

BEST PRACTICES FOR PURSUING A COMPREHENSIVE, SUSTAINABLE APPROACH TO NUCLEAR SAFETY AND SECURITY AT THE NATIONAL LEVEL

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***Abstract:** A fundamental principle in the nuclear industry worldwide is that all nuclear organizations strive to sustain and improve safety. Emergency preparedness is an intrinsic part of those efforts to improve safety. Nuclear emergency preparedness and response is a multi-organizational responsibility, shared by all levels of government and by nuclear facility operators. It involves cooperation and planning with operators, first responders, municipalities, counties, national government and international organizations. Recent global incidents have clearly demonstrated the importance of a well-coordinated response effort to a large-scale emergency and have led to increased public and media scrutiny of emergency preparedness. Within the nuclear industry, this has reinforced the need for authorities to inform the public of the improvements and actions that are being taken by the utilities, government, and response organizations that would be engaged in the event of a nuclear emergency. As a result, countries around the world have reassessed their nuclear emergency response plans with the goal of improving preparedness and response capabilities to a nuclear accident or incidents, including enhanced public communications. The best way to determine the level of the resilience and the robustness of the arrangements is to conduct a full-scale exercise. The overall purpose of a full-scale exercise is to test the preparedness and resilience of the utility, government and non-government agencies and communities to respond to a nuclear event and to identify area for improvements, best practices and lessons learned.*

***Keywords:** exercise; training programme; preparedness; resilience; robustness*

1. INTRODUCTION

In the international practices, the adequacy of emergency response can be assessed during the preparedness phase through conducting full-scale exercises. But also, the ability to carry out the required activities during response to an emergency can be assessed through audits and reviews of past performance.

The emergency preparedness program consists of several components, exercise programs being the key component (IAEA, 2005). The exercise program can provide unique insight in the level of preparedness and also can be the basis for continuous improvement programs for the over emergency response infrastructure. However, to be most useful, emergency response exercise needs to be well organized, professionally conducted and their evaluation must focus on constructive improvement potential.

Nuclear and radiological exercise program can be considered a powerful tool for verifying and improving the quality of all the arrangements developed in the preparedness phase.

To conduct exercises, significant investment of effort, financial resources and people are required to yield the maximum benefit. That benefit can be met if the preparation, conduct and evaluation of the exercise is performed with high quality (FEMA, 2021).

2. STUDY CASE: FULL SCALE EXERCISE VALAHIA 2016

An emergency preparedness program includes development of response arrangement like establishing resources, including human, equipment, communications and facilities, emergency plans and procedures, training program and exercise program. The training program

primarily includes theoretical and practical courses as well as testing and refresher training also for all of the key organizations and positions identified in the emergency plans (IAEA, 2005). For effectiveness of this program a qualification process should be conducted. To evaluate the level of these arrangements and their adequacy an exercise program should be in place. The exercise program should comprise command post exercise, table top exercises, drills and full-scale exercise. The focus of the exercise should be the testing of interfaces across emergency response organizations, related linkages, arrangements, governance structures and their implementation, roles, responsibilities, capabilities, and the integration across emergency response organizations. For each exercise an evaluation process should be conducted for identification of best practices, gaps and areas for improvement (IAEA, 2007). A successful exercise identifies where improvements are necessary in the plan, assesses the correctness of revised procedures introduced as a result of previous exercises and furthers the development of adequate emergency preparedness. A good exercise is one that allows many lessons to be identified. An exercise should not be seen as an opportunity to demonstrate the flawlessness of a response. A good exercise is not necessarily one where everything goes well, but rather one where many lessons learned are identified.

Exercise Valahia 2016 has been about a full-scale nuclear emergency at Cernavoda Nuclear Power Plant, designed to assess the preparedness of the utility, government agencies and local communities to respond to a severe accident. The exercise consisted of a carefully constructed scenario involving a release that resulted in off-site consequences. Following an extensive planning and development process, the exercise was effectively executed and considered a success on many fronts.

