

Physical Protection Systems Education at PIEAS: Current Status, lessons Learned, and Future Prospects

By

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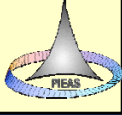
Pakistan institute of Engineering and Applied Sciences (PIEAS)

Presented

at

**International Conference of Physical Protection of Nuclear
Materials and Facilities, Vienna, Austria**

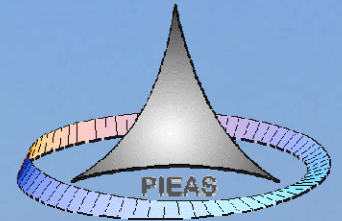
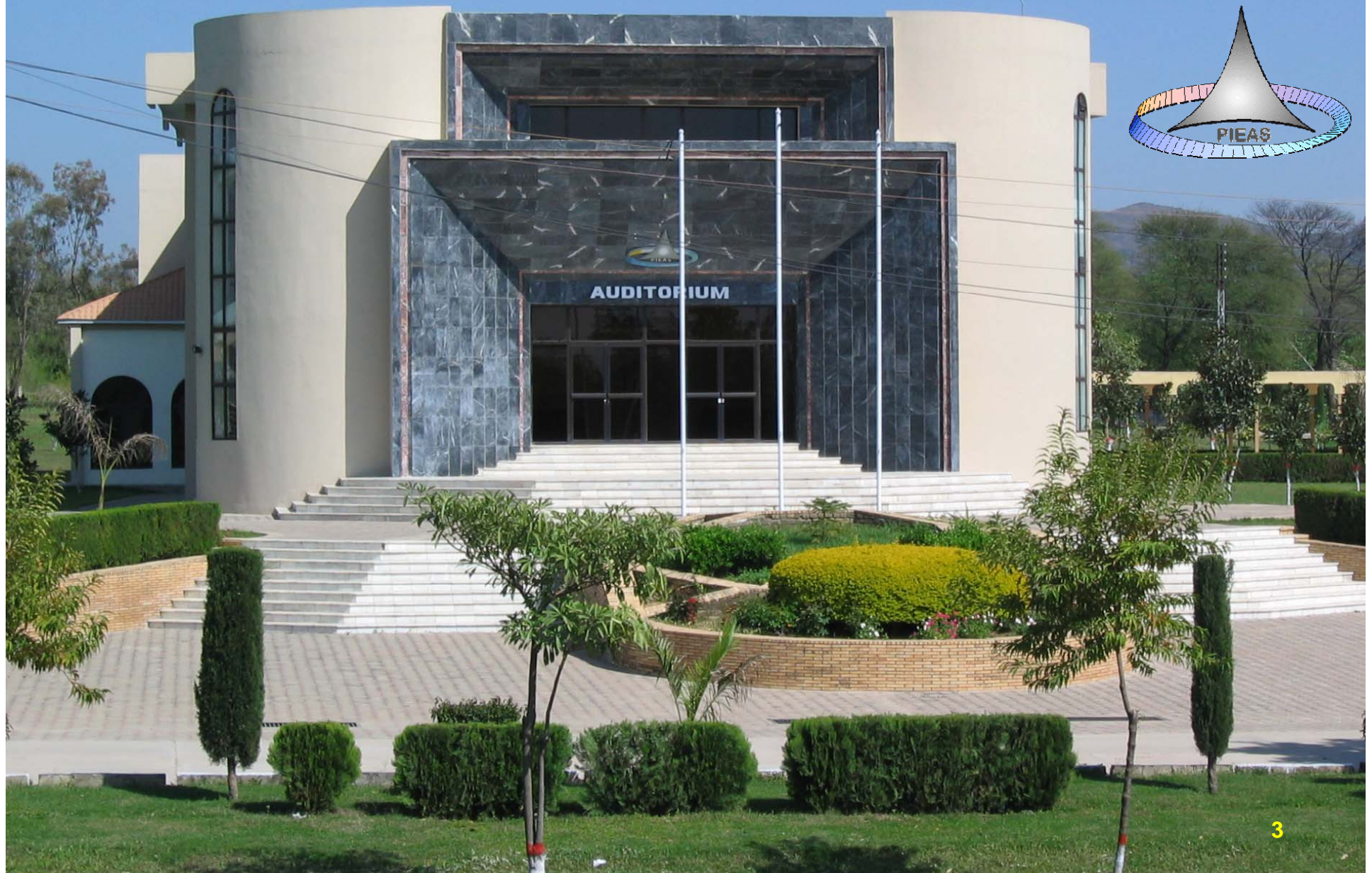
November 13-17, 2017.

