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Reinforcing Defence in Depth –A Practical Systemic Approach

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Synopsis

The concept of defence in depth for ensuring nuclear safety of nuclear installations is often oversimplified and interpreted as a set of physical barriers, whose integrity is ensured by safety provisions in the form of the plant systems implemented independently at various levels of defence. However, the provisions established at each level of defence should in general terms include not only hardware components (active and passive systems), but more comprehensively, also inherent safety characteristics, safety margins, operating procedures and guidelines, quality assurance, safety culture, staff training, and many other organizational measures as parts of management of safety.

Many of the above mentioned provisions belong to the category of human and organizational factors. While various hardware components are typically specific for different levels of defence, human and organizational factors may have an impact on several levels of defence. These factors are associated with large uncertainties due to their emergent property and can result in latent weaknesses.

This paper discusses how a strengthened focus on human and organizational factors, along with a systemic approach to safety, can enhance defence in depth in practice. In the first part it introduces a screening method developed by the IAEA as a tool for facilitating systematic assessment of the comprehensiveness of defence in depth. This method uses screening of safety provisions at five levels of defence to ensure integrity of the physical barriers and achievement of safety objectives at each level of defence. This part of the paper includes an example of how the method is applied to human and organizational factors. Opportunities for strengthening the role of human and organizational factors in defence in depth are also indicated.

The second part focuses on how a systemic perspective can be used to understand the dynamics within and between organizations, making it possible to anticipate otherwise invisible challenges to safety. It uses the example of what changes when a situation shifts from level 3 to 4 of the defence in depth framework to show how a systemic perspective can reveal hidden vulnerabilities and concludes with a brief look at how leadership that builds shared space during normal operating conditions can ensure the resiliency required at levels 4 and 5.

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