

Report on
Workshop on Vulnerability Assessment for Nuclear Material Security
27 – 31 October, 2014, HBNI, Anushaktinagar, Mumbai



Global Centre for Nuclear Energy Partnership

**Workshop
on
Vulnerability Assessment
for
Nuclear Material Security**

27 - 31 October, 2014
Mumbai, India



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1. Introduction

School of Nuclear Security Studies (SNSS), Global Centre for Nuclear Energy Partnership (GCNEP), Government of India organized a Workshop on “Vulnerability Assessment for Nuclear Material Security” during 27 – 31 October, 2014, at Homi Bhabha National Institute (HBNI), Anushaktinagar, Mumbai with active cooperation from National Nuclear Security Administration (NNSA), Department of Energy (DOE), USA. This was the first workshop organized under the framework of cooperation between the Government of India and Government of United States of America concerning the GCNEP.

The purpose of the workshop was to introduce the participants to the subject of conducting vulnerability analysis of Physical Protection System at Nuclear Facilities to protect unauthorized removal of nuclear material and sabotage and to enhance their knowledge base to conduct vulnerability analysis. The workshop also aimed at increasing the awareness of participants on the importance of nuclear security and physical protection system.

There were 20 participants in this workshop. All the participants are from different units of the Department of Atomic Energy (DAE), India. The participants of the workshop are mostly involved in the activities like design and implementation of nuclear material accounting and control (NMAC), physical protection systems for nuclear and radioactive facilities etc.

This Report includes the overview of the course, various sessions in the training course, topics covered, list of participants and faculties, feedback obtained from the participants, few photographs taken during the workshop and the course schedule.

2. Objective:

The major objective of this workshop was to figure out the vulnerabilities in the protection, accounting and control of nuclear material and to evaluate the effectiveness of security system against theft or unauthorized removal of the nuclear material. The other objective is to introduce the participants to different quantitative and qualitative vulnerability analysis techniques for evaluating the effectiveness of NMAC and security system.

3. Course Details:

The course consisted of 14 lectures and small-group working sessions for exercises. During the working group sessions, the participants applied the course contents,

teaching methods and their experience in the field as they worked through practical exercises on a hypothetical facility. Following sections provide details of each sessions:

3.1 Inauguration Session:

The training course was inaugurated by Dr. K L RamaKumar, Director, Radiochemistry and Isotope Group (RC & I G), BARC and Head NCPW, DAE. Other dignitaries present in the inauguration sessions were Mr. Y S Mayya, Associate Director, E&I Group, Ms. Regina Galer, Coordinator from DOE, USA and Mr. Ranajit Kumar, Course Director on 27th November morning. Chief guest Dr. Ramakumar and other dignitaries present on the occasion addressed the participants.

3.2 Introduction of Participants:

The inaugural session was followed by the introduction of participants where the participants gave their introduction including their affiliating organization, their current position/designation, nature of work and responsibilities and their expectation from the course.

3.3 Course Topics

The workshop duration was 5 days. 14 lecture sessions and 10 workgroup exercise sessions were included in the workshop to cover wide ranging topics on Requirements, Evaluation, Nuclear Material and Accounting and Vulnerability assessment using VISA techniques for nuclear material security, analysis for insider and outsider threats etc.

Details of the topics covered in the training course are as follow:

- 1) Introductions & Course Overview
- 2) Threat Characterization
- 3) Facility & Protection System Characterization
- 4) Overview of VA Methods
- 5) Path Analysis & The Probability of Interruption
- 6) VISA Scenario Analysis
- 7) Outsider Scenario
- 8) Insider Abrupt Theft
- 9) Quantifying MC&A
- 10) Item Inventory and Attribution Sampling
- 11) Bulk Processes
- 12) Material Balance Evaluation
- 13) Protracted Theft
- 14) Upgrade Analysis

Annexure A provides the detailed schedule of the training course.

3.4 Workgroup Exercise Sessions:

Participants were divided into two groups. An exercise booklet was given to each participant describing a hypothetical facility. Participants were asked to carry out given exercises. There were 10 workgroup exercise sessions. At the end of each exercise session, the two groups came to the lecture hall and presented their findings. Each group was asked various questions on its findings. The groups developed interesting credible scenarios for protected and bulk material theft.

