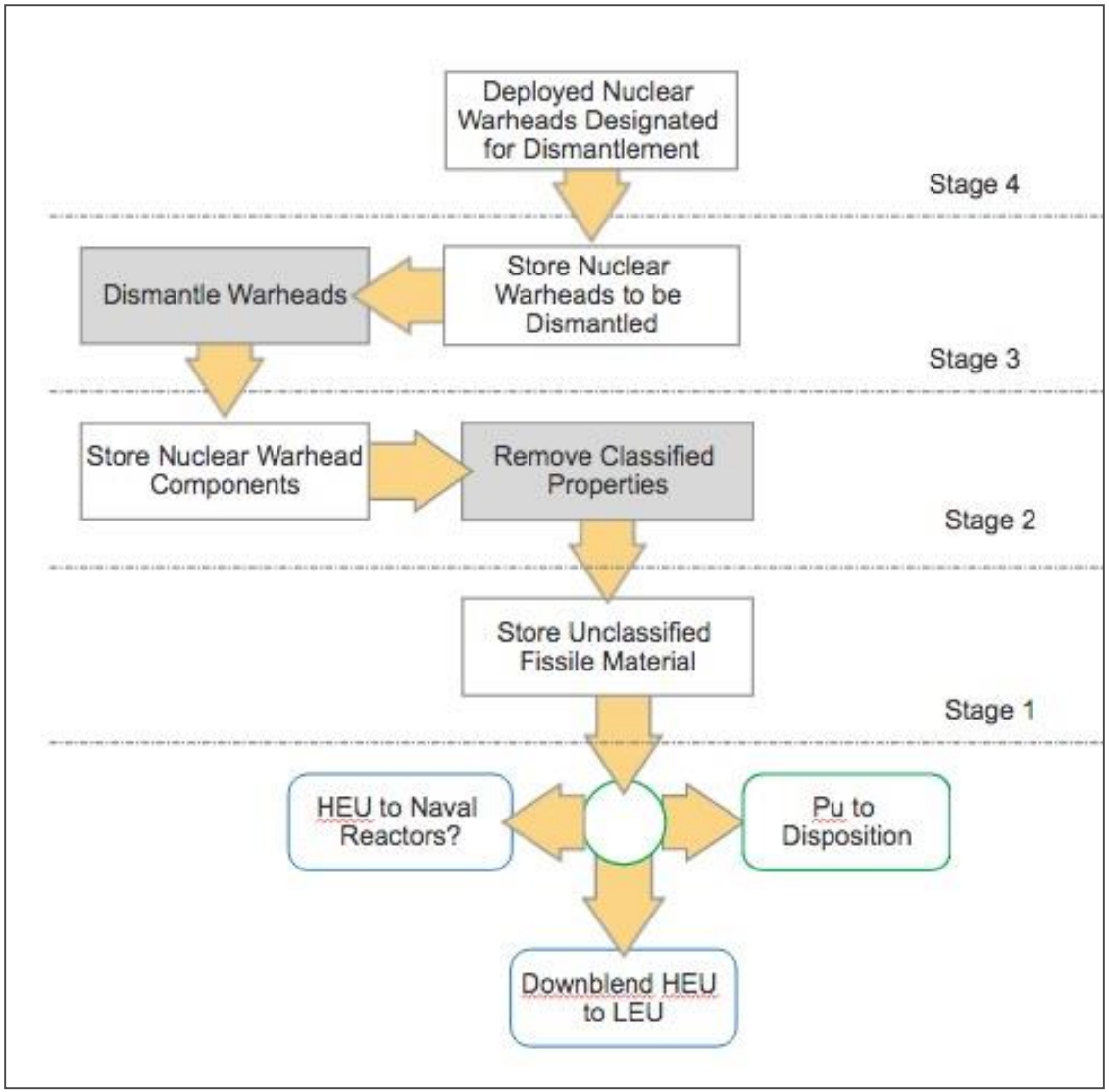
# International Nuclear Disarmament Agency

