**Legislative and Regulatory Framework**

**for Protecting Emergency Workers in Ukraine**

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**Abstract**. Issues related to protection of emergency workers are regulated in Ukraine by a number of normative documents at different legislative levels. The paper presents information on health and radiation regulations, procedures on issuing permission for increased planned exposure, definition of emergency personnel, measures on protecting emergency workers. Conclusions are given on conformity of the Ukrainian regulations with the international safety requirements.

1. **Introduction**

This paper describes the requirements of Ukrainian legislation for protecting emergency workers. Among the normative documents addressing issues of protecting emergency workers there are documents of upper legislative level (code, law), state safety standards, normative documents of the regulatory authority and the operating organisation. Information on some provisions of these documents is presented in the paper together with assessment of their conformity with international safety requirements.

1. **General Principles of Civil Protection**

According to the Constitution of Ukraine, Article 3, “the person, his life and health, honour and dignity, inviolability and safety are recognized in Ukraine as the highest social value”. This constitutional provision is a fundamental base for general principles of civil protection that introduced by the Code of Civil Protection of Ukraine [1]. Among those general principles of civil protection there are some ones that directly linked to the basic principles of protecting emergency workers, for example: guaranteeing and ensuring by the State the constitutional rights of citizens for protection of life, health and property; priority of tasks aimed at rescue of life and preservation of health of citizens; voluntariness in case of involvement of citizens in civil protection activities insecure for live and health; justified risk and responsibility of managers of civil protection forces for ensuring safety during rescue work, etc.

1. **Dose Limits**

The Norms on Radiation Safety of Ukraine [2] establish three categories of persons who are subject to exposure. Those individuals who work directly, permanently or temporarily, with sources of ionising radiation belong to the Category A – the personnel.

The dose limits for exposed persons are established in terms of individual annual effective dose of internal and external exposure and equivalent dose of external exposure for some organs and tissues (eye's crystalline lens, skin, hands and feet) Ref. [2]. An effective dose limit for the personnel of the Category A DL eff = 20 mSv⋅year-1 is permitted as averaged dose over five consecutive years, but not more than DLeff max = 50 mSv in any single year. Equivalent dose limits of external exposure: DL lens of the eye = 150 mSv⋅year-1, DL skin = 500 mSv⋅year-1, DL extremities = 500 mSv⋅year-1. The dose limits for occupational exposure (except the dose limit for lens of the eye) are in line with requirements of Ref. [3], Schedule III. Distribution of the dose during a calendar year is not regulated.

1. **Emergency Workers**

Definition of emergency workers is given in the state safety standard Ref. [2]: emergency workers are the staff participating in work at the facility in emergency. Emergency workers could be divided into two main categories: 1) the main staff – is the personnel of the facility in emergency and members of special emergency brigades prepared in advance (medical teams of a fast response, dosimetric emergency groups, fire brigades prepared to work under conditions of radiation accident, brigades for repair-and-renewal operations, etc.); 2) the outside staff – is the personnel involved in emergency work that are to be trained and informed on radiation situation at the places where the work to be performed. Definition “emergency worker” given in Ukrainian safety standard is quite close to descriptions given in Ref. [3], Definitions, and Ref. [4], para. 4.58. and Glossary.

Dose constraints for the main staff aim at non-exceeding the values of regulations for the staff of Category A. The outside staff in conditions of “General emergency” is to be given the status of the staff of Category A, Ref. [2]. Requirement on non-exceeding the values of regulations for the occupational exposure is in line with Ref. [3], para. 4.14.

The outside staff and the main staff are to be provided at the same extent with all regular and special means of individual and collective protection as well as with system to measure and record doses received during the work, Ref. [2]. Requirement on equivalent protection for outside workers and for workers employed on a permanent basis is in line with a provision of Ref. [5], Article 51.

Emergency workers are to be permanently informed on received and potential doses as well as on relevant health hazard, Ref. [2], that is in line with Ref. [3], para. 3.110 and 4.17, and Ref. [4], para. 4.59.