3.5 Feedback session:

A feedback session was arranged towards the end of the workshop. All the participants were asked to fill the feedback form and give their experience about different aspects of the workshop. Major observations of the feedback received are:

- a) The workshop is relevant to the present duty of the participants
- b) The overall impression of the participants about the workshop was very good
- c) An additional lecture on Statistical Analysis, tools and charts has been suggested by many participants.
- d) Participants suggested smaller Sub Group size for effective participation in the work group exercises.
- e) Participants also suggested to include a lecture on PPS sensors and gadgets.
- f) Suggestion on relatively shorter duration of Workshop was also given by few participants.

3.6 Certification Distribution & Concluding Session

The workshop successfully came to an end on 31st October afternoon. Certificates were distributed to all participants by Shri Y S Mayya, Associate Director, E&I Group BARC. Ms. Regina Galer of DOE, USA and the course director Mr. Ranajit Kumar also addressed the participants in the closing function.

4. Training Course Material:

One Course Material book containing the handouts of the presentations and one volume of exercise book containing hypothetical nuclear facility, exercise data etc. were provided to all the participants.

A DVD containing all the presentations, hypothetical nuclear facility and work group exercises and a few important documents published by IAEA on Nuclear Security and related topics, details of participants and faculty members, few course photographs etc. were distributed to all the course participants and faculties.

5. Training Course Participants

A total of 20 participants from various units of Department of Atomic Energy, India took part in the training course. The participants were from NPCIL, IGCAR, AERB, NFC, NRB, DAE, GCNEP and BARC. Annexure – B gives the list of participants.

6. Faculties

A total of 06 faculty members were involved for deliberation of different lectures and conducting the work group exercises. Two faculty members from NNSA, DOE, USA took major modules of the workshop. Four faculties from DAE, India also took part in delivering some of the workshop modules and in the work group exercises. The administrative coordinator from NNSA, DOE, USA also participated actively in the workshop and made various observations for improvement in the workshop content, course materials and work group exercise etc. The list of the faculty members, both from India and abroad are attached as Annexure - C.

7. Conclusion

Participant's feedback suggests that the workshop was well organized and overall the program was very valuable. Most participants also felt that the lessons learnt in the training course would be very useful for carrying out their duties. The lectures were very useful for understanding the subject. Printed presentation material, lecture notes and other technical documents provided were well appreciated by everyone and they found them to be very informative.

Annexure – A
Course Schedule

| Time | Module number | Module title | Lecturer |
|----------------------------|----------------------|---|-----------------|
| Monday, 27 October | | | |
| 9:00- 09:30 | | Registration of participants | |
| 9:30 – 10:00 | | Inauguration session | |
| 10:00 – 10:30 | | Tea break | |
| 10:30 – 10:45 | | Introduction of the participants | |
| 10:45 – 11:30 | L1 | Introduction & Course Overview | India |
| 11:30 – 12:15 | L2 | Target characterization | US |
| 12:15 – 13:15 | | Lunch break | |
| 13:15 – 14:45 | E1 | Exercise on Target characterization | |
| 14:45 – 15:30 | L3 | Threat Characterization | India |
| 15:30 – 16:00 | | Tea break | |
| 16:00 – 17:00 | E2 | Exercise on Threat Characterization | |
| | | | |
| Tuesday, 28 October | | | |
| 9:30 – 9:45 | | Review of previous days presentations | |
| 09:45 – 10:30 | L4 | Facility & Protection System Characterization | India |
| 10:30 - 11:00 | | Tea break | |
| 11:00 – 12:15 | E3 | Exercise on Facility Characterization | |
| 12:15 – 13:15 | | Lunch break | |

