

Developing GNEII for Regional Expansion

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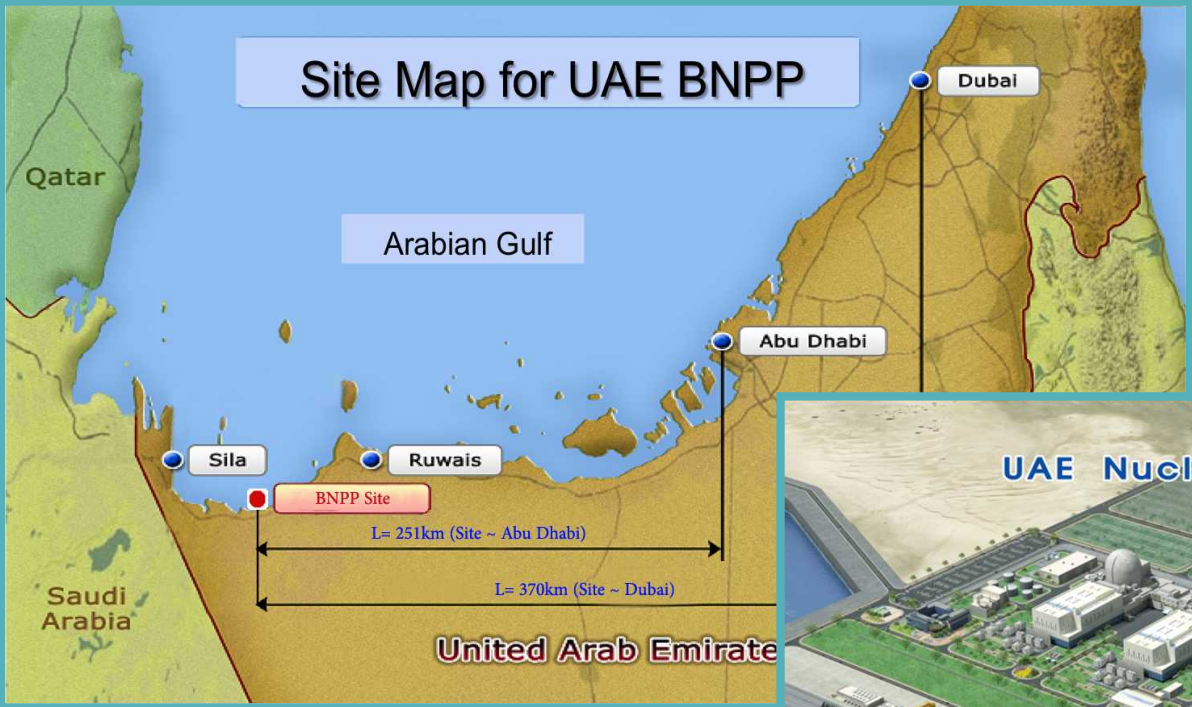
A.D. Williams, A.H. Mohagheghi, R.J. Finch

*Sandia National Laboratories**



Conference on
Nuclear Training and
Education

UAE Nuclear Program



Khalifa University Background

- Established on 13 February 2007 by **His Highness Sheikh Khalifa bin Zayed Al Nahyan**, the President of the UAE
- Born of the vision of **His Highness Sheikh Mohammed Bin Zayed Al Nahyan**, Crown Prince of Abu Dhabi, Chairman of Board of Trustees
- **Etisalat University College** (established 1989) acquired to provide foundation of engineering programs



Vision and Mission

VISION

To be a **leading international center of higher education and research in technology and sciences**

MISSION

An independent, non-profit, multi-cultural, co-educational institution

Dedicated to the advancement of learning through teaching and research and to the discovery and application of knowledge

Pursues international recognition as a world class research university, with strong tradition of interdisciplinary teaching and research and of partnering with leading universities around the world



The Gulf Nuclear Energy Infrastructure Institute



KHALIFA
UNIVERSITY



Background

GNEII is designed to be:

- A **regionally based** institute for development of human resource capability
- A part of nuclear energy 3S (safety, safeguards & security) infrastructure for **development & education** in a regional context
- A **strategic effort** to develop a responsible nuclear energy culture in future program decision-makers

****Not intended to train nuclear engineers or operators, intended instead to educate and prepare future leaders of region's nuclear energy programs*



