
The Physical Protection of Nuclear Material and Nuclear Facilities in the Czech Republic

J. Sedlacek
L. Bartak

** State Office for Nuclear Safety, Senovazne nam. 9, 110 00 Prague 1, Czech Republic*

ABSTRACT: The paper describes comprehensively past and present of physical protection of nuclear facilities and materials in the Czech Republic, particularly: the changes made in ensuring and legislation of physical protection following the political changes in 1989; the basic concept and regulation in physical protection and the effort made to strengthen the national regulatory programmes, as well as a brief survey of the nuclear facilities in the Czech Republic; experience in design, operation, inspection and licensing of the integrated physical protection system for nuclear power plants with WWER-440 and WWER-1000 reactors; the role of the police as a response force and the role of the new private security companies; the upgrading of the physical protection systems at the different types of the nuclear installations to fulfill the more strict requirements of the new Atomic Law No. 18/1997 Coll. and Regulation No. 144/1997 Coll., on physical protection of nuclear materials and nuclear facilities; the follow up actions in connection with IAEA IPPAS missions carried out in 1998 and 2002 are given.

1 INTRODUCTION

The physical protection of nuclear facilities and nuclear materials in the Czech Republic is considered to be an integral part of nuclear safety. There is no difference in the damage to the environment by the release of radioactivity whether it is due to failure of technological systems or to radiological sabotage. Referring to the basic IAEA recommendations [1-3] to ensure the commitment following the Convention on the Physical Protection of Nuclear Material, the Non-Proliferation Treaty and the implementation of safeguards, from the beginning of the operation of nuclear power plants and other nuclear facilities in the former Czechoslovakia, the physical protection of these facilities and nuclear materials has been ensured.

The ultimate objective of the physical protection system (PPS) is to prevent the accomplishment of unauthorized overt or covert actions to nuclear facilities and nuclear materials. When a physical protection system is applied to a nuclear facility or to nuclear materials, its objective is to prevent radiological sabotage of facilities and theft of nuclear materials. Thus an effective system of physical protection also plays an important role in preventing illicit trafficking of nuclear materials.

Before the former Czechoslovakia was split into two parts, the State Office for Nuclear Safety (SONS) was established by the Czech Law No. 21/1992, Coll. [4]. From 1 January 1993, SONS as a regulatory body has carried out most of the activities performed by the former Czechoslovak Atomic Energy Commission (CSAEC) in the field of nuclear safety [5]. Since 1 July 1995, SONS also performs State supervision of radiation protection according to Law

No. 287/1993, Coll. [6] and Law No. 85/1995, Coll. [7]. All former commitments of Czechoslovakia regarding the aspects of safeguards and physical protection are fully covered by the Czech Republic. The responsibility and role of SONS are declared by Law No. 18/1997, Coll. [8]. In respect of the splitting of the Czechoslovakia it is necessary to mention that there was no gap in ensuring nuclear safety in newly established Czech Republic. All laws and regulations regarding nuclear safety as well as former decisions of CSAEC were fully accepted by SONS and by the utilities.

2 PAST PHYSICAL PROTECTION

In the past, the State Defence Council declared nuclear power plants (NPPs) as installations of special importance. In accordance with the decision of SDC, physical protection of NPPs had to be performed by the army forces on the outer perimeter of the facilities. Protection of inner parts (entry control, search of transport means, etc.) as well as response to terrorist attack had to be provided by the forces of the Ministry of the Interior. From the very beginning it was recognized that the efficiency of the PPS should be improved and the human factor influencing the quality of protection should be minimized and/or excluded. Thus, in 1982, on the basis of governmental decision, the project on development, design and construction of the integrated PPS for NPPs started. This decision gave the basic technical requirements of this system as detection in depth, automatic access control of persons and vehicles, a fully computerized system, provisions on barrier detection systems and vehicle barriers, provision of a closed circuit television (CCTV) system, as well as manufacture of the system's components by Czech enterprises. The concept of this system fully corresponded to similar systems operating in western countries at that time. The performance of the system was based on the recommendations given by the IAEA. The Research Centre Dukovany was established to realize this system at NPP Dukovany. The system design including software for the operation of the system was developed there at the end of the 1980s. In 1990, the installation of this system at the NPP Dukovany was started. The system was put into operation step by step within approximately two years, and the decision of CSAEC for permanent operation from 1 January 1993 was issued. This is the first integrated system designed to ensure physical protection of NPPs operating WWER-440 type reactors and fully covers the IAEA recommendations published in INFCIRC/225/Rev. 3 and the requirements set Nuclear installations in the Czech Republic by Regulation No. 100/1989, Coll. [9] of CSAEC.

