SAND2011-6284C

# International Nuclear and Radiological Threat Reduction

## *role of radiation measurements*

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**International Nuclear Threat Reduction**
**Sandia National Laboratories**

**DOECAP 2011**
**September 19-22, 2011**
**Pleasanton, California**
**USA**

**SAND# 2011-6284 C**

Sandia National Laboratories is a multi-program laboratory managed and operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.

Sandia National Laboratories

National Nuclear Security Administration

# Presentation Outline

- Sandia National Laboratories Mission Areas
- International, Homeland and Nuclear Security (IHNS)
  - Sandia's Global Security Programs
    - International Nuclear Threat Reduction (INTR)
- National Security Issues: What is the problem?
- Strategies to Combat WMD Proliferation
- Demand Reduction Strategies – New Initiatives
- Security Issues in the Middle East
- INTR Middle East Program
  - RMCC Project - Update

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# Four Mission Areas

- Nuclear Weapons
- Defense Systems and Assessments
- Energy, Climate, and Infrastructure Security (ECIS)
- International, Homeland and Nuclear Security (IHNS)

  Nonproliferation
  - Global Security Programs
  - Other Programs


***Helping our nation secure a peaceful and free world through technology***

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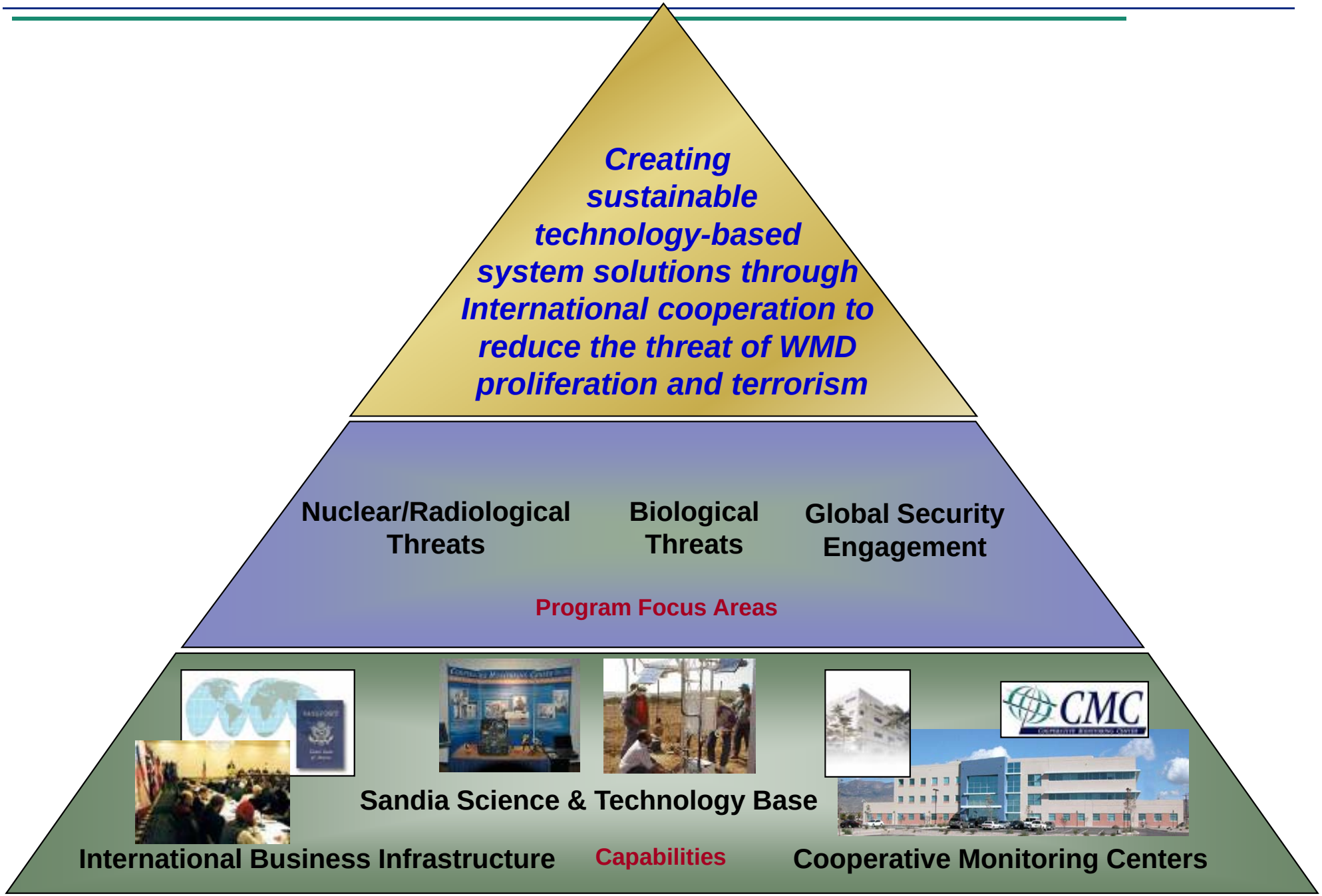
# Global Security Programs



# Cooperative Monitoring Centers (CMC)

*Enabling International Technical Cooperation on Critical Security Issues*

**Technology integration and operation**

**Technology testing and demonstration**


**Technology training courses and workshops**

**Technical collaborations and experiments**

**Visiting scholars program, research, and analysis**

# SNL's International Nuclear Threat Reduction (INTR) Department

## Key Theme

- Develop and Implement "Advanced technical concepts for reducing nuclear threats"
- Elements of Program
  - Nuclear Material Controls
  - Nuclear Technology and Facility Controls
  - Nuclear Expertise Controls
  - Nuclear Arms Controls
- **Both topical and regional emphasis**

SAND2011-5097C

# Processes/Approaches Used in Our Work

- Idea generation/ advanced concepts
- Engagement
- Training
- Capacity Building
- Experimentation/Demonstration
- Analyses
- Sandia Reach-back to related Sandia capabilities and competencies

SAND2011-5097C

# Our Work in the INTR Department Supports

- **DoD Strategic Military Framework to Combat WMD in Consequence Management and Emergency Preparedness**
- **DOS Partnership Programs, Capacity Building, Human Resource Development**
- **Other Government and Non-Government Organizations (NGOs)**
  - **Provide full-spectrum system solutions to lower the risk posed by nuclear proliferation and terrorist threats, radiological events, or accidents from peaceful uses of nuclear energy or nuclear material**

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# What's the Problem? What's the Potential Solution?