Background

GNEII is a **Strategic Partnership**

UAE PARTNERS

Under the sponsorship of and implemented by:

- Khalifa University of Science, Technology & Research

With Support from

- The Federal Authority for Nuclear Regulation (FANR)
- The Emirates Nuclear Energy Corporation (ENEC)
- Critical Infrastructure and Coastal Protection Authority (CICPA)

US PARTNERS

Under the sponsorship of:

- **DOE/NNSA** – International Nuclear Safeguards and Engagement Program (INSEP) & International Nuclear Security department (INS)
- **DOS/CTR** – Partnership for Nuclear Security (PNS)

Implemented by:

- Sandia National Laboratories (**SNL**)
- Texas A&M University (**TAMU**)

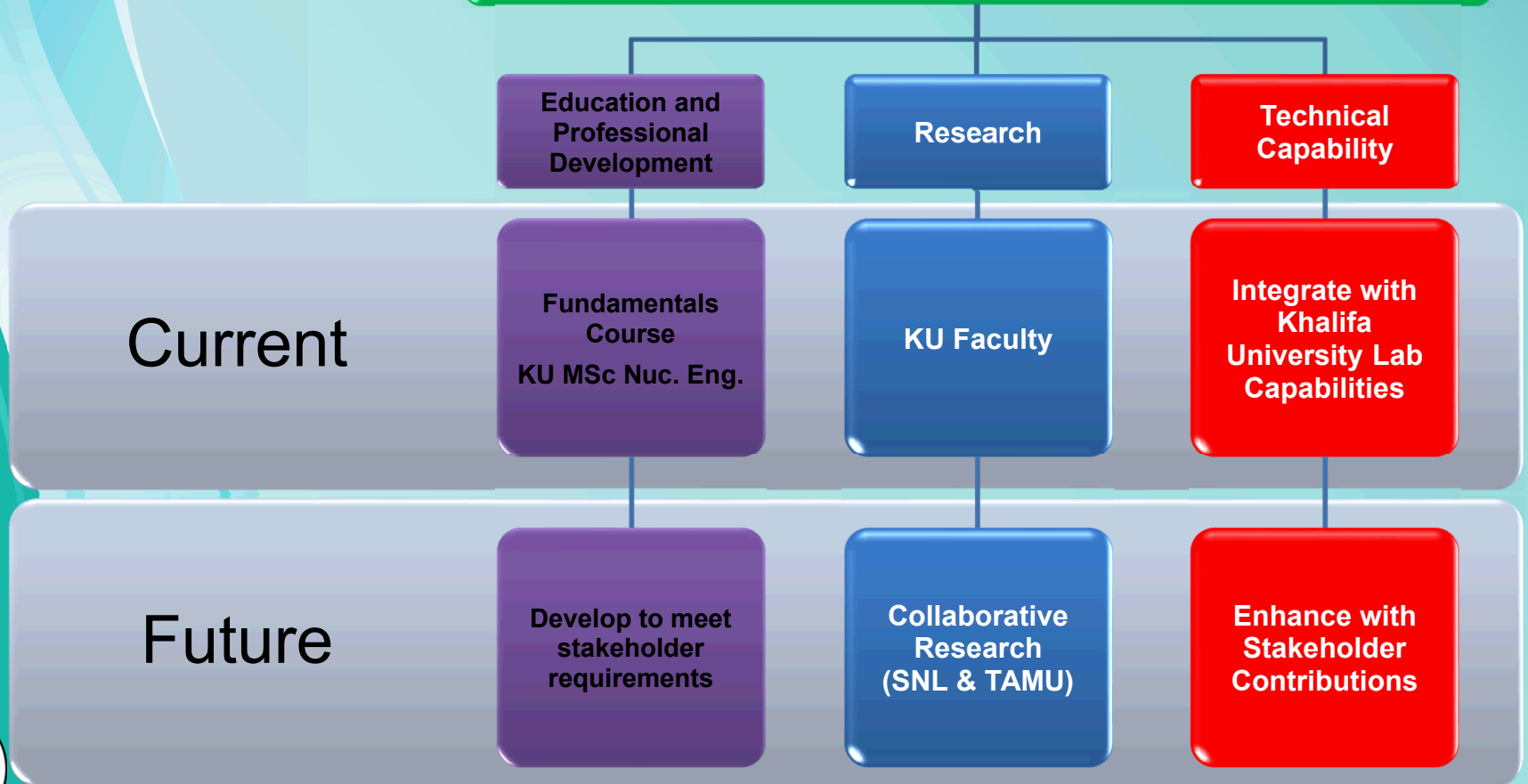


CONTE



GNEII - The INSTITUTE

Elements of the Institute



Education

- ***GNEII Fundamentals Course***
 - **Nuclear Energy Technical Foundations**
 - Critical Thinking, Systems Approach, Physical Foundations, Nuclear Fuel Cycle
 - **Nonproliferation, Safeguards, Safety & Security**
 - International Nonproliferation Regime, International Safeguards, Safety Culture and Risk Analysis, Physical Protection and Security Culture, 3S Interactions
 - **Capstone Research**
 - Educational and intellectual foundation for conducting independent research
 - Bridges GNEII's *Education* and *Research* elements
- ***2015 Fundamentals Course [11 January -21 April]***
 - GNEII Symposium on 21 April 2015



GNEII Fundamentals Course

- **Enrollment**

- 64 GNEII Fellows Graduated since 2011
- 19 Fellows enrolled for 2015

- **Regional Participation**

- Gulf Cooperation Council (GCC) countries