Exercise Valahia 2016 involved more than 500 participants on every level of response from more than 15 organizations. The high-level focus of Exercise Valahia 2016 was to assess operational interoperability and coordination, transfer of scientific data and public communications. All Tier One exercise objectives were achieved, while each organization was provided with the opportunity to meet their internal goals. Participating organizations were able to test the response plans and strategic preparedness in response to a nuclear emergency, as well as assess of the communication and overall interoperability. Throughout the

exercise planning process, there were several key working groups that provided guidance and necessary logistical support for the development and preparation for Valahia 2016 conduct and evaluation. Each group was comprised of representatives from participating organizations or functional areas to ensure that the proper input and direction was provided from each of the disciplines. Given the large scale and scope of Valahia 2016 exercise, careful consideration was given to the development of a strategic communication plan that could provide accurate and consistent messaging to the media and public.

An evaluation working group was established to develop an effective and objective process for identifying the nuclear emergency response functions to be evaluated and to identify the operational linkages between response organizations. The working groups further define the evaluation criteria against which the response of various organizations would be measured. Once the evaluation was complete, they were also engaged to provide feedback for the improvement of identified response gaps.

The planning and development of Valahia 2016 required significant input from planners and trusted agents across all participating organizations. As such, several planning sessions, comprised of conferences and workshops, were conducted in an effort to better understand the exercise requirements and expectations.

To assist members of the Exercise Design Team in maintaining good communications throughout the planning process, an information website was established and served as a portal for all relevant documentation that was generated or required for planning purposes. The website had restricted access to ensure the integrity of sensitive information, and was an efficient and effective way of securely disseminating information to organizations. The website remained active throughout the entire planning, conduct and evaluation processes.

Valahia 2016 was conducted over three days, from 04 to 06 October 2016, with a daily exercise window from 09:00 to 17:00. There were a number of measures put in place before and during the exercise that allowed the exercise controllers to effectively manage the exercise process with minimal issues and interruptions. Exercise control was effectively maintained through the use of a large team of controllers situated in key locations across Romania. Controllers were selected by their own organization based on their level of knowledge and expertise in their respective area of

operations. Controllers were trained on their responsibilities prior to the exercise and received a comprehensive controller manual containing instructions and all exercise details. An exercise control cell was established in Bucharest, Romania during Valahia 2016, to ensure that the exercise stayed on course across all of the operations centres that were in play. The exercise control cell was well equipped with computers, phones and internet to provide an optimal environment for maintaining communication and situational awareness. The Lead Controller, overseeing all controller activity, was in direct communication with all Site Controllers via cell phone and the chat function on the exercise website. Exercise control was responsible for tracking injects, simulating non-participating organizations, managing site controllers, resolving issues, and controlling exercise forums.

The following exercise scenario overview provides a short summary of key exercise events. For a more detailed description, including player actions, please refer to the Valahia 2016 Controller Manual. Day 1 at 09:02 on the morning of 4 October 2016, Unit 2 of the Cernavoda Nuclear Power Plant experience conditions that led to a Facility Alert. The situation degraded, forcing a Facility Emergency at approximately 09:55. During repair attempts, two station personnel became injured and required transport to hospital. At 13:00 an earthquake of magnitude 7.7 struck the NPP and resulted in the loss of class III and class IV power, along with the Emergency Power System (EPS). These events forced the site to move to General Emergency. Emergency Mitigating Equipment (EME) was deployed and available at 14:30. Projections eventually led to an estimated release time 70-75 hours after General Emergency was declared. Day 2 at 06:13 on 5 October an aftershock damaged the EME. The projected controlled release time was moved up to 14:00 that day. At 13:45 a containment isolation valve failed, leading to an uncontrolled release that resulted in the contamination of some evacuees. By 14:45 the containment valve was repaired and the unfiltered release stops. A second, controlled release was scheduled for 21:00 that evening. It began as anticipated. Day 3 at 00:30, on 6 October, class III power and EPS were re-established. At 01:00 the controlled release ended and no further releases were expected. On 6 October field activities were conducted. While taking field samples a worker passed out in the field and required extraction. While doing surveys a local radiological hotspot was identified that required

the evacuation of a small area of houses. Surveys continued throughout the day.