- "**. . .by developing atomic energy for peaceful uses, you reach the nuclear weapon option. There are not two atomic energies.**"

  **David Bergman, former Chair, Israeli Atomic Energy Commission**

- **Goal: Reduce the risk that states can acquire the capabilities to develop nuclear weapons; Maintain a separation between peaceful and non-peaceful uses of nuclear energy**
  - **Reduce the risk that states might believe that their neighbors were acquiring the capabilities to develop nuclear weapons**

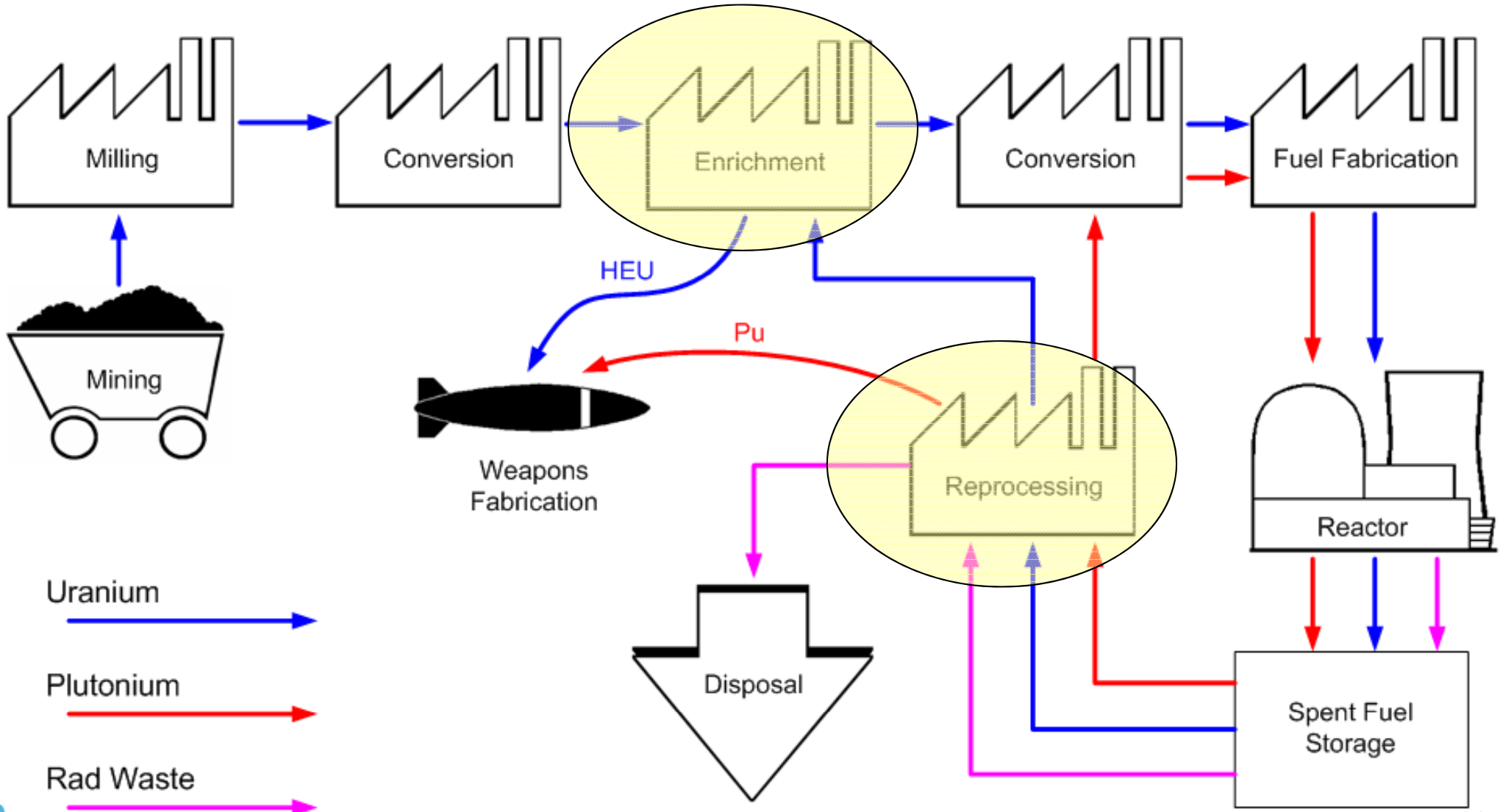
- **Elements of a nuclear weapons capability**
  - **Material**
  - **Technology**
  - **Expertise**
  - **Motivation**

- **Potential Solutions**
  - **Restrict access to key elements**
  - **Monitor the use of key elements**
  - **Reduce the motivation**