3 PRESENT PHYSICAL PROTECTION

3.1 Strengthening the State system of the physical protection

Strengthening of the national regulatory programme has been established by a new comprehensive Atomic Law [8]. The proposal of the Atomic Law constitutes the legal basis for the physical protection of nuclear facilities, nuclear materials and transport of nuclear materials (paras 2, 3, 4, 9, 13, 18, 20 39 and 44). To follow the basic requirements of the Atomic Law the new basic national regulation Decree No. 144 on Physical Protection of Nuclear Materials and Nuclear Facilities and on its Inclusion into Particular Category was prepared [10]. The new regulation very clearly describes technical and administrative measures to ensure physical protection of nuclear facilities and materials, as well as nuclear

materials during transport, categorisation of nuclear materials, parts of nuclear installations and licensing of physical protection. The provisions of the Decree follow the basic IAEA recommendations on Physical Protection of Nuclear Material and Nuclear Facilities (INFCIRC/225/Rev.4 (Corrected)) [11] and provisions of the Convention on the Physical Protection of Nuclear Material (INFCIRC/274/Rev.1) [3]. The specific physical protection measures, which are applied to a particular facility, are determined by the State. That determination is based on factors specific including the State, threat perception, economics, political infrastructure and culture. According to the Atomic Law [8] the licensee bears the responsibility of physical protection of his facility and nuclear material. The licensee has to submit to SUJB for approval a safety report the contents of which are described in the Appendix of the Atomic Law and in para 18 of the Decree No. 144/1997 Coll.; the safety report has to show how the requirements to ensure physical protection are fulfilled. All systems of physical protection of nuclear materials and nuclear installations have to follow updated requirements set by Decree No. 144/1997, Coll., not later than five years after entry into force of the Atomic Law (June 1, 2002). These additional requirements determine general aspects, detailed requirements concerning the design of the technical system including its maintenance and communication means, requirements concerning the provisions of guarding as well as the demands of dealing with confidential information. A detailed description of the contents of the above mentioned chapters is given in para 18 of Decree No. 144/1997, Coll. [10]. We can also confirm that above mentioned Atomic Law and Decree fully cover "Physical Protection Objectives and Fundamentals Principles" given in GOV/2001/41, IAEA, 15 August 2001 – Appendix to GC(45)INF/14 – 14 September 2001.

3.2 Nuclear installations in the Czech Republic

At nuclear installations in the Czech Republic there are very strictly followed the provisions to ensure the physical protections of nuclear materials in accordance with INFCIRC 225/Rev.4 [11]. In addition the national Regulation [10] requires protecting all nuclear material of Category I, II and III by using technical alarming systems. Still there are potential to seized namely depleted and natural uranium and small samples of enriched uranium and plutonium in the quantities lower than the limit for Category III as given in Table: Categorisation of Nuclear Material [10]. For these nuclear materials there are no strictly defined measures for their physical protection (only in accordance with prudent management practices).

In the Czech Republic, only the following steps of the nuclear fuel cycle are covered:

exploration, mining and milling of uranium ore; storage of uranium concentrate (yellow cake); operation of nuclear reactors; storage of highly enriched uranium (HEU) and other nuclear materials; interim storage of spent fuel (away from reactor); storage of high level radioactive wastes; disposal of low and medium radioactive wastes; transport of nuclear materials.

The principal nuclear facilities are briefly described as follows.

