



Documentation and Training of Possible Solution of Tasks of Population Protection in Case of Accident at Temelín Nuclear Power Plant

Dokumentace a nácvik možného řešení úkolů ochrany obyvatelstva v případě havárie na Jaderné elektrárně Temelín

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Abstract:

The paper focuses on the processing of the characteristics of the Temelín Nuclear Power Plant External Emergency Plan and its updating as a document for the strategic level of management and coordination of the Integrated Rescue System components in the solution of a radiation accident. A case study of the activities of selected central and territorial administrative authorities, crisis management bodies of the South Bohemian Region, municipalities with extended powers, municipalities, Integrated Rescue System components and other subjects in dealing with an emergency occurring in connection with a simulated radiation accident at the Temelin Nuclear Power Plant. From a methodological point of view, the literature search, expert reflection, methods of analysis and synthesis, deduction were used for the paper. The paper evaluates the External Emergency Plan of the Temelín Nuclear Power Plant and the Zone 2019 exercise as a case study.

Keywords: Crisis Management, Emergency Planning, Exercises, Nuclear Power Plant, Population Protection.



Abstrakt:

Príspevok sa zameriava na spracovanie charakteristík vonkajšieho havarijného plánu Jadrovej elektrárne Temelín a jeho aktualizáciou ako dokumentu pre strategickú úroveň riadenia a koordinácie zložiek integrovaného záchranného systému pri riešení radiačnej havárie. Prípadová štúdia sa zameriava na činnosti vybraných ústredných a územných správnych úradov, orgánov krízového riadenia Juhočeského kraja, obcí s rozšírenou pôsobnosťou, obcí, zložiek integrovaného záchranného systému a ďalších subjektov pri riešení mimoriadnych udalostí v súvislosti so simulovanou radiačnou haváriou v jadrovej elektrárni Temelín. Z metodologického hľadiska bola pre prácu použitá literárna rešerš, expertné reflexie, metódy analýzy a syntézy, dedukcia. Príspevok hodnotí vonkajší havarijný plan Jadrovej elektrárne Temelín a prípadovú štúdiu cvičenia Zóna 2019.

Kľúčové slová: *Krízové riadenie, havarijné plánovanie, jadrová elektrárňa, ochrana obyvateľstva*

Introduction

The aim of the paper is to characterize the External Emergency Plan of the Temelín Nuclear Power Plant and its update as a document for the strategic level of management and coordination of the intervention of the Integrated Rescue System components in dealing with a radiation accident. Furthermore, a case study of the activities of selected central and territorial administrative authorities, crisis management bodies of the South Bohemian Region, municipalities with extended powers, municipalities, integrated rescue system components and other entities in dealing with an emergency occurring in connection with a simulated radiation accident at the Temelín Nuclear Power Plant. From a methodological point of view, the literature search, expert reflection, methods of analysis and synthesis, deduction were used for the paper.

The research part included a systematic process of gathering information and synthesizing existing knowledge with the intention of its dissemination. In order to achieve the objective and source materials for the fulfillment of the objective, a system approach of literature search was used with the aim of obtaining available information sources, published results and information on safety and population protection in the event of an accident at a nuclear power plant. Furthermore, the method of analysis and synthesis was used, ie the division of the whole into components and the connection of partial information into the whole, the description of the principles in mutual dependencies. This procedure was used in the analysis of current information and especially its synthesis in the final part. One of the methods for processing the objective of the research was deduction, ie the process of reasoning from the premises, where the conclusion is based on evidence. The procedure was applied in processing the findings of the case study into the summary final part.

The Fire Rescue Service of the South Bohemian Region (HZS JČK) is, according to the legal regulations (Act No. 239/2000 Coll., On the Integrated Rescue System and on Amendments to Some Acts, as amended) the author of the Temelín NPP External Emergency Plan (EEP Temelín). It is a document of the South Bohemian Region for the strategic level of the governor's management to coordinate joint intervention of the IRS units in coping with a radiation accident. The subject of the plan is protective measures, which serve to limit the consequences of an accident at a nuclear power plant, and sets out basic activities and procedures for their implementation. The measures planned for the EEP Temelín are verified and practiced

within the exercises. On 10 - 12 June 2019, an exercise of crisis management authorities under the name “ZONE 2019” was held, focusing on practicing the activities of selected central and territorial administrative authorities, crisis management authorities of the South Bohemian Region, municipalities with extended powers, municipalities, of the rescue system and other entities in dealing with an emergency occurring in connection with a simulated radiation accident at the Temelín Nuclear Power Plant [1].

