

Modelling and Simulation to inform decision making on Physical Protection Solution and Land Management

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Modelling and Simulation (M&S) in nuclear safety applications is commonplace, for example to underpin and inform criticality, dose and shielding assessment. However, the adoption of modelling and simulation for nuclear security has not seen the uptake that many anticipated. This is despite significant advances being made in the capability of equivalent tools for nuclear security, coupled with the potentially significant cost savings that could be achieved. Further, despite workshops/initiatives by organisations such as the Institute of Nuclear Materials Management (INMM), and development of best practice guides by the World Institute of Nuclear Security, evidence of M&S tools being used to inform decisions in the nuclear sector are not well publicised.

This paper intends to present the results of work undertaken jointly by the National Nuclear Laboratory on behalf of Magnox Limited and the Nuclear Decommissioning Authority (NDA) to provide evidence upon which future land use and security infrastructure decisions can be made. Magnox Limited are responsible for the management and decommissioning of the early UK Magnox reactor fleet, and a number of early UK nuclear programme research and development sites. These sites are owned by the Nuclear Decommissioning Authority, who sponsored this application of modelling and simulation to this project.

The ARES Security Corporation. AVERT product was utilised for conducting a programme of work to assess potential future changes to a site perimeter, and also its policing and guarding arrangements. The outcome of this work is to be used to inform future investment decisions on infrastructure modifications with the intention of being able to reduce the overall footprint of the site and release land back for redevelopment. Coupled with this will be the necessary changes to the policing and guarding posture commensurate with providing the guarding and response for a smaller site.

The site has been re-created in 3-dimensions using existing engineering models built in CAD, along with options for future potential layouts/configurations. The work utilises the UK Design Basis Threat known as the Nuclear Industries Malicious Capabilities and Planning Assumptions (NIMCA) document to derive the postulated scenarios and adversarial capabilities that the site is required to mitigate against. These have been integrated into modelled scenarios to determine overall security system effectiveness as a measure for comparison between the options. The scenarios that are being assessed are also aligned to those used in the Vital Area Identification process.

Analysis of the comprehensive model output files enables interrogation of key scenarios and key events. This provides an unrivalled insight to the progression of an adversarial attack, their interaction with the integrated Physical Protection System (PPS), and determine the effectiveness of the various layers and components.

The paper will present comparative results arising from the work and their use in aiding decision making on future land-use, and the associated policing and guarding arrangements. Key challenges and benefits associated with the use of modelling and simulation will also be presented to further inform the debate and development of these innovative approaches.

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