 - UAE, Saudi Arabia, Kuwait, Qatar
- Jordan (2012, 2015)

	2011	2012	2013	2014	2015
Fellows:	10	22	20	12	19
Countries	1	5	3	1	2



Short Courses and Workshops

- To supplement the Fundamentals Course, GNEI is developing capability to offer/conduct more specified knowledge transfer:
 - Hosted ‘Root-Cause Analysis’ Course in August 2014
 - Hosted Nuclear Security Curriculum Development Workshop in December 2013



Research

Research Areas

Integrated 3S
Methodologies

Nuclear
Infrastructure
Development

Gulf/Middle
East Regional
Nuclear
Interactions

Research Methodology

Fundamentals
Capstone

Joint Research

Collaboration
within Khalifa
University

Research Goal

Provide the Gulf - and surrounding region - an avenue through which the global nuclear community can effectively collaborate to achieve broader nuclear energy safety, security and safeguards priorities



2014 GNEI Capstone Projects

- 1. Survey of the Current Spent Nuclear Fuel Storage Technologies & Assessing Safety Approaches of Existing Systems for Barakah Nuclear Power Plant (BNPP)**
- 2. Development of Recommendations for the Nuclear Security Culture in the UAE**
- 3. Evaluation of Security and Safeguards Measures for the Transportation Security in the UAE**
- 4. Evaluation of Safeguards and Security Options for the Dry Cask Storage in the UAE**
- 5. Synergy between Safeguards and Security at an NPP**
- 6. An Initial Radiation Baseline Study of Urban Environment in Abu Dhabi**
- 7. Effective Enhancements for Integrated Safety and Security Control Systems in BNPP**



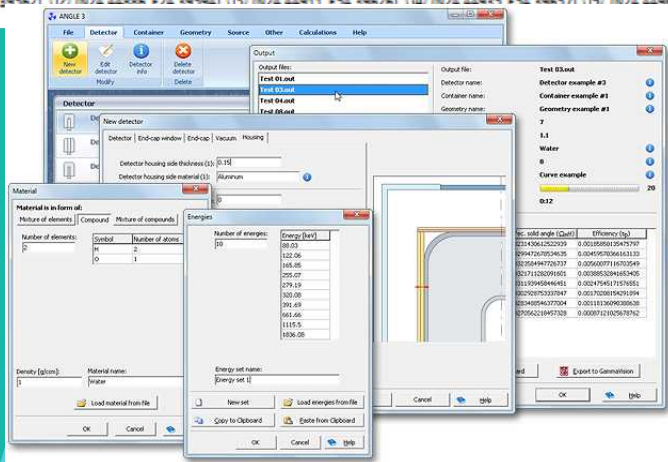
Radiation Baseline in AD Urban Environment