NPP Dukovany: four units, WWER-440/type 213, low enriched uranium (LEU), category I;

NPP Temelín: two unit, WWER-1000, LEU, category I;

Nuclear Research Institute rez: reactor LWR-15 (HEU) and reactor LR-0 (LEU), category II;

Czech Technical University, Prague: reactor VR-1P (HEU), category II;

Interim storage of spent fuel (away from reactor) at NPP Dukovany site dry type using cask CASTOR-440/84, capacity 60 casks, category I;

Storage of fresh fuel (HEU): Nuclear Research Institute rez , category I;

Institute of Nuclear Fuel, Prague, D, N, LEU, category III;

Storage of uranium concentrate: DIAMO, s.p. Straz pod Ralskem and GEAM, o.z. Dolní Rozínka, N, category III;

Storage of high level radioactive wastes: Nuclear Research Institute Rez, irradiated HEU and LEU, radioactive wastes, category II;

Regional repository of low level radioactive wastes at NPP Dukovany, category III;

Repository of radioactive wastes Richard (near city Litomerice), SURAO, category III.

Note: D - depleted uranium, N - natural uranium, LEU - low enriched uranium, HEU- high enriched uranium, category j: the level of physical protection.

3.3 Basic concept of the physical protection

The basic concept of the PPS for particular nuclear facilities and/or nuclear material in use and storage should fulfil the general requirements set up by Decree No. 144/1997 [5]. More details on the physical protection of nuclear materials and nuclear facilities in the Czech Republic are given in papers [12 - 16]. To fulfil the requirements set up in this Decree for nuclear installations of category I the basic concept of physical protection is based on detection in depth, which can be represented as follows:

The layout of the nuclear facility (see Fig. 1) is divided by the mechanical barriers into three adjacent areas as follow

- Equipment and nuclear materials of category I must be located in the inner area;
- Equipment and nuclear materials of category II must be located in the controlled area;
- Equipment and nuclear material of category III must be located in the protected area.

For PPS at NPP and nuclear facilities of the category I there is compulsory to installed an integrated protection system. This system guarantees:

- (a) Independent checking of authorized entrance of persons or vehicles into different areas of the NPP;
- (b) Detection in depth, representing detection of unauthorized entrance to selected devices, depending on their significance in ensuring nuclear safety (three categories according to "fault tree" analysis).

For another nuclear facilities there is compulsory to have direct output of the electronic alarming systems [17] to the central security control room of the local Czech police office.

All other provisions regarding the detection systems for barriers and inner areas, delay components, access control, vehicle barriers, CCTV system and other administration measures are set up in the safety report and in supplement documents (communication and guarding rules, response activities, tactics).

Following the amendment of the Law on the Police of the Czech Republic [18] in § 44 of the Atomic Law, the police guarantees the timely response in the case of emergency situations, in accordance with the provisions of regulations [10] and governmental decision No. 937 dated September 18, 2000.

From 1 January 1992, a private security company has provided the inner guarding.

4 UP-GRADING OF THE PHYSICAL PROTECTION

Technical measures:

- All nuclear facilities prepared new safety analysis report declaring that new requirements has been fulfilled and received from SUJB new licence to ensure the physical protection; only two facility have a temporary licence because they should in high extend to change the control system (preliminary based on PC network) or completely installed the new integrated system (preliminary based only on separate electronic alarming systems);
- At the facilities of the II and III category has been performed direct connection of alarming systems to local offices of the Czech police, digital transfer of data by radio;
- Delay time of the mechanical barriers has been increased: new design of the isolation zone, additional bared wires concertina, stop-roads equipment, safe doors, bullet resistance windows, vault type rooms and safes etc.;

- Implementation of new detection systems with higher reliability and detection probability and lower false alarm;
 - More sophisticated systems to control the entering persons, cars and luggage (rtg . devices, metal detectors);
 - Introducing the biometrics detection (hand geometry, finger print, face recognition system);
- Implementation of video capture systems (pre and post alarm evaluation) and using only CCTV cameras;
- To fulfil the “Two persons rule” by technical system;
 - To established the secondary alarm station.

This technical means are supporting by improvement of the administrative measures:

In accordance with national regulations (see Ref. [10]) uranium concentrate [yellow cake] of an amount of >1000 kg is considered as nuclear material of category III;

Providing regular tactics exercises of licensee, police and guarding companies;

To fulfil the requirements of QA in preparation of documents, installation, maintenance and testing of the physical protection systems;

Continuous activities to develop and improve the overall efficiency and reliability of the whole system.