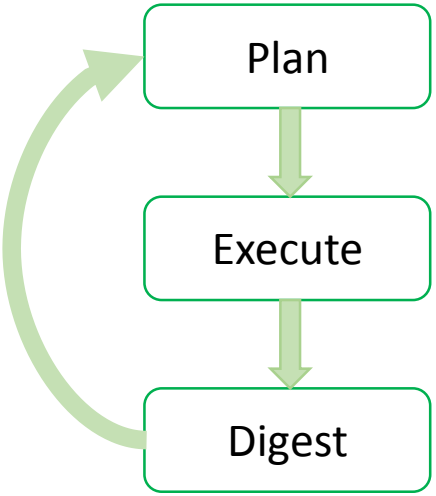


# Verification Assignments

| INDA | IAEA |
| --- | --- |
| 1. Encourage disarmament; | 1. Disposition fissile material |
| 2. Verify arms reductions and fissile material controls at four levels; | 2. Verify converted mission-critical nuclear weapon facilities |
| 3. Certify and eliminate mission-critical nuclear weapon facilities; | 3. Detect diversion of declared stocks of nuclear material from declared facilities |
| 4. Verify non-explosive military use of fissile material | 4. Detect undeclared production, processing at declared facilities |
| 5. Estimate historical production or other acquisition of fissile material for nuclear weapons | 5. Detect clandestine production |
| | 6. Estimate and verify historical production |