1. External emergency plan of the Temelín Nuclear Power Plant

In order to ensure emergency preparedness, to plan protective measures and to mitigate the consequences of a radiological emergency at a power plant, the operator of the nuclear facility prepares an internal emergency plan, the first approval of which is dated 16 December 1999. The Temelín NPP emergency plan, which was first elaborated by the District Office of České Budějovice and approved by the head of the District Office of České Budějovice on 26 June 2000. Thus, in July 2000 fuel could be delivered for Unit 1 of the nuclear power plant. In 2001, since the entry into force of the new legal regulations, the preparation of the EEP NPP Temelín has been the responsibility of the Fire Rescue Service of the JČK. In September 2001 HZS JčK submitted EPP NPP Temelín to the Security Council of the South Bohemian Region for evaluation. After discussing and incorporating the comments, the plan was approved in November 2001 by the President of the Region.

Updates are being carried out on an ongoing basis in response to changes in legislation at national and global levels, reflecting the conclusions of the exercises and taking into account foreign knowledge and experience in the field of radiation accident and radiation protection [2, 3]. The last extensive update was approved by the President of the South Bohemian Region on March 19, 2019. In addition to the Fire Rescue Service of the Czech Republic, the update was also attended by the Regional Office of the South Bohemian Region.), Regional Veterinary Administration of the State Veterinary Administration for JČK, Regional Hygiene Station of JČK, municipalities with extended powers (hereinafter ORP) and other entities involved in the preparation and eventual solution of a radiation accident. With regard to the subject of the update, the State Office for Nuclear Safety (SÚJB) and the operator of the nuclear installation ČEZ, a.s.

UPDATE OF EXTERNAL EMERGENCY PLAN NPP TEMELÍN 2017 - 2019

The update focused on changes resulting from the new Act No. 263/2016 Coll., The Atomic Act (the Atomic Act) and implementing legal regulations, and from the revision Nos. 5 and 6 of the EEP Temelín NPP Internal Emergency Plan. Furthermore, the NPP Temelín was modified in connection with the selection of new decontamination sites, which are followed by other measures such as the change of the main evacuation routes, the location for the closure of the emergency planning zone, etc.

The introductory meeting to update the EEP Temelín NPP was held at the beginning of 2017, organized by ČEZ, a.s. with affected regional fire brigade representatives for the purpose of informing each other about the impact of the new

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legal regulations, in particular the Atomic Act and SÚJB Decree No. 359/2016 Coll. Information on the preparation of the new NPP Emergency Plan, the replacement of iodine prophylaxis tablets, new terminology, the procedure of processing “Basic Information for the Population”, etc. were handed over. in order to maintain the interconnection of the Temelín NPP External Emergency Plan and the Temelín NPP Internal Emergency Plan, which came into effect on 28 December 2017. The meeting was attended by representatives dealing with emergency and crisis planning issues [1].

The changes resulting from the new Atomic Act in relation to the protective measures of the population, which were incorporated into plans for specific activities of the EEP Temelín NPP, concern in particular:

- responses to a radiological emergency, where the direct notification is the direct notification of the competent authorities through the Regional Fire Rescue Center, and therefore this procedure need not be resolved by agreement between ČEZ and the Regional Fire Rescue Service,
- the obligation of the operator of the nuclear installation [4] to propose to the governor the introduction of an urgent evacuation protective measure,
- the duty of the regional fire brigade, the governor and the ORP municipal authorities to inform the population without delay in the event of a radiation accident, resp. in the event of a radiation accident linked to a suspected leakage of radioactive substances and in a radiation accident,
- distribution and variation of iodine prophylaxis tablets.

Since the beginning of 2017, partial co-ordination meetings have been held in accordance with the issue under discussion with the participation of the relevant territorial administrative authorities and representatives of other entities concerned. In the course of the update, individual processors of the partial parts opened areas that had not been solved within their ministries or were only marginally solved. Addressing measures in a radiological accident clearly requires the involvement of central administrative authorities and ministries and cannot be left only within the limits of the region's competence. In order to ensure uniformity of the solution across the ministries and the interconnection of the regional and central levels, the EEP of Temelín NPP summarized the selected conclusions and formulated questions related to activities contained in the “Monitoring Plan”, “Emergency Plan for Veterinary Measures”. and water ". Some of the areas concerned relate to safeguard measures which move from urgent population protection measures to subsequent, in particular regulation of food distribution [5]. In the final phase of the discussed area, they are not the subject of external emergency plans of nuclear power plants, but they are included in the Type Plan - radiation accident and the National Radiation Emergency Plan, which is currently being prepared. SÚJB is responsible for the elaboration of both plans.