According to the Law of Ukraine “On Individuals Protection against the Impact of Ionising Radiation” [6], Article 7, involvement of individuals in activities on elimination of radiation accidents and their consequences is permissible only on a voluntary base and under the contract where potential dose is to be indicated. It is prohibited to involve individuals with medical contraindications, persons under 18 and women of child-bearing age. Overexposure of individuals involved in activities on elimination of radiation accidents beyond the basic dose limits is permissible only if the individual gives his consent and only in cases when there is no possibility to take measures to prevent such exceeding and could be justified only by rescuing people life and preventing further dangerous development of the accident and overexposure of larger number of people. Requirement on involving workers in emergency activities on a voluntary base is in line with Ref. [3], para. 4.17.

1. **Increased Planned Exposure**

The increased planned exposure of emergency workers is allowed when work is associated with the following situations: 1) when undertaking intervention to prevent serious negative health effects; 2) when undertaking actions to avert a large collective dose; 3) when undertaking actions to prevent such a development of accident that may lead to catastrophic conditions, Ref. [2], that is in line with Ref. [3], para. 4.15, and Ref. [4], para. 4.57.

Increased planned exposure of emergency workers ranged from 1 to 2 DLmax (50-100 mSv) per year is to be authorised by the local authorities of the State Sanitary-Epidemiological Inspectorate. Single dose up to 2 DLmax (100 mSv per year) is to be compensated in such a way that after the period of 10 years an effective dose would not exceed 200 mSv. It is prohibited to plan an increased re-exposure until the compensation of the previous one. Increased planned exposure of emergency workers ranged from 2 to 5 DLmax (100-250 mSv) is to be authorised in the exceptional cases by the Ministry of Health of Ukraine and only once during all the working activity of the employee. In the exceptional cases, when activities aim at saving human lives, all possible measures shall be taken to prevent emergency workers from receiving equivalent dose for any organ (including proportional irradiation of the whole body) above 500 mSv, Ref. [2]. Increased planned exposure limits established by Ref. [2] are in line with guidance values for restricting exposure of emergency workers required by Ref. [3], Table IV-2.

The increased planned exposure of emergency workers is prohibited for men under 30 and for women. The individuals exposed to the dose of 2 DLmax and higher are to be taken off from the exposure area and to be subject to medical examination.

Emergency workers performing activities under conditions when the dose can exceed the maximum dose limit DLmax are to be volunteers, have to pass medical examination, to go through preliminary training and to sign a written consent to take part in these activities Ref. [2]. Requirement on training emergency workers is in line with Ref. [3], para. 4.17, and Ref. [4], para. 4.62.

The doses received due to performing the emergency operations are not the reason for taking the worker off the job, but if an individual received a dose of 500 mSv, his further occupational exposure is to be allowed only upon qualified medical examination and providing to the worker information on possible risks for his health in case of continuation of work connected with usage of radiation technologies, Ref. [2]. Requirement on medical examination before further occupational exposure is in line with Ref. [3], para. 4.19.

1. **Requirements to Emergency Plans**

In accordance with Ref. [4], para. 3.8, the state safety standard [2] lays down requirements to the emergency plans of the enterprises dealing with nuclear and radiation technologies. It is established that the emergency plan is an integral part of the licence and is to be approved by the state regulatory bodies; that a top manager of the enterprise is a person responsible for the development of the emergency plan; the emergency plan is subject to updating and reviewing on a regular base with taking into account lessons learnt from the emergency exercises; the emergency plan is to include information on officials responsible for organisation and general management of emergency work, for individual and collective dosimetric control, for medical control, for informing emergency workers, for documenting the workers’ consent to participate in activities with involvement of increased planned exposure, procedures on exchange of information between the facility and the outside response organisations, etc.

1. **NPP Emergency Plans**

Issues on protecting emergency workers are addressed in the NPP Emergency Plans developed on the base of Standard Emergency Plan for NPPs of Ukraine, Ref. [7].

**Criteria for introduction of protective measures** are the dose rate and averted calculated dose for the period of 14 days. On the base of numeric values for averted calculated dose established in Ref. [2], the numeric values for the gamma dose rate are introduced in Ref. [7]: the first regime, when the dose rate exceeds 2.5 mR/h (6.9 nGy/s), requires restriction on staying outdoor on the NPP site; the second regime, when the dose rate exceeds 6.3 mR/h (17.4 nGy/s), requires sheltering and iodine prophylaxis; the third regime, when the dose rate exceeds 62.5 mR/h (173.6 nGy/s), requires evacuation; and the forth regime, when the dose rate exceeds 625.0 mR/h (1736.0 nGy/s) requires urgent evacuation. The NPP Emergency Plan provides information on the persons responsible for defining the protection measures and making decision on implementation of these measures. This practice is in line with requirements of Ref. [4], para. 4.60 and 4.65.