# Eliminating Existing Arsenals

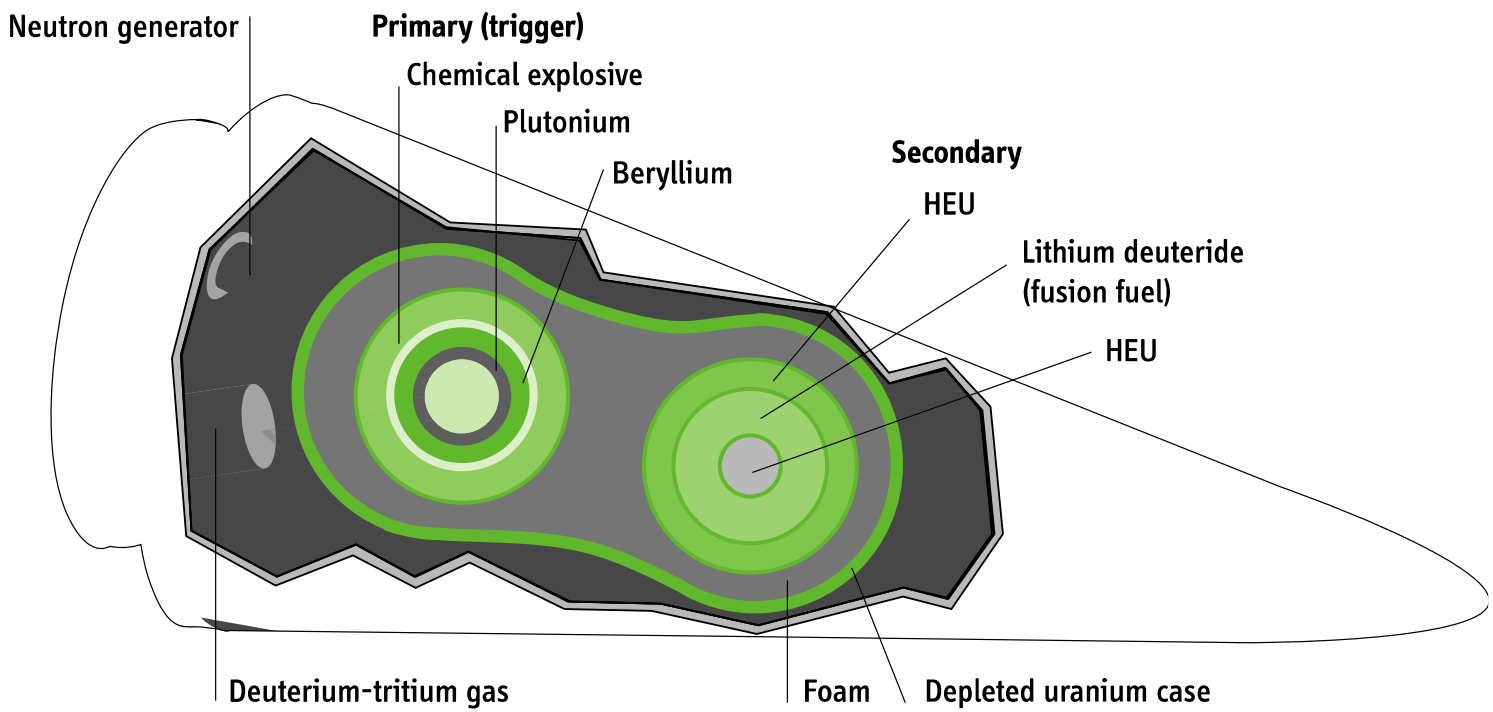


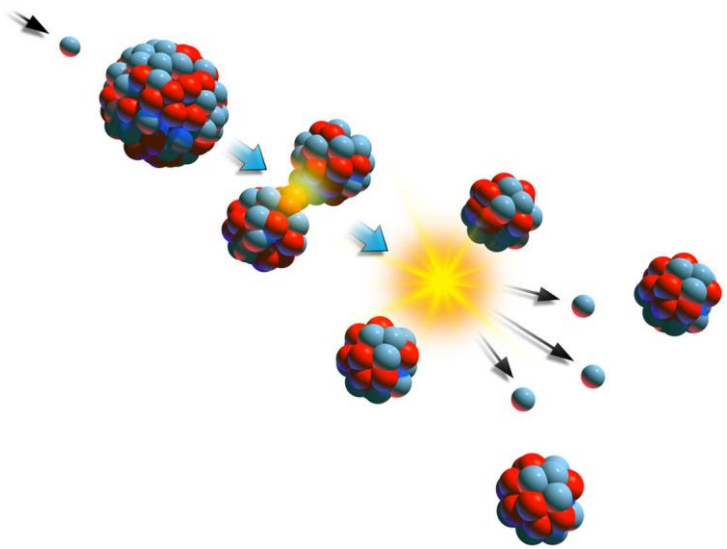
# Strategic / Tactical Nuclear Warheads

- Missile Warheads  (ICBM, MRBM, Cruise)
- Gravity Bombs
- Torpedoes
- Sea Mines
- Artillery Shells
- Man-portable Weapons

# Fissile Material in Nuclear Weapons



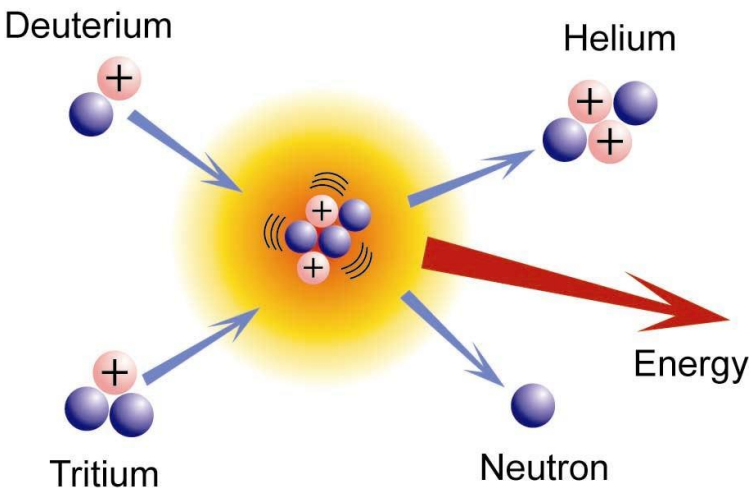

How could international inspectors verify warheads and warhead dismantlement without revealing design or manufacturing secrets?



Uranium-235 is the only naturally occurring fissile nucleus.

Plutonium is a man-made element.

Plutonium rich in the isotope Plutonium-239 and/or Uranium with high enrichments of Uranium-235 are used in all nuclear weapons.




Fusing the isotopes of hydrogen is the easiest reaction to create.

# Verification of Classified Forms of Fissile Material

- Each nuclear-armed State must be satisfied that the methods and procedures will not enable inspectors to gain access to nuclear weapon design or manufacturing secrets.
- INDA must be satisfied that the verification results are based on sound science and are authentic.
- Use of computers in the verification systems opens possibilities for hacking and back-door functions that could circumvent the approval arrangements.
- *Ergo, first generation verification systems should include no electronic components.*
- *R&D should be carried out by scientists from all TPNW States Parties.*

# Verification determines disarmament value

| | |
|---|---|
| 1* | Pu and/or HEU present? |
| 2* | Isotopics as used in nuclear weapons? |
| 3* | Mass of Pu and/or HEU above specified minimum? |
| 4 | Exact mass of Pu and/or HEU verified? |
| 5 | Mass of Pu and/or HEU in bins? |
| 6 | Total Pu and/or HEU verified? |
| 7 | Warhead, pit or secondary? |
| 8 | Warhead, pit or secondary model ID? |

* Scope of Trilateral Initiative

Moving down allows faster progress, but complicates security approvals.