GPS Sector Locations



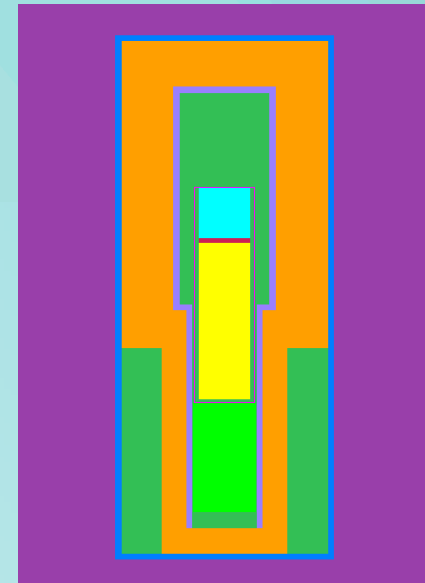
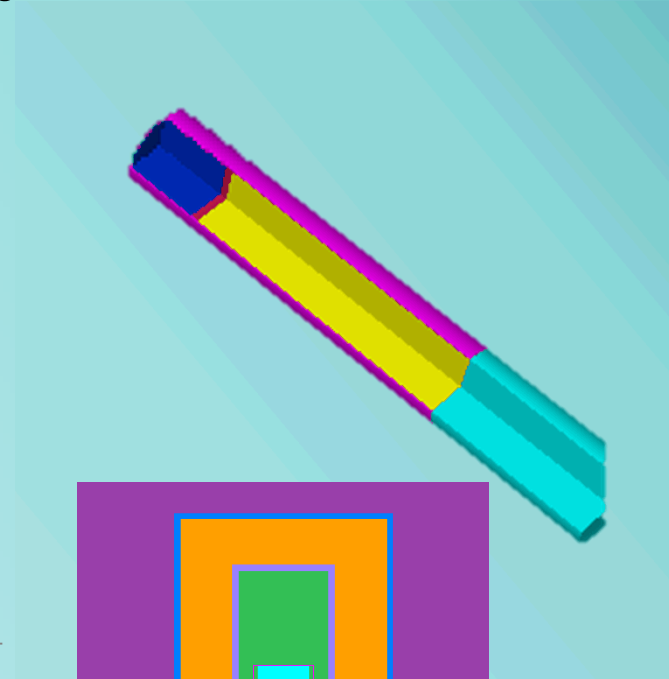
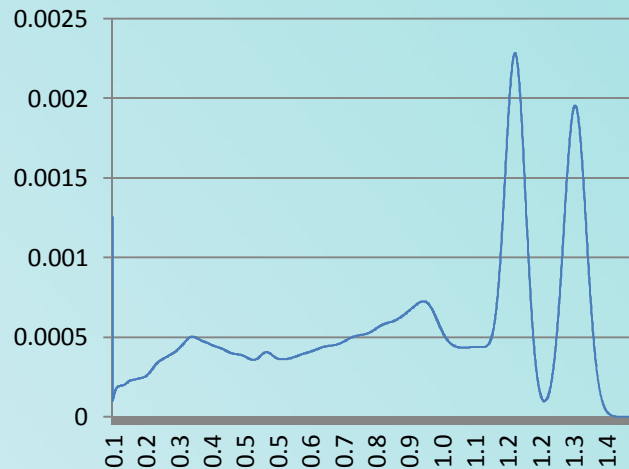
Coordinates

- ① (N24.44805 E54.39614) ② (N24.44829 E54.39647) ③ (N24.44853 E54.39679) ④ (N24.44877 E54.39711) ⑤ (N24.44901 E54.39746)
- ⑥ (N24.44833 E54.39589) ⑦ (N24.44857 E54.39621) ⑧ (N24.44882 E54.39653) ⑨ (N24.44906 E54.39685) ⑩ (N24.44930 E54.39716)
- ⑪ (N24.44862 E54.39467) ⑫ (N24.44886 E54.39499) ⑬ (N24.44911 E54.39531) ⑭ (N24.44934 E54.39563) ⑮ (N24.44958 E54.39595)