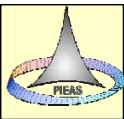


Presentation Layout

- Introduction to PIEAS
- Introduction to MS Nuclear Engineering program
- Physical Protection Systems (PPS) education
 - Modules covered
 - Methodology
 - Class Exercises
 - Case studies
 - Role playing exercise
- Lessons learnt
- Future prospects
- Establishment of physical protection educational laboratories at PIEAS
- Summary and conclusions

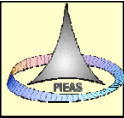
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Background Information

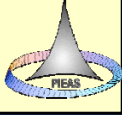
- **Pakistan Nuclear Regulatory Authority (PNRA) initiated nuclear security training and education program in 2007.**
- **PNRA requested PIEAS to initiate MS Nuclear Security educational program in 2008.**
- **IAEA published Nuclear Security Curriculum guidelines NSS-12 in March 2010.**
- **Curriculum guidelines at PIEAS were streamlined in the light of IAEA Curriculum guidelines.**
- **Resource persons were identified**



MS Nuclear Security as Sub-Specialty of MS Nuclear Engineering Program

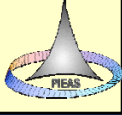
It was decided that MS Nuclear Security will be implemented at PIEAS in collaboration with PNRA as following:

- It will be a part of MS Nuclear Engineering program with specialization in Nuclear Security**
- The core courses of MS Nuclear Engineering will be offered in first two semesters**
- Nuclear Security courses will be offered as elective courses in the third and fourth semester**



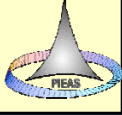
Objectives of MS Nuclear Security Program

- To develop nuclear engineering professionals having comprehensive understanding of the requirements for nuclear security and safety matters**
- To cover the broad areas of prevention, detection and response to theft / sabotage or unauthorized use of nuclear/radioactive materials.**



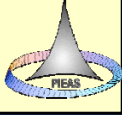
MS Nuclear Security as Sub-specialty of MS Nuclear Engineering Program

- **The main advantages of this approach are:**
 - **The students specializing with Nuclear Security will have thorough understanding of nuclear safety and security matters**
 - **To develop a broader vision of the technical aspects of both nuclear security and nuclear safety for necessary integration**



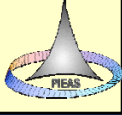
MS Nuclear Engineering at PIEAS

- **MS Nuclear Engineering programme consists of five (05) semesters:**
 - **1st and 2nd Semesters (core courses)**
 - **3rd Semester (core + elective courses)**
 - **4th Semester (core + elective courses + preliminary work on MS thesis)**
 - **5th Semester (dedicated for MS Thesis work)**



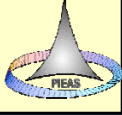
Comparison with IAEA Curriculum

- A thorough analysis of the IAEA's MS (NS) Curriculum Guidelines and the existing MS (NE) Curriculum of PIEAS indicated that
 - Several required courses of IAEA's curriculum are almost similar to the core (compulsory) courses in existing MS Nuclear Engineering curriculum of PIEAS.
 - Elective courses will be introduced in the 3rd and 4th semester



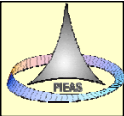
Main Challenges Faced by DNE

- The introduced courses were scrutinized by the following academic bodies
 - Board of Studies (BoS) of Department of Nuclear Engineering
 - Board of Faculties (BoF) of PIEAS
 - Academic Committee of PIEAS (the highest academic body at PIEAS)
 - Starting of complete new discipline for award of MS Nuclear Security will require the approval of Board of Governors (BoG) of PIEAS.



Nuclear Security Education at PIEAS

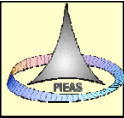
- **The following two elective course have been offered regularly since October 2009**
 - **Introduction to Nuclear Security in 3rd semester, 3 credit hour (Fall 2009)**
 - **Physical Protection Systems in 4th semester 3 credit hour (Spring 2010)**
- **Since then, these two courses have been offered regularly at PIEAS**



Physical Protection Systems (PPS) Education at PIEAS

PPS education at PIEAS has the following parts:

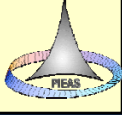
- **Part 1: PPS requirements**
 - Legal requirements
 - Facility and asset characterization
 - Threat assessment and preparation of DBT
- **Part 2: PPS Design**
 - PPS design requirements



Physical Protection Systems (PPS)

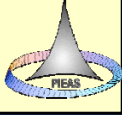
Education at PIEAS (contd.)