Most of the up-upgrades are improving the deficiency of the original design of NPPs, both WWER-440 and WWER-1000 types, which did not take into account the general requirements of physical protection (e.g. unsuitable location of vital equipment, insufficient resistance of building walls, doors, windows, unprotected pipe channel, etc.).

5 IPPAS MISSION

On the request of the Czech government in the end of the 1998 IAEA performed the IPPAS mission in the Czech Republic focusing on the legislation and regulation aspects as well as on implementation of the physical protection. The IPPAS team visited NPP Dukovany and Temelín, training reactor at Czech Technical University in Prague and Nuclear Research Institute at e (Two reactors, storage of HEU fresh fuel and storage of high radioactive wastes including the irradiated fuel originally LEU and HEU type).

The results of the IPPAS mission declared the high level of the ensuring the physical protection at nuclear facilities as well as the legislation covering the physical protection in whole. Regulatory body and licensee have accepted the final report with recommendations, suggestions and good practises. Appropriate action has been taken.

As follow-up action in 1999 the workshop on DBT has been carry out in Prague. This was first opportunity to have a detailed discussion of the representatives of regulatory body, licensee, Ministry of Interior, Police of the Czech Republic and Intelligence Service on DBT together with experts of the IAEA, USA, U.K. and Germany. Conservatively the Czech utility are still basically dealing with DBT defined in early 80's. There is under preparation to include the DBT into amendment of the Decree No. 144/1997 Coll.

There was established also direct co-operation between the NRI and Sandia National Laboratories focusing on up-grade of the physical protection system, which covered not only technical assistance but also the financial support to improve the physical protection of the NRI facilities handling HEU (originally 80 or 36 wt. % ²³⁵U). The up-graded PPS is in full operation from 1. 7. 2003.

We also requested the follow-up IPPAS to visit the NPP Temelin where the physical protection system has been finished. During mission in 1998 only the project and part of the outer perimeter was ready. The operation of the physical protection system has been approved by SUJB in January 2000 and it is in full operation from this time. The licensee fulfilled the basic requirements that integrated technical system must be in operation at least 3 months before first loading of the fresh fuel into the reactor core (July 5, 2000). This

integrated system is under frequent inspections of the SUJB and results of inspection show that system is very reliable and it is operating without problems. Also the IPPAS Mission which took place in 2002 stated that PPS is comparable with western systems and no recommendation were given in final report of the mission.

6 ACTIVITIES TO COMBAT NUCLEAR TERRORISM

There are generally applied some activities based on strengthening administrative and technical measures at nuclear facilities These can be summarised as follows: Strengthening of the PPS; Co-operation with Police and Intelligence Services; Police - surveillance of the vicinity of the nuclear facility; Strong limitation of access to nuclear facilities; Temporary deployment of the ground-air missiles; Prohibited areas - Radius 1.1 NM, Upper/Lower Limit 5000 ft AMSL/GND; Protective Airspace - Radius 12 NM, Upper/Lower Limit FL 95/GND Entry into restricted area for civil aircraft if the two-way radio contact upon TWR/APP Brno -MTWR/MAPP Namest or FIC Praha/ACC Praha - MIL ACC approval only. Restriction applies also to dept., arr. and the local flight activity of aerodromes located within the restricted area or whose areas of activity penetrate the restricted area.

7 CONCLUSIONS

Physical protection of the operating NPP is provided by technical means (integrated PPS), guarding is performed by a private security company and response is guaranteed by the Czech police. The system fulfil as a minimum, the IAEA recommendation for nuclear material category I and corresponds to western standards of the physical protection of NPPs. As a result of of SONS inspections the system is continuously upgraded as given in paper.

All other nuclear facilities are also protected in accordance with IAEA recommendations. In addition the requirements of SONS and new regulations to reduce the risk of unauthorized handling of nuclear material also for category II and III require compulsory to use technical alarming systems.

The efficient state physical protection system of nuclear materials and the state system of accountancy for and control of nuclear material play a crucial role in preventing the possibility of illicit trafficking of nuclear materials from nuclear installations in the Czech Republic.