Monte Carlo Detector Modeling

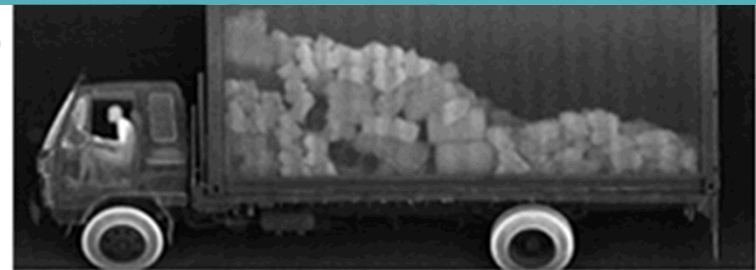
- Monte Carlo modeling capabilities for safeguards and security applications
 - Radiation portal monitors
 - Detector Efficiency Transfer
 - U enrichment measurement simulations
- ANSWERS MCBEND Monte Carlo radiation transport software
 - model NaI, HPGe and CZT detectors
 - benchmark with experimental data
 - benchmark with ISOCS, ANGLE



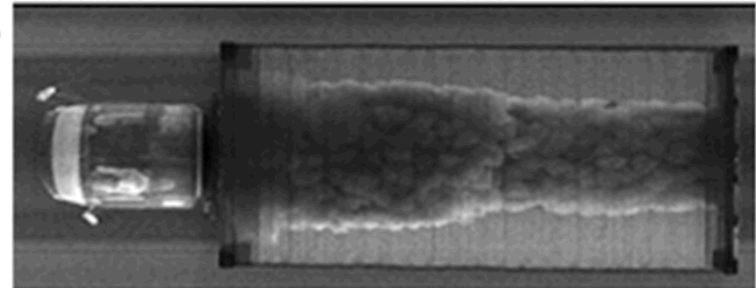
Abu Dhabi Port Security



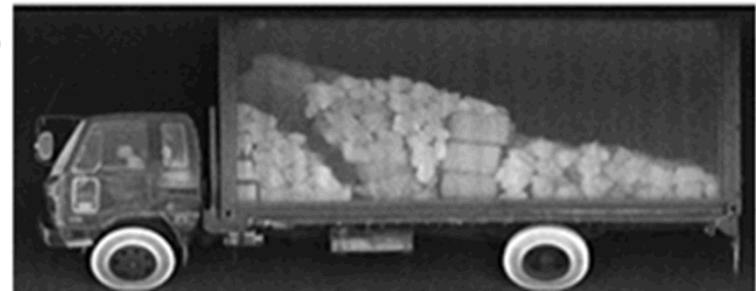
Z Backscatter,
Left



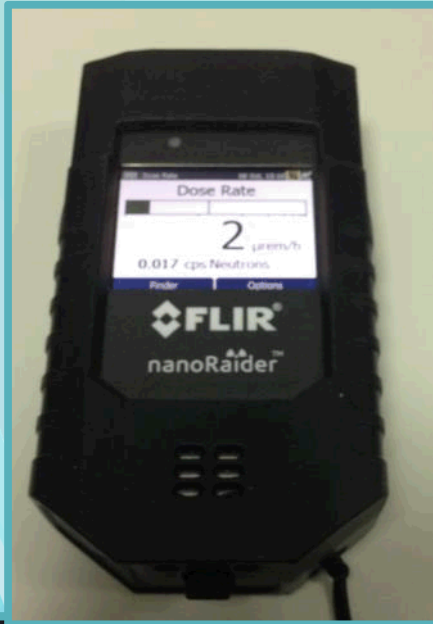
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Top View



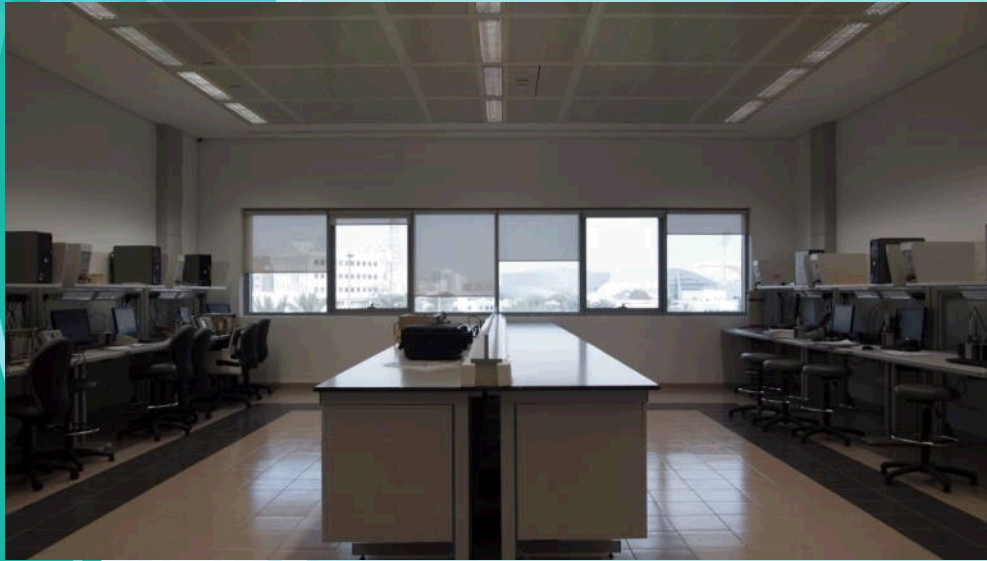
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Right