- **Part 3: Detection and response systems**
 - **Intrusion Detection Sensors**
 - **Alarm Assessment**
 - **Entry control systems and contraband detection**
 - **Alarm communication and display**
 - **Access delay systems**
 - **Response systems**
- **Part 4: Evaluation of PPS designed system**
 - **Evaluation of PPS**
 - **Adversary sequence diagrams**
 - **Path analysis**
 - **Neutralization analysis**
 - **Scenario analysis**
 - **Insider analysis**



PPS Course Material Preparation

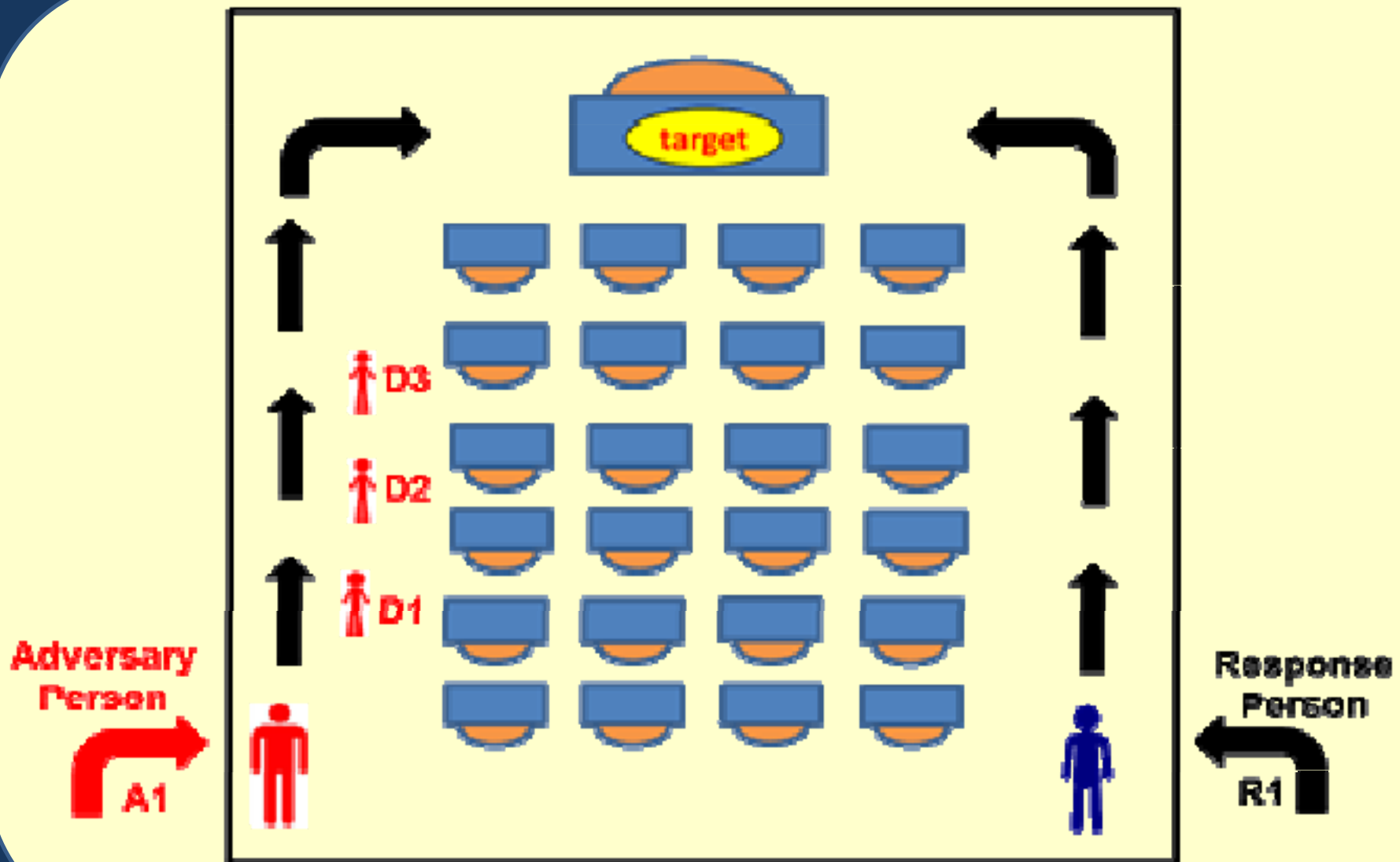
- **Course material available through IAEA training courses on PPS**
- **Use of textbook**
- **Exercise data book for a hypothetical nuclear facility**
- **Group exercises based on the hypothetical nuclear facility for practical implementation of PPS principles covered in theory**

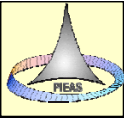


Course Teaching and Evaluation Methodology

- **3 one hour lectures of theory per week**
- **80% course grade allocated to**
 - **Two one hour sessional exams**
 - **One terminal exam**
- **20% course grade allocated to assignments**
 - **One term project on selected topic for PPS**
 - **Exercise data book based assignments**
 - **Surprise quizzes**
 - **Discussion of real life PPS relevant case studies**