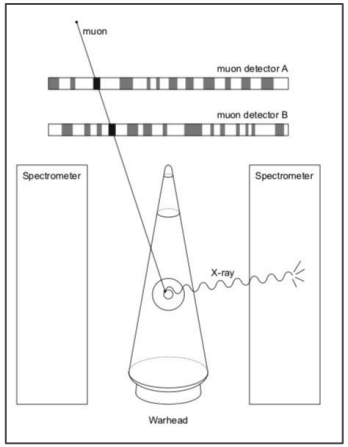
# Possible Methods for Verifying Nuclear Warheads

- Trilateral Initiative: Attribute Verification by Neutron and Gamma Ray Assay

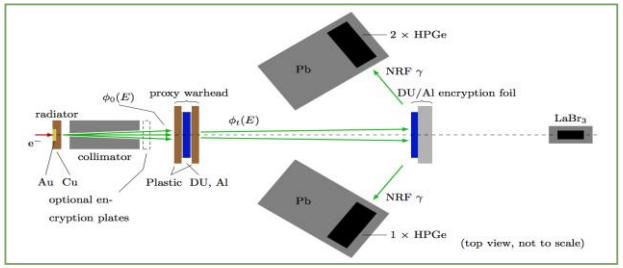
- BNL Thermal Neutron Imaging

- Princeton Bubble Chambers

- VA Tech Cosmogenic Muons




- MIT Nuclear Resonance Fluorescence



# Elimination / Irreversible Conversion of Mission-Critical Nuclear Weapon Facilities

The U.S. Pantex plant assembles, maintains and dismantles all U.S. nuclear weapons.

# Verification Missions

| INDA | IAEA |
| --- | --- |
| 1. Encourage nuclear-armed States to disarm; | 1. Dispose of fissile material |
| 2. Verify arms reductions and fissile material controls at four levels; | 2. Convert mission-critical nuclear weapon facilities to peaceful use |
| 3. Certify and eliminate mission-critical nuclear weapon facilities; | 3. Detect diversion of declared stocks of nuclear material at declared facilities |
| 4. Verify non-explosive military uses of fissile material | 4. Detect undeclared production, processing at declared facilities |
| 5. Estimate historical production or other acquisition of fissile material for use in nuclear weapons | 5. Detect clandestine production |
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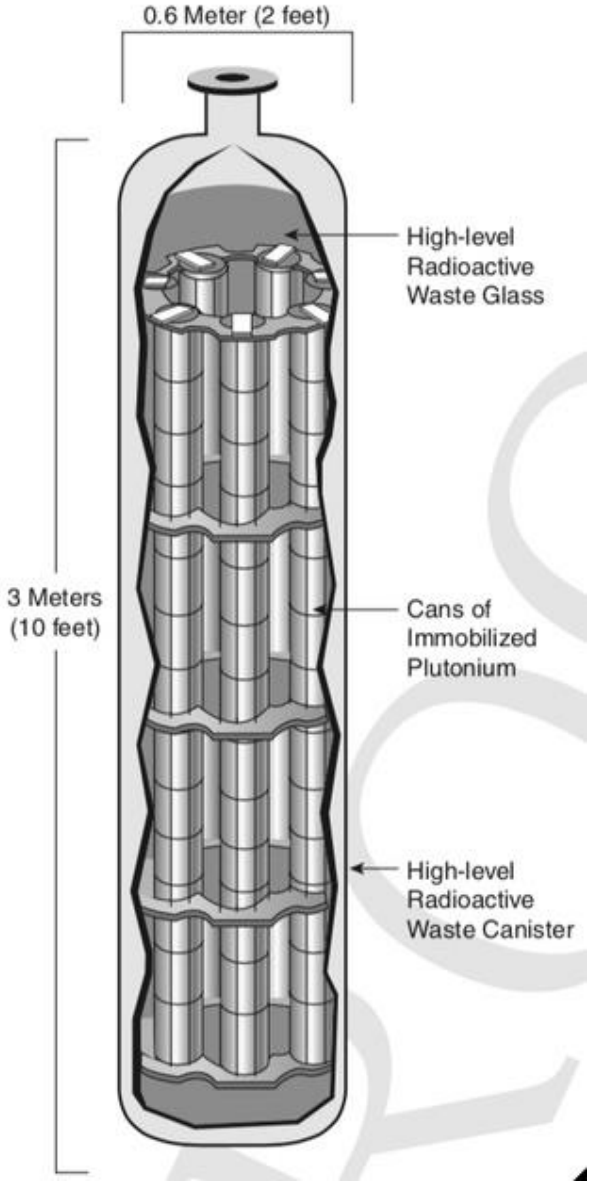



A can-in-canister arrangement could be used to severely impede re-use of plutonium from nuclear weapons, which would also reduce the risks of re-armament and reduce the costs of verification.