These areas are currently being solved within the working group for unification of external emergency plans of nuclear power plants, which deals with the issue. The group is organized by the Ministry of the Interior - DG Fire Rescue Service of the Czech Republic, regularly attended by representatives of Fire Rescue Service of the JČK, Fire Rescue Service of the Vysočina Region and Fire Rescue Service of the South Moravian Region. The aim of the group is to unify the procedures for

preparation for the solution of a radiation accident with the involvement of the central level [1].

A part of the update of the EEP Temelín NPP was the selection of new decontamination sites. In connection with the acquisition of a new technique for decontamination and for a faster dosimetric inspection, the decontamination sites were revised. In the last three years, the selection, reconnaissance and, in one case, practical verification of the new site of decontamination took place. The Fire Rescue Service of the JČK has designated nine decontamination sites that meet the requirements for the activities of the Czech Fire and Rescue Service and the Czech Armed Forces at one place, but also independently. Recognition was carried out by the Fire Rescue Service of the JČK and subsequently by the ACR. One of the annexes of the EEP Temelín serves the FRS JČK as a support for deciding which decontamination points in a radiation accident should be optimally selected based on the development of the situation. The characteristics of the individual sites and the information necessary for the decision to select specific sites are given in the Annex to the EEP Temelín.

With respect to the new decontamination sites, the main evacuation routes have been identified which lead from the hazardous area to decontamination sites on roads with a profile that allows the bus to pass through the parameters of 2.55 m, height 4 m, length 15 m and weight 26 t. The patrol posts of the Police of the Czech Republic and the closure of the JČK Road Administration were also adapted to the routes. From the decontamination point to the receiving center, routes will be selected operatively. Based on the above mentioned changes, the Fire Rescue Service JČK revised the GIS layers and maps, which are listed in the annexes of the EEP Temelín NPP.

2. Exercise „ZONE 2019“

On 10 - 12 June 2019, an exercise of crisis management authorities under the name “ZONE 2019” was held. of the rescue system and other entities in dealing with an emergency occurring in connection with a simulated radiation accident at the Temelín Nuclear Power Plant.

The aim of the exercise ZONE 2019 was to practice basic documentation to deal with a radiation accident, the activities of emergency management bodies in fulfilling selected tasks of population protection according to the External Emergency Plan of the Temelín Nuclear Power Plant in dealing with a radiation accident, audio video conference system between the Ministry of the Interior Republic, the State Office for Nuclear Safety and the Crisis Staff of the South Bohemian Region. Further practice the activation and operation of the monitoring network, involving aviation groups, mobile groups and measurement laboratories [6]. The aim of the exercise was also to practice the emergency response organization of the Temelín Nuclear Power Plant and communication flows with the State Office for Nuclear Safety, the Operational and Information Center of the General Directorate of the Fire Rescue Service of the Czech Republic and the Operational and Information Center of the Fire Rescue Service. The actual training of crisis staffs was focused on the practice of selected practical tasks in dealing with a radiation accident [7].

Exercise should examine the ability of crisis management to respond actively to the task of dealing with emergencies type of radiation accident and timeliness of the

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external emergency plan Nuclear Power Plant, especially plans for specific activities in relation to the fulfillment of the set tasks, or regional emergency plan.

PREPARATION OF EXERCISE

The exercise was carried out in accordance with the “Plan of Exercise of Crisis Management Bodies - specified for 2019–2021”, approved by Resolution of the State Security Council No. 18 of 18 September 2018, which was imposed on the Ministry of Interior - General Directorate with the State Office for Nuclear Safety to prepare, perform and evaluate this exercise. For this purpose, a training group was set up under the leadership of the Ministry of the Interior - General Directorate of the Fire Rescue Service of the Czech Republic, consisting of representatives of the State Office for Nuclear Safety, CEZ, as. and the Police Presidium of the Czech Republic.

The Exercise Preparation Group, in cooperation with the relevant training subjects, prepared a “Plan for the Preparation, Execution and Evaluation of Exercise ZONE 2019” approved by the Minister of the Interior. Several partial meetings were held at the central level on the form and structure of the exercise.

