THE UNITED KINGDOM'S EXPERIENCE IN DEVELOPING AND DELIVERING PHYSICAL PROTECTION WORKSHOPS

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Abstract

This paper discusses the development and delivery of a workshop on the "Fundamentals of Physical Protection", which has been run since the early 1990s, as part of the UK's Global Threat Reduction Programme (GTRP). Over the years, the workshop has brought together a wide range of international practitioners – from operators, regulators and government bodies to share their nuclear security knowledge and experiences. The objectives and structure of the workshop are outlined, followed by a discussion of challenges encountered and how these were overcome. Here the educational benefits of different teaching tools in delivering physical protection training will also be explored. It is argued that to build on the solid conceptual foundation for physical protection outlined in the IAEA Nuclear Security Series guidance document it is important to utilise real-life case studies and a range of interactive teaching methods. As these enable participants to internalise key concepts and explore their practical application.

1. INTRODUCTION

International efforts to reduce global nuclear threats and prevent WMD terrorism have increased significantly over the past few decades. Since the end of the Cold War, and following the terror attacks of 9/11, multilateral initiatives such as the Global Partnership (GP) have prioritised international counter-proliferation assistance programmes aimed at securing sensitive materials, information and infrastructure. A key part of this work has been improving the effectiveness of physical protection systems. The United Kingdom has been a key player in these efforts since the 1990s, and more recently through its Global Threat Reduction Programme (GTRP) established in 2002 [1]. Work undertaken within the GTRP has included infrastructure projects to improve physical protection systems at nuclear facilities around the world, in states as diverse as Russia, Ukraine, Tajikistan, the Philippines, Georgia and Kazakhstan [2].

It was recognised early on in the UK's threat reduction efforts that these physical protection systems would only be effective if those implementing them understood how they should be maintained, tested and as necessary updated to take into consideration evolving threats and new technological capabilities. To address this the UK developed a 'Fundamentals of Physical Protection' workshop, a training effort to complement to its physical security upgrade work. Initially offered directly to project partners the focus of workshop has expanded over time from a nationally tailored workshop to one delivered in London which involves an international audience of operators, regulators and government officials. Since 2014 this workshop has been delivered by a consortium of academia and industry, led by King's College London (KCL) in partnership with the National Nuclear Laboratory (NNL), Imperial College London and the University of Central Lancashire (UCLAN). This paper will focus on how the workshop has evolved during this period. It will outline the approach taken in the workshops, before moving on to discuss challenges encountered and lesson learnt in designing and delivering this activity.

2. DESIGNING A "FUNDAMENTALS OF PHYSICAL PROTECTION WORKSHOP"

A number of physical protection related workshops and training courses are offered both nationally, regionally and internationally by a range of different organisations including the IAEA, the Nuclear

Security Centres of Excellence, national labs and private industry [3]. These activities range from a few days of training to several weeks, and either focus on specific aspects of physical protection or seek to provide a broad overview. The goal of the London-based 'Fundamentals of Physical Protection Workshop' was to provide a group of international participants with both a holistic understanding and in-depth knowledge of physical protection issues. The broader intention is that participants return to their home organisations with sufficient analytical skills to be able to evaluate their current physical protection setup and consider whether and how it should be strengthened. To this end the workshop also considers topics that may not be found on a more 'traditional' narrowly-focused physical protection workshop, such as regulatory approaches and security culture.[1] These other topics are explored in detail, with a focus on how they can impact the functioning of different physical protection systems.

Recognising both resource constraints and the other demands on a nuclear security professional's time a workshop length of 6-days was decided upon. This represented sufficient time to cover a range of topics in a good level of detail while also being short enough to fit in alongside a attendees' day job. Selection of participants reflected the holistic approach taken to exploring physical protection issues, with attendees selected from different professional backgrounds to encourage interaction between different nuclear security stakeholders. Primarily, participants were drawn from nuclear operators, with a significant proportion from national regulators and smaller number of government officials and academics.

The focus here is very much on individuals directly responsible for security at organisations holding nuclear materials. In previous iterations of the workshop those involved in radiological security were also invited to attend. However, given the different operating environments, levels of protection and security measures employed in these two different contexts it was decided in 2016 to develop a separate parallel radiological source security workshop [4].

Around 16 participants are typically selected to attend each physical protection workshop, this number is kept deliberately small to enhance interaction. It also reflects another key underlying goal of this activity: the sharing of good practice in different organisational and national contexts. Although the speakers are drawn from the UK, time is set aside for the participants to present viewpoints drawn from their professional experiences in different national contexts. This, alongside the diverse teaching methods utilised, means that this activity should be considered a workshop as opposed to a training course.