## Legal Annexes

A.1: Text of the Treaty on the Prohibition of Nuclear Weapons

A.2: A model INDA Nuclear Disarmament Verification Agreement

A.3: IAEA model safeguards agreement for sustainable disarmament

## Technical Annexes

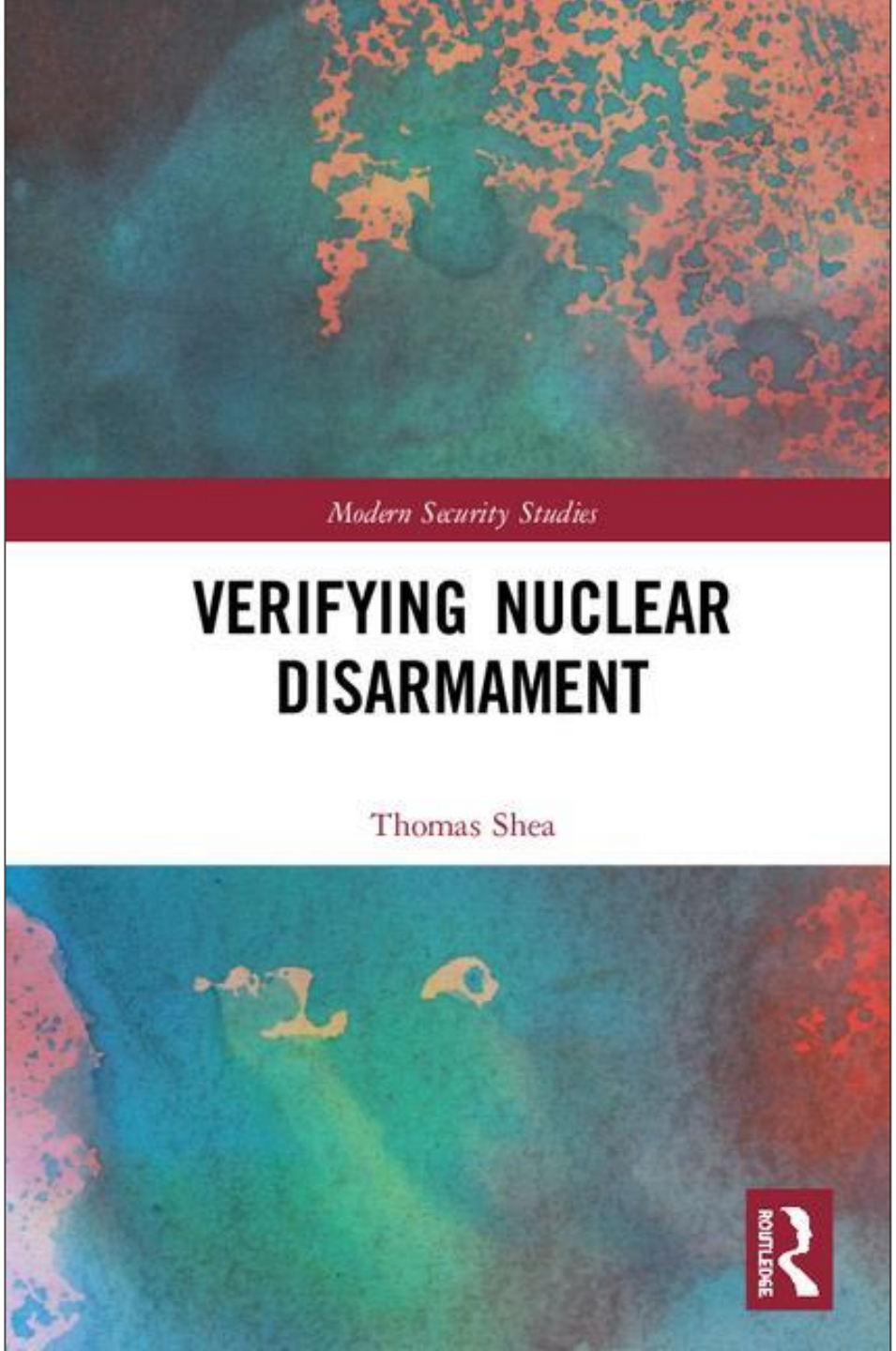
B.1: International Centre for Nuclear Disarmament R&D: Installations & initial tasks

B.2: Candidate verification methods for classified forms of fissile material

B.3: Inspection procedures for classified forms of fissile material

# Confidence Building Measures

1. Bilateral arms reduction treaties
2. TPNW engagement exercises
3. Temporary monitoring of nuclear weapons, warheads, or warhead components
4. Controls on warhead refurbishment and re-manufacturing
5. Export/import controls for nuclear-armed states
6. Controls on fusion materials
7. Standardizing dismantlement and conversion facility architecture
8. Extra-territorial siting
9. Antineutrinos
10. Subsidizing disarmament




Disarmament won't come quickly, quietly, or cheaply.

Important to start, bring TPNW into force, establish verification framework, commence R&D on methods and procedures.