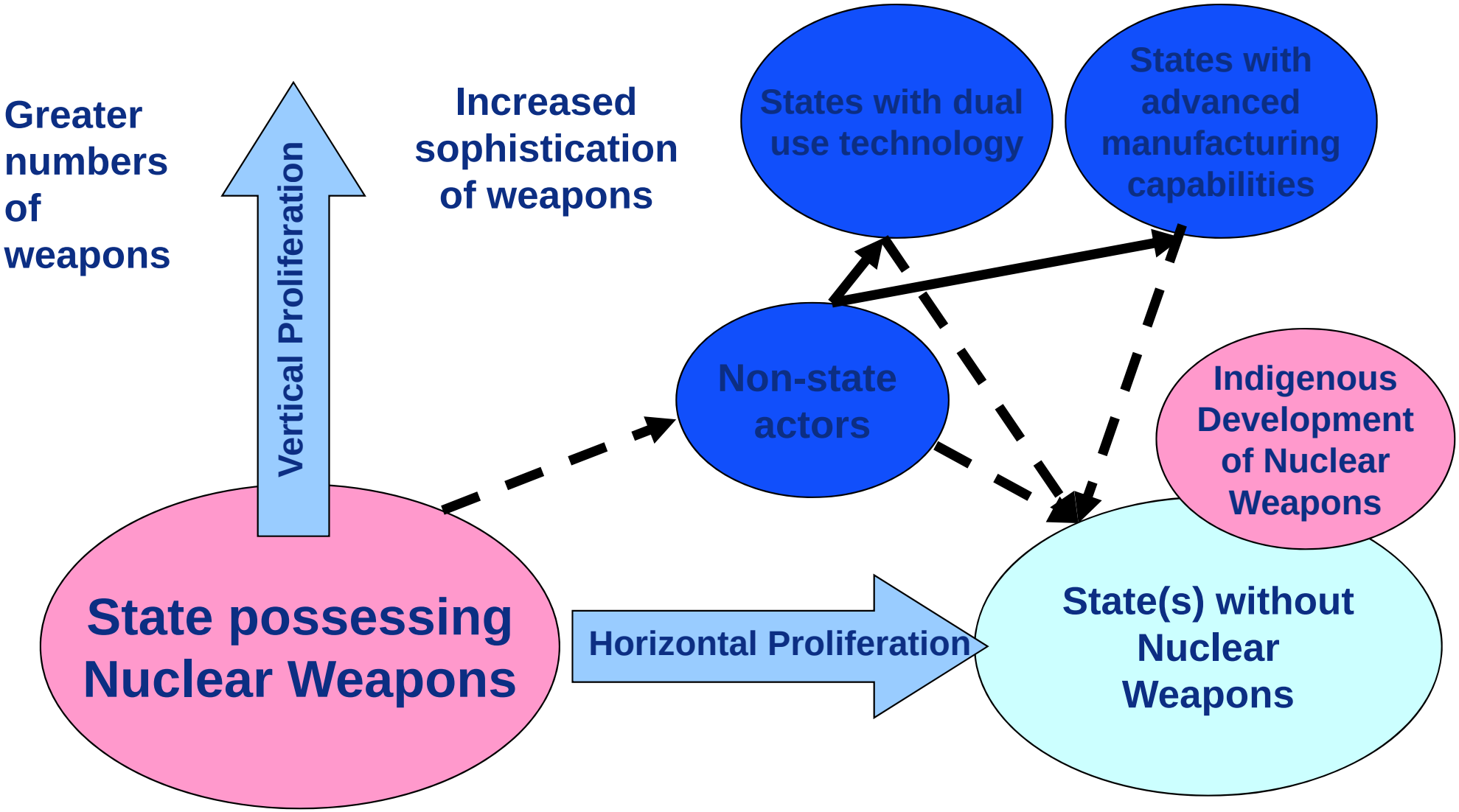
***Restricting the dispersion of sensitive materials and technologies can limit opportunities and reduce misperceptions***