For the purposes of the exercise, three basic lines were established that were independent of each other in time and did not follow the exercise tasks [7]:

1st line of exercise: the occurrence of a radiation accident and accident at the Temelín Nuclear Power Plant, duration of the exercise - the first and the second day of exercise 10 - 11 June 2019; radiation situation monitoring, duration of exercise - second day of exercise 11 June 2019

2nd line of exercises: practicing the practical activities of protection of the population and IRS components - activity at the entry and exit point - regulation of the movement of persons and equipment for the ZHP and activities at the reception center and at the place of emergency accommodation, execution time - second day of exercise 11 June 2019

3rd line of exercise: activities of the Crisis Staff of the South Bohemian Region in connection with the fulfillment of the tasks of population protection, time of implementation - third day of exercise 12 June 2019.

1st line of exercise - the occurrence of a radiation accident and radiation accident at the Temelín Nuclear Power Plant

The first line of exercises related to the development of a radiation accident and accident at the Temelín Nuclear Power Plant according to the prepared scenario. Monitoring of the radiation situation was also carried out, in which selected mobile groups were involved. Helicopters of the Army of the Czech Republic and Police of the Czech Republic were used for aerial monitoring.

2nd line of exercises - practicing practical activities of population protection

On the second day of the exercise, activities at the entry and exit points and activities at the reception center and emergency accommodation were practiced.

Activities at the entry and exit points were focused on the specific execution of tasks in the regulation of the movement of persons and vehicles in the event of a radiation accident at the Temelín Nuclear Power Plant. This part of the exercise

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verified the functionality of the Plan for the regulation of the movement of persons and vehicles, which is prepared for the entire territory of the emergency planning zone and for roads serving as evacuation. Only two patrol posts of the Police of the Czech Republic near the towns of Radostná and Dražič were allowed to enter the enclosed area on designated roads. This verified the set-up mechanism for handing over the lists of persons entering the restricted zone, exchanging information between the sending person, the intervention commander, the Operational and Information Center of the Fire Rescue Service, the Information Operational Center of the Regional Directorate of the South Bohemian Region Police.

As part of their activities at the reception center and emergency accommodation, selected municipalities with extended powers (České Budějovice, Písek and Strakonice) prepared and operated the reception center. They also secured emergency accommodation in connection with the performance of their tasks, including ensuring the survival of the evacuees with the involvement of the NGO Panel to provide humanitarian assistance.

3rd line of exercise: activities of the Crisis Staff of the South Bohemian Region in connection with the fulfillment of the tasks of population protection

As part of the third line of exercises, on 12 June 2019, the Crisis Staff of the South Bohemian Region and the Crisis Staff of the Integrated Rescue System (ie the HZS JČK Staff, the Crisis Staff of the Regional Directorate of the South Bohemian Region) took place. The task of the staffs was to perform predetermined tasks and interviews concerning selected tasks of population protection.

This line of exercises was carried out in the form of tasks and given specific rozeher from the central level according to the approved Rozeher Plan. The introduction to the completely fictitious situation at the Temelín Nuclear Power Plant was carried out in the form of videoconferences moderated by representatives of the Ministry of the Interior - General Directorate of the Fire Rescue Service of the Czech Republic and the State Office for Nuclear Safety from their workplaces. Tasks and roles were handed over to the Crisis Staff by the judges on the spot in the envelope and subsequently sent by e-mail. Transmission of tasks and roles was coordinated in time. The task was e-mailed to the Ministry of the Interior - General Directorate of the Fire Rescue Service of the Czech Republic by e-mail. The number of rozeher was intentionally higher, because one of the goals of the exercise was to put the crisis crew into time stress.

OBSERVATIONS FROM EXERCISE

The objectives of the exercise, which were related to the exercise of selected activities of the Regional Crisis Staff, the Integrated Rescue System, monitoring the radiation situation [8] and checking the timeliness of the planning documentation were met. The planned activities and tasks in the practical part of the exercise were carried out in full and with the maximum effort of all instructors.

In preparation for practical activities and subsequently in their real implementation, the practitioners verified and learned the procedures they used with certainty in solving gaps. An example of this is the procedure for entering intervention personnel into a closed emergency planning zone. The addition of practical activities appeared to be beneficial and productive, when the South Bohemian Region was

actively involved in the process of preparing a specific measure and its subsequent practical implementation.