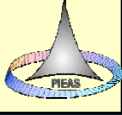
PPS Role Playing Exercise in Class





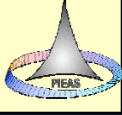
Center of Excellence (CoE) in Nuclear Security

- **Pakistan announced Center of Excellence (CoE) in Nuclear Security in Nuclear Security Summit, 2014. This consists of:**
- **Pakistan center of Excellence in Nuclear Security (PCENS) at Chakri Academy, Rawalpindi.**
- **National Institute of Safety and Security (NISAS) at PNRA HQ.**
- **Pakistan Institute of Engineering and Applied Sciences (PIEAS)**



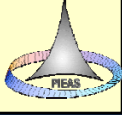
Collaboration with other National Institutions

- **PIEAS maintains a very collaboration with its CoE partners:**
- **Exchange of resource persons, lectures, training materials, etc.**
- **Visit of PIEAS students to**
 - **PCENS**
 - **PPS interior labs at NISAS**
 - **PPS exterior labs established at PCENS in collaboration with NISAS and IAEA**



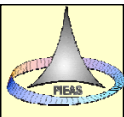
Lessons Learned

1. Enhancement of nuclear security culture
2. Development of broader vision for nuclear safety and security
3. Development of integrated nuclear security in new designs
4. Effective implementation of PPS concepts in existing facilities by operators
5. Effective upgrade of PPS in nuclear facilities
6. Development of synergy among engineers, scientists and security people



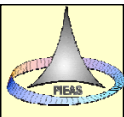
Lessons Learned (contd.)

- 7. Development of PPS awareness among the scientist and engineers working at nuclear facilities**
- 8. Introduction of PPS education at university level in Pakistan**
- 9. Opening up of new horizons for mutual collaboration at national level and at international level**
- 10. PIEAS has emerged as a vital pillar of CoE of Pakistan in nuclear security**



Current Status and Future Prospects of PPS Education at PIEAS

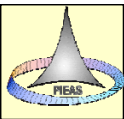
- **Since 2009, PPS course has been offered on regular basis.**
- **78 students have graduated with this sub-specialty.**
- **More students are getting interested in this course.**
- **PPS educational labs have been established at PIEAs in collaboration with IAEA and PNRA.**
- **Use of these labs will enhance the quality of PPS education at PIEAS.**



Inauguration of Nuclear Security Educational Labs

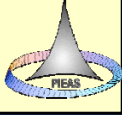


**Raja Abdul Aziz bin Raja Adnan,
Director NSNS, IAEA**



Access Control and Intrusion Detection Labs





Elements of Nuclear Security Educational Lab

- **Physical Protection Interior lab**
 - Access Control Lab (ACS Lab)
 - Intrusion Detection Lab (IDS Lab)
 - CCTV Lab
- **Radiation Detection Lab**

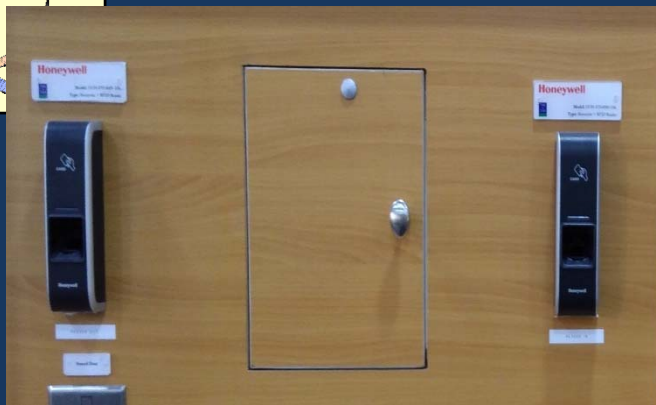
Access Control System and CCTV Camera Lab

Access control systems

- **Pin+RFID card reader**
- **Biometric reader**
- **Face Recognition system**
- **Hand Geometry system**
- **Electromagnetic door lock**
- **Iris ID cam**
- **Balance magnetic switch**
- **Swipe reader**
- **Scrambled pin pad**

CCTV cameras in lab

- **PTZ Camera**
- **Box low light camera**
- **IR Bullet camera**



Biometric reader



Iris ID cam



Face Recognition system



Swipe reader



Scrambled pin pad

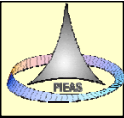


Hand Geometry system



Pin+RFID card reader

**Access
Control
System
Lab**



Summary and Conclusions

- **Nuclear Security Education has been initiated at PIEAS as a sub-specialty of MS (NE)**
- **Since 2009, PPS educational course is offered on regular basis.**
- **78 students have passed out**
- **Use of physical protection interior labs at PIEAS and exterior labs (PPEL) at PCENS and will greatly enhance the quality of PPS education at PIEAS**
- **PIEAS PPS education will be able to meet the national and international needs of human resource development in this area**

*Thank you for your
kind attention!*