# The Civilian Nuclear Fuel Cycle: A Review

**Plutonium and high-enriched uranium might be used to produce nuclear weapons.**



# A New Kind of Proliferation (?)



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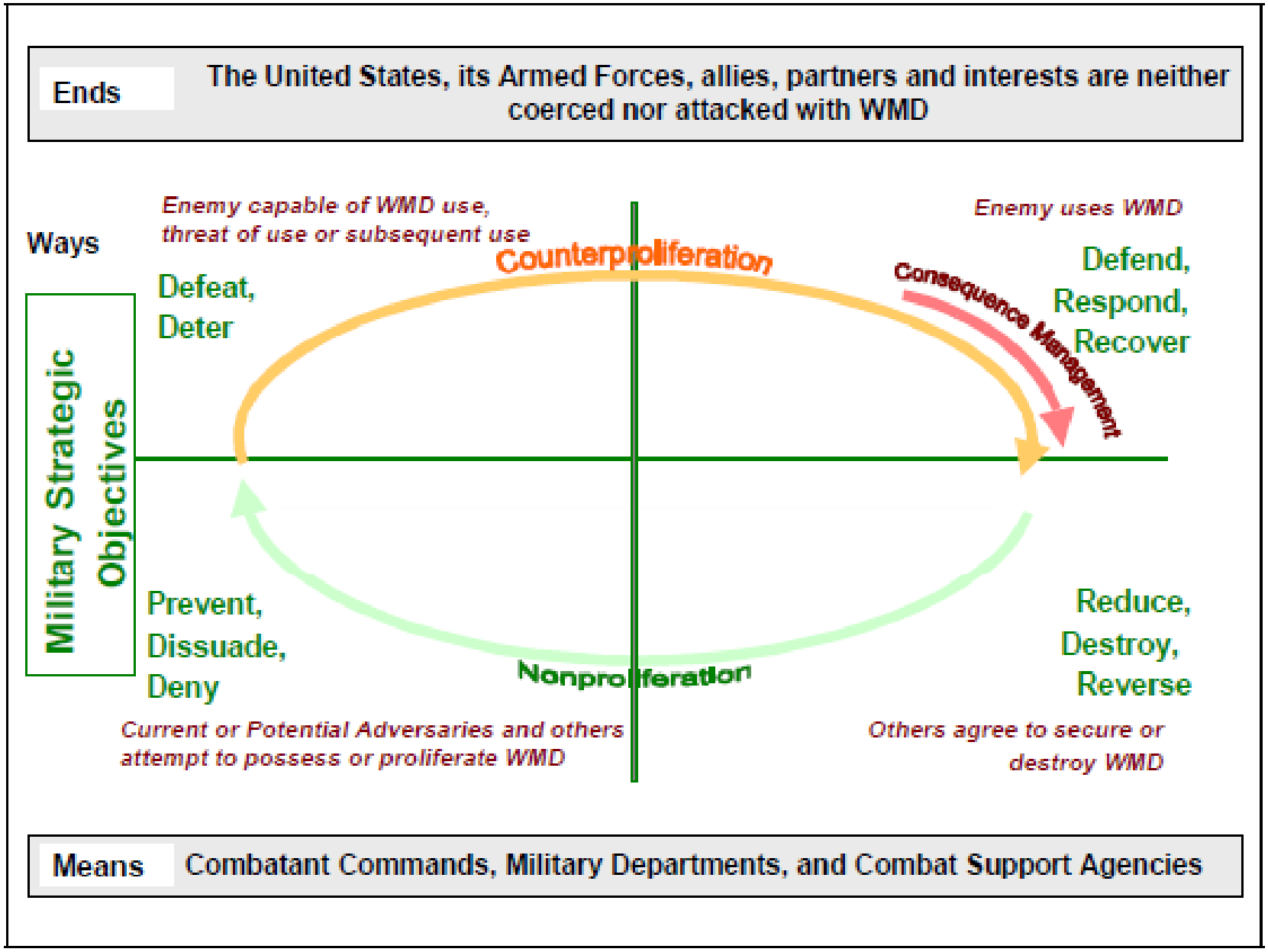
# General Strategies for Dealing with CBRN Threat


**Workshops, Analytical Studies, Visiting Scholars, Capacity Building, and Technical Projects are tools that can be deployed to implement these strategies**

# Strategic Military Framework to Combat WMD



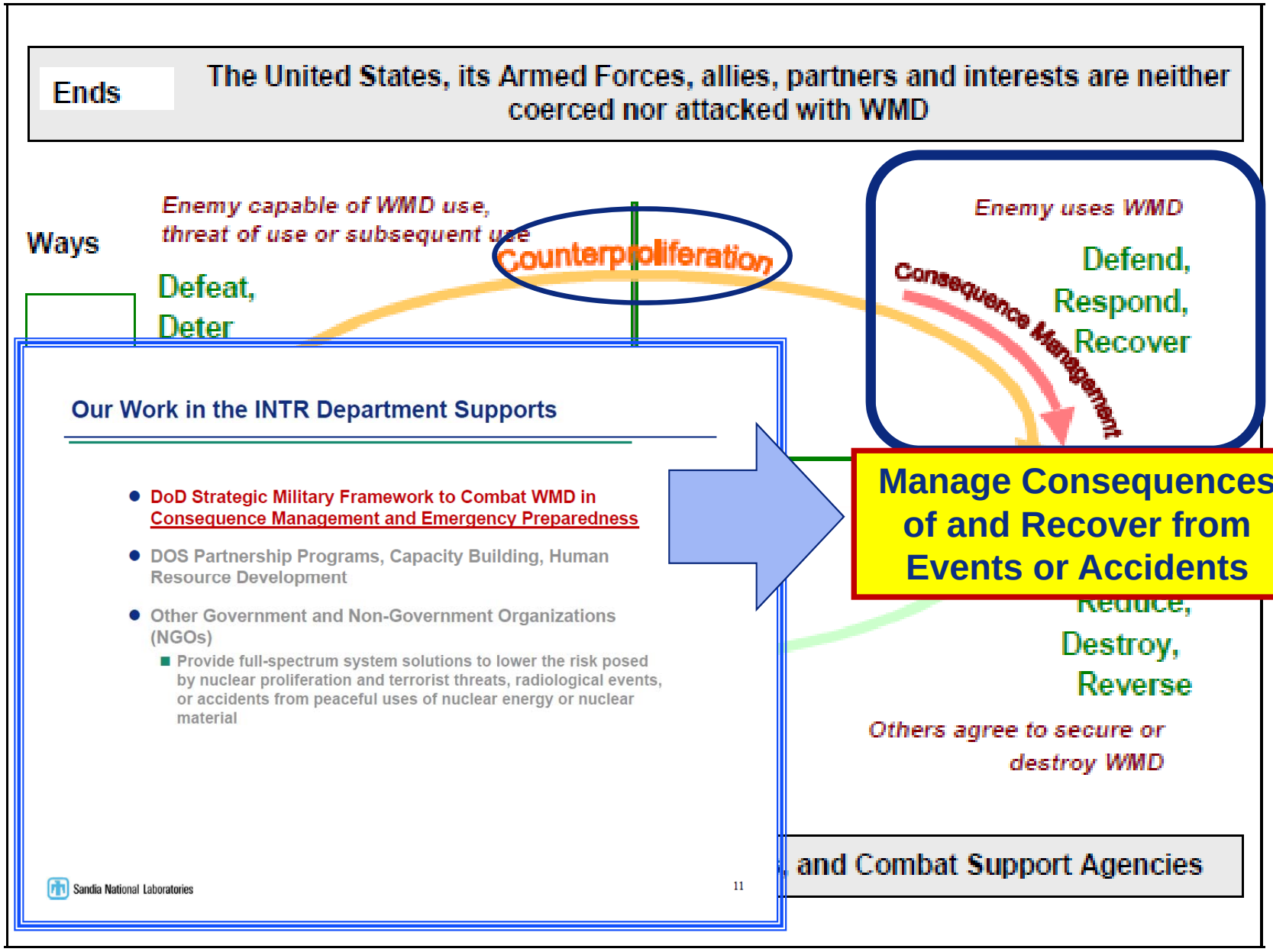
# Framework Consists of:


**Ends:** Military Strategic Goals and Associated End State

**Ways:** Ways to Achieve Military Strategic Objectives

**Means:** Combatant Commands, Military Departments, and Combat Support Agencies

# Military Strategy to Combat WMD: Counter-proliferation



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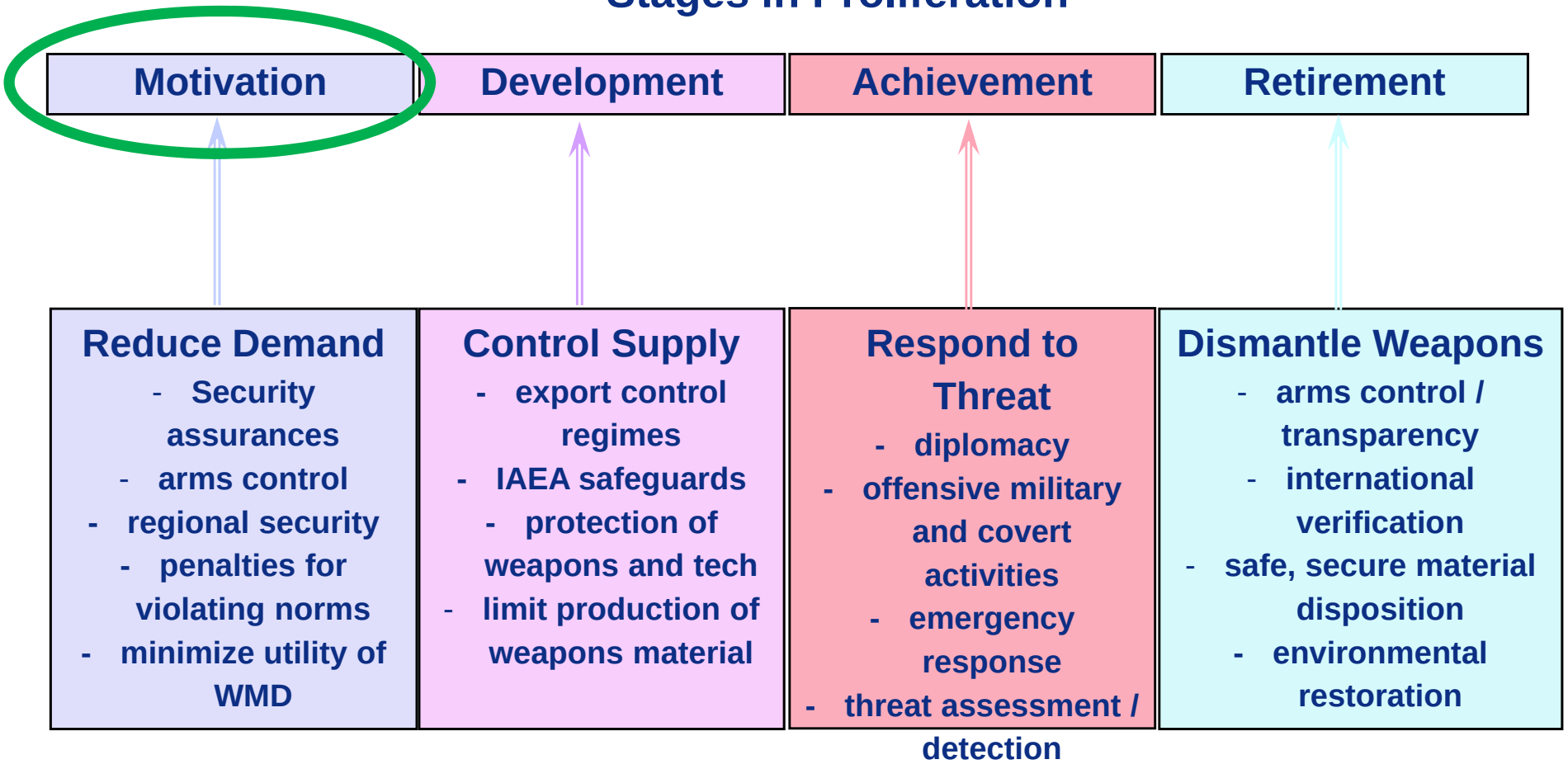
# Different possible strategies for dealing with proliferation

## Stages in Proliferation




**Strategies to prevent, rollback, or mitigate consequences of proliferation**

# What motivates countries to develop nuclear weapons?

| | |
|---|---|
| **Security** | Nuclear weapons are considered to be an effective deterrent against nuclear and non-nuclear enemies. |
| **Prestige** | States that possess nuclear weapons have greater influence across a range of forums (e.g., permanent membership in UNSC) |
| **Power** | Nuclear weapons confer inordinate destructive and political power and can give weak states global influence. |

# Can approaches to reducing demand be tailored according to the "connectivity" of states to global systems and institutions?