**Radiation survey** is to be conducted in order to assess radiation situation inside the buildings, on- and off- the NPP site, to define locations of contamination, to confirm radiation parameters necessary for the accident classification, to clarify conditions and continuation of emergency work, routes of the staff transportation, and protective measures for emergency workers. According to the NPP Emergency Plan it is prohibited to conduct any emergency work without conducting prior radiation survey and informing emergency workers about radiation situation in the places of work. Results of radiation survey are to be reported to the head of the Radiation Monitoring Group and to the NPP Emergency Headquarter. Information on radiation survey equipment, location of laboratories, points for measurements and sampling on the NPP site and in the monitoring zone is incorporated into the NPP Emergency Plans. This practice is in line with requirements of Ref. [4], para. 4.61.

**Dosimetric control** includes monitoring of radiation parameters on the working places, individual dosimetric control of the personnel, operative planning and recording doses and keeping information on the doses received. Information on fixed and portable equipment for dosimetric control is incorporated into the NPP Emergency Plans. The main tasks of emergency individual dosimetric control are formulated in the NPP Emergency Plan as disclosing facts of radionuclides intake during emergency activities, preventing overexposure of emergency workers, documenting factual doses of emergency workers, reconstruction of doses obtained by emergency workers accidentally (out of control), thorough investigation and accurate assessment of doses, that is in line with requirements of Ref. [3], para. 4.18, and Ref. [4], para. 4.62. Individual records of occupational exposure for each worker (hard copy card and electronic data base) shall be maintained during and after the worker’s working life, at least until the former worker attains or would have attained the age of 75 years, and for not less than 30 years after cessation of the work in which the worker was subject to occupational exposure, that is in line with Ref. [3], para. 3.104.

**Measures on prophylaxis of external and internal exposure of the personnel** (necessity to administer stable iodine tablets) are to be defined by the NPP’s shift supervisor or the head of the Emergency Headquarter. The personnel of the Unit in emergency is to take the stable iodine tablets immediately after declaring emergency of the classes “Site area emergencies” or “Facility emergencies”. When “General emergency” declared, taking of the stable iodine is mandatory for the staff of the whole NPP. The NPP Emergency Plan lays down requirements to the amount of stable iodine tablets to be stored, contains information on the persons responsible for stable iodine administration, and indicates places where the tablets are stored both for the operative staff and the day-time personnel.

**Sheltering** facilitiesare to be arranged for accommodation of the personnel in case of emergency according to the requirements of General Provisions on NPP Safety [8]. The NPP Emergency Plan describes location and capacity of sheltering facilities, indicates a person responsible for opening the doors and accommodating people. Depending on a situation, the working premises and offices could be used for purposes of sheltering.

**Evacuation** preparation is to be completed within three hours after sheltering. The NPP Emergency Plan contains information on evacuation routes, gathering points, transport available. Movement of the staff along the routes could be started only after the radiation survey completion. In case of necessity additional routes could be defined with taking into account safety issues.

**Internal and External Emergency Centres** are to be built for each NPP and commissioned before the NPP physical start-up. The Internal Emergency Centre is to be located on the NPP site and the External Emergency Centre is to be located off-site in the monitoring zone, Ref. [8]. The Centres are to be designed in accordance with requirements of the regulatory normative document, Ref. [9]. The main function of the NPP Emergency Centres related to the protecting emergency workers is a management of activities aimed at radiation protection of the personnel, search and rescue actions, providing emergency medical care and medical control. In cases when engineering protective means and life-sustaining systems of the Internal Emergency Centre could not ensure inhabitability, radiation protection of the personnel and continuity of the emergency response, the External Emergency Centre is to be activated. The NPP Emergency Plan contains information on officials responsible for the Centres activation, on the personnel that has to arrive to the Centres upon emergency notification as well as on checking procedures for systems and equipment installed in the Centres.

**Decontamination** of transport and equipment is to be conducted in the special points; special containers and collectors are to be installed for radioactive waste. In order to provide emergency workers with facilities for changing clothes, shoes, for monitoring radiation contamination of the personnel’s skin and means of personal protection there are special sanitary checkpoints arranged in the sanitary units on the premises of each NPP. Spare clothes, detergents and decontaminators are stored at the checkpoints. Sanitary gateways, both fixed and transferable, are used for preliminary decontamination.