Technology & Demonstration



Radiation Detection and Safeguards Laboratory



Geiger-Müller (GM) Tube:

- Spectrum Techniques ST360
- RSS5: Set of five sources, Alpha, Beta, Gamma.
- RAS20: Set of 20 calibrated absorbers.



NaI(Tl) Scintillation Detector:

- Radiation Sensors 6S6P1.5VD
- 1.5" 10 stage Photomultiplier Tube (PMT) mated to a 1.5" X 1.5" NaI(Tl) cylindrical scintillation crystal



Silicon Detectors for Alpha / Beta:

- ORTEC Silicon Charged-Particle Detectors
- With vacuum chamber, NIM-bin, and oscilloscope



NaI(Tl) LED Temperature-Stabilized Scintillation Detector

- CANBERRA's NAIS-2x2 NaI(Tl) LED In combination with the Osprey-
- CANBERRA's all-in-one HVPS, preamplifier, and digital MCA
- Collaboration with Khalifa University Robotics Institute (KURI)



Radioactive Isotope Identifier :

- SAM 940 from Berkeley Nucleonics Corporation
- 2" x 2" Sodium Iodide (NaI) detector
- Ethernet connections
- Allows third party hardware such as GPS



Multi-purpose Handheld Contamination Meter :

- Thermo Scientific's RadEye B20
- Pancake GM-tube detector for alpha, beta, gamma and X-ray radiation



Environmental Radiation Measurements Laboratory



Gamma Spectroscopy System (HPGe Detector) with Automatic Sample Changer:

- ORTEC GEM40P4
- Detection Efficiency: 40%
- Energy resolution: 1.85 keV for 1.33 MeV peak of ^{60}Co



Low Background Alpha and Beta Counter:

- Protean Instruments WPC 1050
- Ultra low background detection: 0.1 cpm for Alpha, 0.9cpm for Beta
- Detection efficiency: 40% for ^{210}Po / ^{231}Am / ^{230}Th / ^{137}Cs , 35% for ^{99}Tc and 55% for ^{90}Sr / ^{90}Y



Liquid Scintillation Counter:

- Perkin Elmer LSC-Tri-Carb 3110 TR
- Detection efficiency: 60% for ^3H , 95% for ^{14}C



HPGe Detectors from FANR:

- ORTEC: 60% detection efficiency
- CANBERRA: 40% detection efficiency



Source Safe:

- IAEA standard samples
- U.S. DOE MAPEP sample



Preparation Room:

- Oven, rotor mill and vibratory sieve shaker
- Fume hood, emergency shower and eye wash



Future Regional Expansion

- More invitations offered across the Gulf, Middle East and North Africa
 - Streamlined logistics process/timeline for assisting with logistics developed
- Enhanced social media presence being developed for easier access to institute materials/information
- Ongoing discussions toward establishing a GNEI International Partners Council



The Role of Education in Nuclear Security Culture

- Growing **recognition that more** needs to be done to **prepare managers, scientists and engineers** who work with nuclear materials for the **technical and professional challenges** they face today—especially in regard to security and nuclear proliferation
- Alan Heyes “An Assessment of the Nuclear Security Centers of Excellence”*:
 - “An example is the Gulf Nuclear Energy Infrastructure Institute (GNEII) which was established to strengthen nuclear energy security, safeguards, and safety infrastructure throughout the Gulf region”



* <http://www.stanleyfoundation.org/resources.cfm?id=481>

SHUKRAN

- For more information or to nominate GNEII Fellows, please contact us:
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