| Connected | Marginally Connected | | Disconnected | |
|---|---|---|---|---|
| Japan | Argentina | Indonesia | Libya | Somalia |
| South Korea | Brazil | Vietnam | Columbia | Sudan |
| Germany | South Africa | Thailand | Algeria | Syria |
| Sweden | Egypt | Malaysia | Iran | Afghanistan |
| Canada | Jordan | Saudi Arabia | Iraq | DPRK |
| Italy | Bangladesh | Qatar | | |
| Australia | | Kenya | | |
| New Zealand | | Nigeria | | |
| …… | | ……. | | |

Possible "connectivity" categorization scheme

# Connected States: Assuring Continued Commitment to Nonproliferation Norms

- **Address regional security concerns**
  - **Resolve DPRK nuclear standoff**
  - **Reinvigorate US security alliances in East Asia**

- **Refrain from further restrictions on nuclear fuel cycle technology**
  - **High dependence on nuclear energy**
  - **Outstanding record on compliance with nonproliferation norms**

## Marginally Connected States: Strengthen commitments to nonproliferation norms and accelerate global connectivity

- Nuclear weapon states act to decrease the perceived value of nuclear weapons
- Nuclear weapon states act to increase prestige of "connected" non-nuclear weapon states
- All "connected" states act to raise status of non-nuclear, non-weapons technology as symbol of technological excellence
- "Connected" states developed nonproliferation partnerships with "marginally connected" states
- Assist "marginally connected" states acquire nuclear power in ways that reduce proliferation risk
- Consider providing security assurances in key regions

## Disconnected States: Decreasing support (tacit or explicit) for terrorist organizations or black-market networks

- **Build capacity of legitimate governments**
  - Governance
  - Public health
  - Security for citizens
  - Border control
- **Accelerate global connectivity**
  - Military to military partnerships
  - Educational partnerships
  - Economic partnerships

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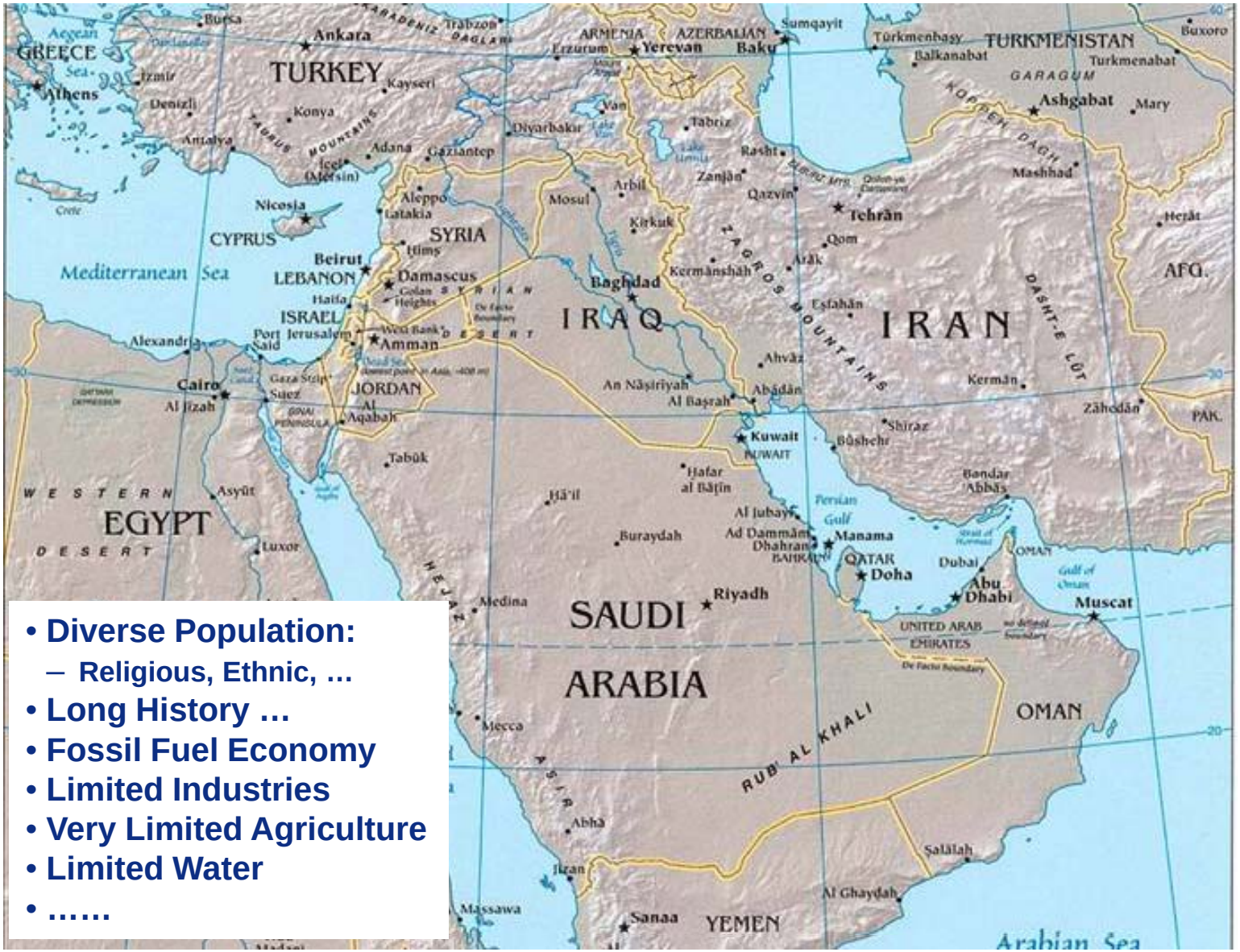
# Middle East Geo-Political Background