3. PROMOTING ACTIVE ENGAGEMENT AND PARTICIPANT CENTRIC LEARNING

A key aim of the Fundamentals workshop is to introduce participants to key physical protection concepts before considering how they might apply in practice, subject to varying organisational constraints. To achieve this a range of different educational methods, designed to promote active learning and engagement, were utilised. Chief amongst these was a detailed table-top exercise involving a hypothetical nuclear research facility [5]. This was used in a red-teaming format where participants were first asked to play the role of the adversary to identify potential security weaknesses, before switching to the role of security manager to consider how weaknesses and gaps in security could most effectively be eliminated. Participants undertook these table-top exercises in small groups, presenting back every day on their progress and culminating in a 30-minute presentation on a proposed security upgrade plan to a fictitious company board of directors, played by the instructors. Real-life and in-depth case studies are also used throughout the week, including past incidents where nuclear material has been stolen and key systems sabotaged. This enables participants to explore the interaction of security systems with an adversary(s), learning how poor security practice may be exploited in a variety of different ways.

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[1] Recent iterations of the workshop have covered topics such nuclear and radiological materials and technology; introduction to the nuclear fuel cycle; nuclear and radiological threats; threat assessment and Design Basis Threat (DBT); vital area identification and vulnerability assessment; legal frameworks for nuclear security; safety-security interface and safeguards; physical protection fundamentals; a UK regulatory system case study; physical protection technologies; security by design and defence in depth; role of the guard force; contingency planning and emergency preparedness; testing and inspection of physical protection equipment; integration of physical protection systems; preventive measures and personnel security; protective measures against insiders; information security and knowledge management; and transport security.

The workshop draws on a diverse range of UK-based subject matter experts from academia, industry, the regulator and government in its delivery, to explore physical protection issues from both a conceptual and practical viewpoint. Experts are drawn from the consortium partners but also the UK's Office of Nuclear Regulation (ONR), EDF Energy and the Civil Nuclear Constabulary (CNC), which provides the armed response force at the UK's civil nuclear facilities. Participants also benefit from a day-long visit to the Dungeness B Nuclear Power Plant, where they are taken on a tour of the site, shown different physical protection technology and given a series of briefings by nuclear security relevant personnel. This trip is designed to expose participants to the practical challenges and opportunities when applying physical protection principles to a working nuclear power plant. Here careful consideration has been given to what can be shown and discussed to provide participants with insights from an operational nuclear facility, while at the same time ensuring that potentially sensitive site-specific information is protected. While providing access to international visitors can be time consuming, from participant feedback the experience has clearly proven to be enriching, allowing those from countries that may not yet have a nuclear power plant, insights into security consideration at a complex and large-scale facility.

To ensure more efficient use of the six days of the workshop, participants are provided with materials before they arrive in London. These are relatively short and focused on the learning objectives of the workshop, so that they can be digested in advance alongside busy work schedules. They include relevant IAEA guidance documents, articles and specially created introductory video lectures. Together these materials help ensure that participants – who come from both technical and policy backgrounds – begin the workshop with a similar baseline level of technical understanding.

On arrival, the participants are provided with a handbook specifically tailored for the course curriculum. This document includes summaries of the main sessions, learning objectives and references to further reading material. An emphasis is made on, where possible, using material which is publically available online. This allows for participants from diverse organisations (often without the access to academic resources) to easily obtain further information on specific topics of interest. Resources have also been created by the nuclear security team at KCL, specifically tailored to the needs of nuclear security educators. These include case study handbooks on insider threats and security culture and a Nuclear Security Briefing Book, which was distributed to delegates at the Nuclear Security Summits [6].

The course materials have also been reviewed by physical protection experts at the IAEA's Division of Nuclear Security. This review was conducted to ensure consistency with the IAEA nuclear security terminology and the recommendations presented in the Nuclear Security Series guidance documents.

4. OVERCOMING CHALLENGES ASSOCIATED WITH THE WORKSHOP PROGRAMME

There are two main challenges relating to the workshop programme which have been identified and overcome in the course of revising the workshop. The first relates to implementing workshops for such a diverse range of practitioners – from different countries, organisations, and with different educational backgrounds (technical and policy-based) and levels of professional experience. The second relates to ensuring sustainability and longer term impact.

The diverse range of participants has meant that the same workshop format must provide useful learning opportunities for a guard force manager at a nuclear power plant, an individual overseeing nuclear security policy at a government energy department, a technician at a small research reactor, or a security inspector at a newly established nuclear regulatory body. As well as this diversity in professional backgrounds and experience, the participants for a typical workshop may come from over ten countries – representing in certain cases very different national contexts and levels of nuclear development and infrastructure.