We appreciate very much the effort of the IAEA to provide on the request of the Members States the IPPAS mission and in this way to promote the international co-operation in the field of the physical protection and to help the Member State improve the level of the physical protection of nuclear materials and nuclear facilities.

To support the strengthening of physical protection of nuclear material and nuclear facilities there are carry out since 1995 jointly organised by IAEA, USA and Czech Republic regional training courses in this field in Brno (the 6th took place in 2002).

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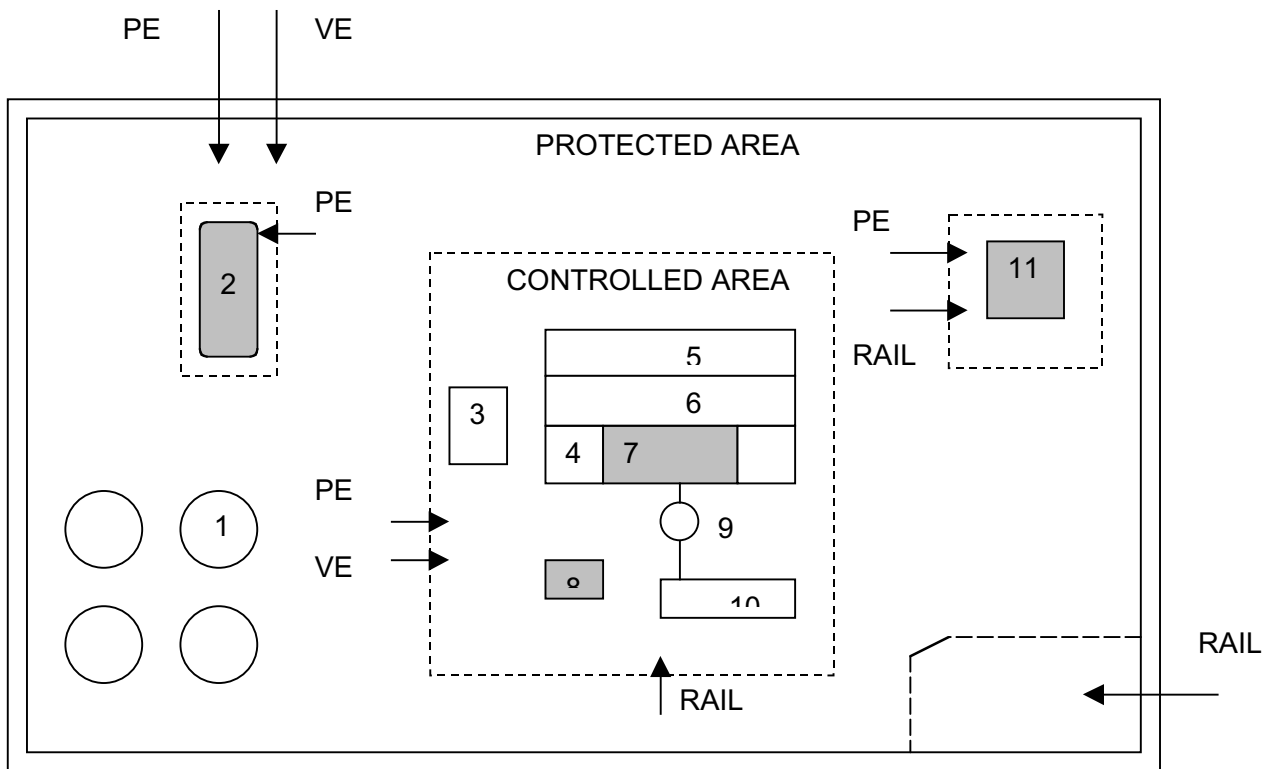


Figure 1 implementation of the physical protection integrated system at hypothetical facility with two reactors WWER-440 and away-from reactor interim spent fuel storage

- Access to NPP
- ══ isolation zone (detection, CCTV)
- - - - fence (detection, CCTV)
- inner area

- 1 – cooling tower
- 2 – central pumping station
- 3 – service building
- 4 – transversal building
- 5 – turbine hall
- 6 – longitudinal building
- 7 – reactor building
- 8 – diesel generator
- 9 – ventilation stack
- 10 – auxiliary building
- 11 – away from reactor spent fuel storage