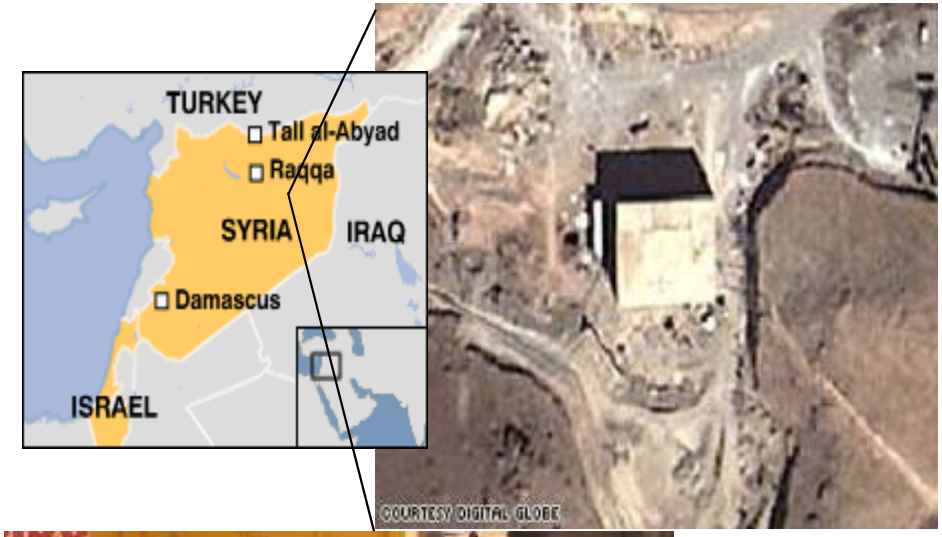

- **Diverse Population:**
  - **Religious, Ethnic, …**
- **Long History …**
- **Fossil Fuel Economy**
- **Limited Industries**
- **Very Limited Agriculture**
- **Limited Water**
- **……**

# National Security Issues in the Middle East

***Robert Gates on Iraq***

***Developments in Iraq over the next year or two will, I believe, shape the entire Middle East and greatly influence global geopolitics for many years to come.*** **December, 2006**

- **Issues:**
  - **Stabilization of Iraq and Afghanistan**
  - **"Arab Spring"**
  - **Israeli Arab Conflict**
  - **WMD Proliferation**
  - **Terrorism and Failed States**
  - **Energy Security**
    - **Fossil fuels**
    - **Nuclear energy**
    - **Renewable energy**
  - **Resource Management (e.g. water)**




**We have been working with our colleagues in the Middle East for over a decade**

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# SNL's INTR Middle East Program

- Middle East Scientific Institute for Security (MESIS)
- Gulf Nuclear Energy Infrastructure Institute (GNEII)
- Technical Collaborations
  - Middle East Disease Surveillance
  - Radiological Source Security
  - Natural Resources Studies
  - Water Security
  - Border Cooperation
  - Energy Security and the Role of Nuclear Energy
  - Radiation Measurements Standards (e.g. RMCC)

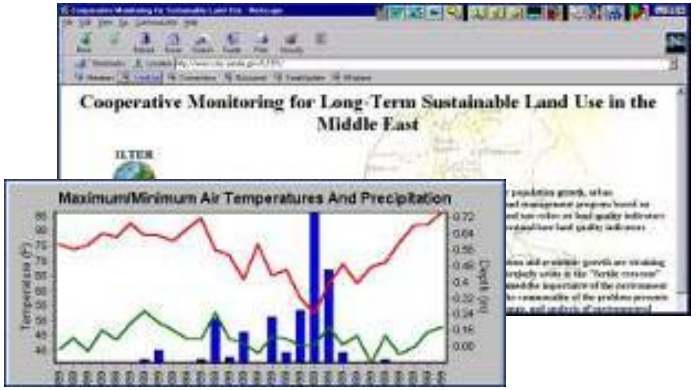
MESIS
معهد الشرق الأوسط العلمي للأمن
Middle East Scientific Institute for Security

GNEII at KHALIFA UNIVERSITY

Tour of CNESTEN research reactor

UCLA Burkle Center for International Relations

Middle East Security Dialogue in Athens




Sustainable Land Use Project

Explosives detection portal

# Middle East Scientific Institute for Security (MESIS)

## formerly CMC@ Amman

- **An institute established by Sandia in Amman, Jordan in 2002 as the Cooperative Monitoring Center @ Amman on campus of the Royal Scientific Society (RSS)**
- **Focus on technical aspects of regional security cooperation in the Middle East**
- **Venue for workshops, technology displays, collaborative research and analysis**
- **Current emphasis on:**
  - **PROMOTING ENERGY, ENVIRONMENTAL AND BORDER SECURITY USING SCIENCE AND TECHNOLOGY**


MESIS

معهد الشرق الأوسط العلمي للأمن

Middle East Scientific Institute for Security

# Gulf Nuclear Energy Infrastructure Institute (GNEII)

- A strategic effort to develop a nuclear energy safety and security culture in future program decision-makers in the Gulf region
- Partnership between Sandia, Texas A&M and Khalifa University of Science and Technology in Abu Dhabi, UAE
- Nuclear energy infrastructure (safety, safeguards & security) for development & education in a regional context
- *Not* intended to train nuclear engineers or operators, intended instead to educate and prepare future leaders of Gulf nuclear energy programs

Khalifa University, UAE

MOU signing, Feb. 2011

GNEII Pilot Course Graduates, May 2011

Pilot GNEII course sessions

GNEII at KHALIFA UNIVERSITY

# Confidence Building and Engagement in the Middle East

- **Middle East Track II Policy Dialogue**
  - Participate in the UCLA  track II meetings on the ME regional security (technical cooperation working group)
  - NDU Regional Network of Strategic Studies Centers in the Middle East ands South Asia – Border Security and WMD, and Non Traditional Security working groups
  - Conduct Studies (NA24 Policy Office)