**Medical protection** ensures administering first medical aid, delivering pre-hospital medical care, carry out triage and transportation of casualties, delivering qualified and special medical assistance. First medical aid is to be delivered by a health unit located on the premises of each NPP and by medical posts deployed in each NPP’s department in case of emergency. Special medical sanitary hospital and its medical emergency teams support the NPPs with pre-hospital medical care. The NPP Emergency Plans contain information on the NPP’s transport available for the medical purposes, on seating capacity of this transport, routes of transportation, location of hospitals prepared to accept casualties.

1. **Roles of the SSTC NRS in emergency preparedness and response**

Experts of the SSTC NRS are assigned to the staff of the State Nuclear Regulatory Inspectorate of Ukraine (SNRIU) Information and Emergency Centre. In an emergency they provide an expert support to the decision making process assessing conditions of the reactor installations and radiation situation, making prognosis for the situation development. Every year the SNRIU’s and the SSTC NRS’s experts participate in a joint emergency exercise organized by the operating organization. For additional exercises conducted by the SNRIU for the purposes of internal training, the SSTC NRS develop scenarios. Other activities of the SSTC NRS in emergency preparedness could be specified as support of the regulatory body in the development of acts on nuclear and radiation safety aimed at prevention of emergencies; in supervision of nuclear installations and other enterprises and organizations for their compliance with the nuclear and radiation safety requirements aimed at prevention of accidents; in expert review of normative documentation developed by the operating organization.

1. **Lessons learnt from the Fukushima accident**

The basic legislation in Ukraine concerning protecting emergency workers has not experienced significant changes since the Fukushima accident. Some amendments were introduced in the Standard Emergency Plan for NPPs of Ukraine. The amendments address the necessity to accumulate resources that would be adequate for multiunit events and events caused by natural disasters. Following these changes, an emergency plan for each NPP was reviewed.

As a rule, an emergency joint exercise based on the scenarios of NPP accident with involvement of the operating organization and the regulatory body is to be conducted annually (each third year for the same NPP). After the Fukushima accident there were conducted additional exercises at all operating NPPs and at the site of the Chernobyl NPP. Scenarios of the exercises were based on events caused by external natural disasters. All these drills and exercises involved elements on training the issues of protecting emergency workers such as exercising activities on radiation survey, dosimetric control, sanitary treatment of the personnel, providing medical care, etc.

1. **Conclusion**

Ukrainian legal and regulatory framework for protection of emergency personnel is in place and generally correlates with the international standards. The Association Agreement with the European Union and its Member States requires from Ukraine to implement a number of the European Union legislations, including a Council Directive 2013/59/Euratom, Ref. [5]. Recently the Cabinet of Ministers of Ukraine has approved a Plan of Implementation of Association Agreement. According to this Plan a number of normative legal acts is to be developed, approved and introduced in order to implement provisions of the Ref. [5] within 2  years (up to the end of 2016). The SNRIU and the SSTC NRS are expected to be involved in reviewing national regulations.

**Appendix: References**

[1] Code of Civil Protection of Ukraine, 02.10.2012, № 5403-VI.

[2] Norms on Radiation Safety of Ukraine (НРБУ-97)*,* ДГН 6.6.1.-6.5.001-98.

[3] Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards. Interim edition. No. GSR Part 3 (Interim), IAEA, 2011.

[4] Preparedness and response for a nuclear or radiological emergency. Safety Standards Series No. GS-R-2, IAEA, 2002.

[5] Council Directive 2013/59/Euratom of 5 December 2013 laying down basic safety standards for protection against the danger arising from exposure to ionising radiation and repealing Directives 89/618/Euratom, 90/641/Euratom, 96/29/Euratom, 97/43/Euratom and 2003/122/Euratom.

[6] Law of Ukraine “On Individuals Protection against the Impact of Ionising Radiation”,14.01.1998, № 15/98-ВР.

[7] Standard Emergency Plan for NPPs of Ukraine, ПН-А.0.03.192-12.

[8] General Provisions on NPP Safety, НП 306.2.141-2008.

[9] Requirements to NPP’s Internal and External Emergency Centres, НП 306.2.02/3.077-2003.