The distribution of pre-reading and the introductory video lectures discussed above helped to level the playing field for those with different professional backgrounds. In more recent workshops, the use of an anonymous electronic voting system provided an additional way for participants to interact with the workshop topics. The anonymous element of this system facilitated a more relaxed teaching environment, where participants would not be embarrassed to contribute to discussion on the grounds of perceived lower expertise. This system was used to pose questions throughout presentations, testing

participant's knowledge and consequently giving instructors the opportunity to clarify areas of misunderstanding as they occurred.

Another way that the challenges associated with diverse professional backgrounds was mitigated was through focusing on the cross-cutting principals of physical protection. These principals such as risk management, graded approach, and defence in depth are applicable to physical protection across the diverse range of facilities hosting nuclear materials [7]. Reducing the formally delivered content in the workshop also allowed more time for discussion, questions and answers, and the sharing of experiences. This allowed instructors to relate these high-level principals of physical protection to specific examples relevant to the participants' interests and needs. In this respect, the diversity of the participants was used as a strength – one that enriched workshop discussion and the broader learning environment.

The second main challenge is ensuring the sustainability of the knowledge and understanding gained from the workshop activities, necessary to ensure their longer-term impact on nuclear security. Here the broader Nuclear Security Culture programme run by the British government under GTRP provided opportunities for continued engagement [8]. As part of this programme follow-up activities were arranged and delivered with local partner organisations that had sent participants to the Fundamentals workshops [9]. KCL has also recently established a Nuclear Security Fellowship Programme to enable those that have attended the Physical Protection workshop or other nuclear security activities to spend time in London engaging with academic and other security experts, to further expand their knowledge in this area.

5. KEY LESSONS FOR HUMAN RESOURCE DEVELOPMENT IN PHYSICAL PROTECTION

Implementing more than twenty workshops under this programme has resulted in many lessons learnt in how to conduct nuclear security human resource development, particularly in relation to physical protection. The first lesson was the importance of taking a broad definition of physical protection –beyond the basic "gates, guards and guns". This is necessary to develop a holistic understanding of physical protection, and for participants to have a tangible and sustained impact on nuclear security in their home country. This broader approach gives participants a wider understanding of nuclear security topics such as security culture, nuclear security regulation, personnel security, and information security and how they relate to physical protection systems.

The IAEA Nuclear Security Series of guidance documents provides a solid foundation upon which to base training and educational activities. However, the use of these guidance documents must be carefully considered to ensure maximum impact. In cementing the concepts contained within these documents, which are often high-level, it is invaluable to utilise real-life cases and realistic examples to demonstrate how security principles translate into practice. Consideration should be given to delivering these in a variety of interactive formats to promote active learning. Particularly given that passive instruction in a traditional lecture style format has been shown to have limited success in facilitating deep learning in the classroom [10]. Consequently, lectures should be supplemented with discussions, debates, tabletop exercises and other modern educational methods. For this workshop around 30-40% of the content is delivered through these more interactive elements, with a large focus on tabletop exercises. This have been shown to be particularly valuable in taking participants on a journey from theory to practice, helping them explore how security concepts apply at the facility level. This interactive element ensures that participants develop their own physical protection solutions for critique and feedback by the workshop instructors.

The development in 2016 of a new radiological security workshop for practitioners under the GTRP programme has also indirectly proved beneficial for the delivery of this activity. Rather than having to try and address both radiological and nuclear security issues at the same workshop, the full time can now be devoted to physical protection in the nuclear context. This provides participants with a more focused in-depth educational experience.

Another lesson is the importance of securing buy-in from local authorities and stakeholders, as their engagement can clearly enrich participants' experiences. Here the best example is the site visit to

Dungeness B nuclear power plant. This allows many of the participants, who are from countries with limited nuclear infrastructure, the opportunity to see the application of physical protection measures at a large nuclear site first-hand. Maintaining the participation, and managing relationships, with the operator at Dungeness B, the UK nuclear regulatory body (ONR), and the armed response provider (the CNC) can be time consuming, but the pay-off for the participant experience and learning is huge.

6. CONCLUSIONS

This paper has outlined one approach to designing and implementing a 'Fundamentals of Physical Protection' workshop for an international audience of practitioners. Over the past 20 years the nature and delivery of this workshop has evolved considerably taking advantages of new teaching methods and technological developments to provide participants with a holistic understanding of physical protection issues. Key lessons that have been learnt from running this workshop include the incorporation of interactive teaching methods (case studies, table-top exercises, electronic voting systems etc.), which are closely matched to the learning objectives of both the workshop as a whole and each individual session. The use of a wide range of subject matter experts has also been key in terms of providing participants with both a transferable conceptual understanding of physical protection issues and a deep technical knowledge of how these apply in practice. The practical application of these concepts is further cemented through the incorporation of a day-long site visit into the programme.

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