Conclusion

In spite of the active two-year update of the EEP Temelín NPP there are still partial areas that need to be solved [9]. Given the difficulty of addressing individual areas, the relationship and the impact on the central level, the changes will be incorporated into further ongoing updates, also taking into account the activities and results of the Group for the unification of the external emergency plans of nuclear power plants. The areas that remain in the solution have no impact on the principles of the radiation accident and will be incorporated in further ongoing updates.

The changes made as part of the EEP Temelín Nuclear Power Plant update were reflected in the “Basic Information in Case of a Radiation Accident for the Years 2020 and 2021”, prepared by the operator of the ČEZ nuclear installation, a.s. and are continuously incorporated into the implementation documentation of the Integrated Rescue System and municipalities. The measures and actions planned in the external emergency plan are regularly reviewed by exercise. The last multistage exercise was carried out on June 10 - 12, 2019 called ZONE 2019. The preparation and execution of the exercise was based on the updated EEP NPP Temelín. The practitioners thus practically verified the procedures resulting from valid legal regulations and selected practical activities.

On the basis of data from exercising, processes the Ministry of Interior - General Directorate of Fire Rescue Service document "Evaluation exercises ZONE 2019". It will include an assessment of the preparation, the course of the exercises and the fulfillment of the objectives and tasks set by the stakeholders, as well as an overview of the measures to address the identified shortcomings. This document will be submitted to the Civil Emergency Planning Committee at the end of 2019 for approval.

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References

- [1] NOVOTNÁ, L.; KAVAN, Š. Aktualizace Vnějšího havarijního plánu Jaderné elektrárny Temelín In *Odborný časopis požární ochrany, integrovaného záchranného systému a ochrany obyvatelstva*, 9/2019. MV-generální ředitelství HZS ČR. Praha, 2019, roč. XVIII. ISSN 1213-7057.
- [2] PARK, J., ARIGI, A. M., KIM, J. A comparison of the quantification aspects of human reliability analysis methods in nuclear power plants In: *Annals of Nuclear Energy*, Volume 133, 2019, Pages 297-312. ISSN: 03064549. DOI: 10.1016/j.anucene.2019.05.031.

- [3] KAUR, R.K., SINGH, L.K., PANDEY, B. Security analysis of safety critical and control systems: A case study of a nuclear power plant systém In: *Nuclear Technology*, Volume 197, Issue 3, March 2017, Pages 296-307. ISSN: 00295450. DOI: 10.1080/00295450.2016.1273702.
- [4] CARESTIA, M. at al. Use of the “hotspot” code for safety and security analysis in nuclear power plants: A case study In: *Environmental Engineering and Management Journal*, Volume 15, Issue 4, 2016, Pages 905-912. ISSN: 15829596.
- [5] YOO, H., LEE, J.-H. Results of nuclear security culture survey on personnel at nuclear power plants In: *Annals of Nuclear Energy*, Volume 85, November 2015, Pages 398-402. ISSN: 03064549. DOI: 10.1016/j.anucene.2015.05.001.
- [6] HOLT, M., ANDREWS, A. Nuclear power plant security and vulnerabilities (chapter in book) In *Challenges Facing the Nuclear Power Industry*, 2015, Pages 83-102. ISBN: 978-163483619-7;978-163483618-0.
- [7] KAVAN, Š., NOVOTNÁ, L., BRABEC, M., MECOVÁ, E. Cvičení Zóna 2019 In *Odborný časopis požární ochrany, integrovaného záchranného systému a ochrany obyvatelstva*, 10/2019. MV-generální ředitelství HZS ČR. Praha, 2019, Volume XVIII. ISSN 1213-7057.
- [8] HESSLEROVÁ, P., POKORNÝ, J. Functional attributes of the landscape surrounding the Temelin nuclear power plant (Czech Republic) In: *International Journal of Remote Sensing*, Volume 36, Issue 19-20, 2015, Pages 5165-5177. ISSN: 01431161. DOI: 10.1080/01431161.2015.1047995.
- [9] JUNEK, L. Normative technical documentation of association of mechanical engineers, Czech national code of equipment and piping of nuclear power plants of WWER In: American Society of Mechanical Engineers, Pressure Vessels and Piping Division (Publication) PVP, Volume 1B-2018, 2018. ISSN: 0277027X. ISBN: 978-079185159-3. DOI: 10.1115/PVP201885155.

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