- **Radiation Measurements Cross Calibration (RMCC) Project**
  - Develop a network of scientists and labs that can devise indigenous solutions to issues such as proliferation monitoring, environmental assessments, emergency response, and radioactive materials smuggling
  - Partner with the IAEA, CTBTO, DOE/MAPEP
  - Conduct workshops in the region

First RMCC Workshop, Kuwait, October 2004

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# Radiation Measurements Cross Calibration (RMCC) Project –

## The Motivation

- **All countries in the Middle East have radiation measurement capabilities associated with:**
  - **Power and research reactors**
  - **Radioactive sources in medicine, commerce, industry**
  - **Responding to accidental or intentional radiation releases**
  - **Environment, health and safety**
  - **Detecting the presence of radioactive sources**
  - **Preventing the illicit use of radiological materials**
  - **Disposing of radioactive sources**

- **Improving and standardizing nuclear monitoring and measurement capabilities in the Middle East are essential elements of developing an approach to such concerns**

# The First Step

- As a first step, develop a set of internationally recognized standards for laboratory radiation measurements in the Middle East
- The project consists of
  - Signup for the DOE proficiency testing program (MAPEP)
  - Receive test samples
  - Analyze and report
  - Follow-up with regional workshops to discuss the results and identify technical assistance needs
  - Participate in targeted studies by the IAEA labs in Seibersdorf
  - Annual workshops

# Past RMCC Workshops

- **RMCC-I: Co-hosted by the Kuwait Institute for Scientific Research (KISR), October 2004**
  - **Participation from Kuwait, Saudi Arabia, Qatar, UAE, Bahrain, Oman, and Jordan**

- **RMCC-II: Co-hosted by the Supreme Council for the Environment and Natural Reserves (SCENR), Doha, Qatar, November 2005**
  - **Participation from Kuwait, Saudi Arabia, Bahrain, Qatar, UAE, Oman, Jordan, and Yemen**

- **RMCC-III: Co-hosted by the Ministry of Regional Municipalities, Environment and Water Resources (MRMEWR), Muscat, Oman, April 2007**
  - **Participation from Kuwait, Bahrain, Iraq, Qatar, Oman, Jordan, and Yemen**

- **RMCC- IV: Co-hosted by the University of Bahrain and the Marine Emergency Mutual Aid Centre (MEMAC), Kingdom of Bahrain, March 2008**
  - **Participation from Kuwait, Saudi Arabia, Bahrain, Qatar, Oman, UAE, and Jordan**

# Past RMCC Workshops

- **RMCC V -2009: Co-hosted by The Qatar University and The Qatar Petroleum (QP)**
  - **First participation by France, Tunisia, and Morocco**

- **RMCC VI - 2010: Coordinated The Middle East Scientific Institute for Security (MESIS), Jordan, and Co-hosted by Jordanian Atomic Energy Commission and Jordanian Nuclear Regulatory Commission (JNRC)**
  - **Participation by all RMCC Members and Tour of The Jordanian Royal Scientific Society Laboratories**

# The RMCC Project Benefits

- Increased confidence in data quality across the region
- Availability of a network of qualified labs for radiological measurements
  - Build up the capacity in the region to produce reliable radiological data

- Improved scientist-to-scientist communication
  - Provides a mechanism for sharing of agreed upon information
  - Enables scientists in the region to work cooperatively to create indigenous solutions to the problems in the region
  - Fosters the development of a network of scientific experts in the region

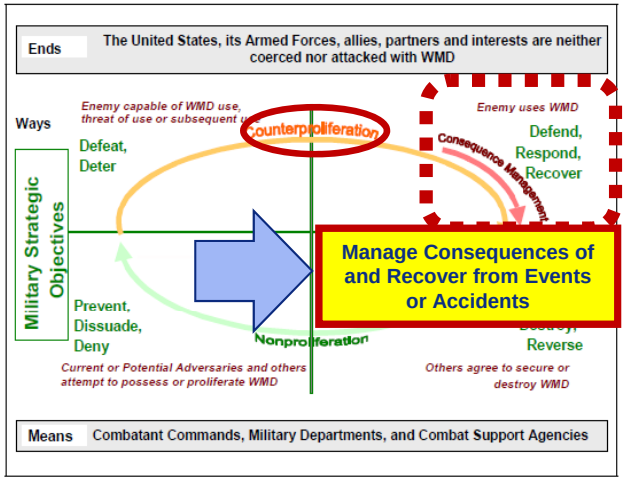
- Training Opportunities
  - Austria – The IAEA Labs in Seibersdorf
  - Germany – Federal Bureau for Radiation Protection
  - USA – Sandia National Laboratories
  - Regional Opportunities

# The RMCC Future

- **Next Annual Workshop**
  - **Location: National Center for Energy Sciences and Nuclear Techniques [Centre National de l'Energie, des Sciences et Techniques Nucléaires (CNESTEN), Rabat, Morocco**
  - **Organizer(s): MESIS, CNESTEN, in partnership with Arab Atomic Energy Agency (AAEA)**
- **Formation of RMCC Advisory Council (RMCC-AC)**
  - **GCC**
  - **North Africa/ Arab League**
  - **Identify gaps and recommend future actions**
- **Suggested by past workshop participants**
  - **A Professional Society, Middle East or Regional**

# Participation in MAPEP Supports:

**Counter-proliferation:**
**Consequence Management of and Recovery from Events or Accidents Involving Radiological Material**




**Safety and Security of Peaceful Uses of Nuclear Energy and Nuclear Material:**
**Develop High Quality Human Resources and Laboratory Analysis Capabilities**

# Thank You for Your Attention