The evaluation focused on the interoperability and coordination of key response organizations and associated plans. For the purposes of the evaluation, interoperability was defined as the ability of Nuclearelectrica, the Cernavoda NPP, local authorities, and the national government to respond and communicate together coherently, effectively and efficiently while responding to a nuclear emergency at the Cernavoda Nuclear Power Plant. The six main nuclear response objectives that were evaluated to establish the level of the response objectives with specific reference to notification, activation and emergency response coordination, to examine the level of the implementation of the urgent protective actions with respect to the public to ensure that optimal safety is established and maintained, along with the provision of services to manage the psycho-social impacts of the event, to inspect the coordination of health services and sharing of medical related information accordingly which are supported by external organization and to review the consistency of the information provided to the public and the ability of all levels.

To assist with the evaluation process, a web-based data collection system was developed to capture observations from evaluators and controllers across all locations. This website also allowed for the collection of data from a player's online post exercise survey, critical timeline from evaluators, and data on interoperability, scientific data exchange, and public communications. Following the exercise, evaluators were required to input the critical timelines in their areas of responsibility and highlight possible areas requiring further investigation as part of the overall exercise evaluation process (e.g., time of alert, emergency declarations, activations, decisions, briefings, communications with external organizations, etc.). This process captured the timings of the responding organizations' important actions. The timelines served as a reference during the evaluation process. Evaluators were asked to complete web-pages that collected their observations as they related to specific response objectives. Their responses were compiled and used to guide the evaluation process during the two days exercise evaluation meeting. The evaluation of each six main nuclear response objectives was performed based on the evaluation criteria that were developed and approved by the evaluation working group during the planning phase of the exercise.

Prior to the exercise conduct, a team of evaluators with knowledge on the roles and responsibilities of response organizations and their respective plans were carefully selected to observe Valahia 2016 participants. Evaluators were selected based on their ability to recognize best practices and deficiencies and to make recommendations for improvement, if required.

A detailed briefing was provided to the selected evaluators in an effort to ensure that they were thoroughly familiar with the scenario timelines, exercise objectives, evaluation criteria and the respective response plans that would be observed in their area of response function. During the exercise, evaluators were strategically placed at specific locations and required to observe and record the timeline and note events and actions, identify strengths and weaknesses and listen to all communication that affected their area of evaluation. Following the exercise, evaluators were directed to provide input via the evaluation website. Information was compiled and organized to serve as a guide to assist with the facilitation of a detailed evaluation discussion based on the components and criteria established by the evaluation working group.

A two-day evaluation meeting was conducted from 10 to 11 October 2016 to enable evaluators to discuss their observations, noting response gaps and elements of best practice as applicable. Supporting observations were captured during the discussions, along with recommendations for improvement. National Exercise Valahia 2016 had many benefits identified by players, controllers, and evaluators. These benefits were determined not only during the conduct phase of the exercise, but also during the planning and evaluation processes. The exercise provided a unique opportunity for participating organizations at all levels to confirm response plans, protocols and procedures for strategic preparedness to a severe accident. Organizations were afforded an exceptional opportunity to test interoperability between participating agencies, enabling the identification of areas of best practice and those requiring improvement. The use of multi-organizational working groups (e.g., Joint Exercise Planning Team, Evaluation Working Group) and a senior level steering committee to plan, develop, and oversee the exercise was seen as extremely valuable. The planning process proved to be highly effective in generating an exercise scenario that allowed organizations to achieve very diverse objectives and effectively resolve issues. The planning and development stage of the exercise

highlighted the opportunity for improvement of inter-agency relationships across all levels of response. The exercise also served to confirm and strengthen the pre-existing relationships between responding agencies. The planning events (i.e., conferences and workshops) also provided an excellent opportunity for exercise staff, subject matter experts and participants to meet, network, and collaborate with multiple organizations that they may not otherwise have had an opportunity to work with.

The scenario demonstrated how quickly resources can become depleted, which resulted in organizations developing a better understanding of the needs for robust mutual aid support and interoperability.

3. CONCLUSIONS

We appreciate that Full Scale exercise Valahia 2016 had many benefits and best practices that can be a solid base for further discussion and included in future emergency preparedness program. These benefits identified can be considered in future exercises and should also be used to enhance real-world operations.

The evaluation result of the Valahia 2016 exercise requires a collaborative approach to revise existing processes and plans or implement new solutions to further enhance interoperability.

The scenario demonstrated how quickly resources can become depleted, which resulted in organizations developing a better understanding of the needs for robust mutual aid support and interoperability and how important is the level of resilience.

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