| | | | |
|------------------------------|-----|---|-------|
| 13:15 – 13:45 | L5 | Overview of VA Methods | US |
| 13:45 – 14:30 | L6 | Path Analysis | India |
| 14:30 – 15:00 | | Tea break | |
| 15:00 – 16:00 | E4 | Exercise on Path Analysis | |
| 16:00 – 17:00 | L7 | VISA Scenario Analysis | US |
| | | | |
| Wednesday, 29 October | | | |
| 9:30 – 9:45 | | Review of previous days presentations | |
| 09:45 – 10:15 | L8 | Outsider Scenario Analysis | US |
| 10:15 - 10:45 | | Tea break | |
| 10:45– 12:15 | E5 | Exercise on Outsider Scenario Analysis (Contd.) | |
| 12:15 – 13:15 | | Lunch break | |
| 13:15-14:45 | E6 | Exercise on Outsider Scenario Analysis | |
| 14:45 - 15:00 | | Tea break | |
| 15:00-15:15 | L9 | Insider Abrupt Theft Analysis | US |
| 15:15-17:45 | E7 | Exercise Insider Abrupt Theft Analysis | |
| | | | |
| Thursday, 30 October | | | |
| 9:30 – 9:45 | | Review of previous days presentations | |
| 09:45 – 10:15 | L10 | Quantifying MC&A | US |
| 10:15 - 10:30 | | Tea break | |
| 10:30– 11:00 | L11 | Item Inventory and Attribution Sampling | US |

| | | | |
|---------------------------|-----|---|----|
| 11:00– 12:30 | E8 | Exercise on inventory sampling | |
| 12:30-13:30 | | Lunch break | |
| 13:30 – 14:15 | L12 | Quantifying Late Detection in MC&A for Bulk Processes | US |
| 14:15 – 15:15 | L13 | Trickle Diversion Exercise with Process Control | |
| 15:15-15:45 | | Tea break | |
| 15:45 - 16:15 | L14 | Material Balance Evaluation | US |
| 16:15-17:15 | L15 | Protracted Theft Analysis | US |
| | | | |
| Friday, 31 October | | | |
| 9:30 – 9:45 | | Review of previous days presentations | |
| 09:45 – 11:00 | E9 | Exercise on Protracted Theft Analysis (contd.) | |
| 11:00– 11:20 | | Tea break | |
| 11:20 - 12:30 | E10 | Exercise on Protracted Theft Analysis | |
| 12:30 - 13:30 | | Lunch break | |
| 13:30 - 14:00 | L16 | Upgrade Analysis Lecture | US |
| 14:00 – 14:30 | | Sharing of Perspectives / Feedback | |
| 14:30 - 15:00 | | Tea break | |
| 15:00-15:30 | | Closing Ceremony : Distribution of certificates | |

Annexure – B
List of Participants

| Sr. No. | Name | Institute |
|----------------|--------------------------|------------------|
| 1 | Amrit Prakash | BARC |
| 2 | B. Surendra | BARC |
| 3 | Umesh S. Awasthi | AERB |
| 4 | Prashant B. Bhandut | BARC |
| 5 | Ajai. S.S | BARC |
| 6 | M. S. Ananda | BARC |
| 7 | Ashish Thakur | GCNEP |
| 8 | P. G. Jaison | BARC |
| 9 | Dr. N. Kumar | BARC |
| 10 | R. Amudhu Ramesh Kumar | IGCAR |
| 11 | B. Sasidhar Rao | IGCAR |
| 12 | Padmakumar S. | DAE |
| 13 | Suresh Kumar | NRB |
| 14 | Dr. R. Sathiya Narayanan | BARC |
| 15 | Sushil B. Wankhede | BARC |
| 16 | Uma Prasad | NPCIL |
| 17 | P. Sudhakar | NPCIL |
| 18 | Arunprasath V | BARC |
| 19 | A K Singh | NFC |
| 20 | L B Prabhakar | NFC |

Annexure – C
Faculty Members

| S.No. | Name | Organization and Country |
|-------|---------------------|--------------------------|
| 1. | Mr. Garl Bultz | NNSA, DOE, USA |
| 2. | Mr.Philip Gibbs | NNSA, DOE, USA |
| 3. | Ms. Regina Galer | NNSA, DOE, USA |
| 4. | Mr. Ranajit Kumar | BARC, India |
| 5. | Mrs. Ranjana Kulgod | BARC, India |
| 6. | Mr. Anand Laddha | BARC, India |
| 7. | Mr. Anil Upreti | BARC, India |

Annexure – D

Photographs



Workshop Inauguration



Inaugural Address by Dr. K L Ramakumar, Director, RC & IG, BARC & Head NPCW, DAE



Participants in work group exercises



Participants in work group exercises



Group Photo



Closing Remarks by Y.S. Mayya, AD, E & IG, BARC and Project Director, GCNEP