

## **ENHANCEMENT OF RADIOLOGICAL SAFETY CULTURE WITHIN IGNALINA NPP AND CONTRACTORS**

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### **ABSTRACT**

The Lithuanian Hygiene Standard HN 83:1998 “Radiation Protection of Outside Workers” (1998), that is based on requirements set out in the Law on Radiation Protection of the Republic of Lithuania (No. VIII-1190 of 12 January 1999), [1] and other legal acts, establishes the radiation protection requirements for contractors (hereinafter - outside workers) when they are performing their activities within the controlled areas. The principal requirement of the Lithuanian Hygiene Standard HN 83:1998 is that the radiation protection of outside workers shall be at the same scale as of permanent workers. One of crucial points for ensuring the high radiological safety culture between the license holder, employer and outside workers is the clear allocation of tasks and distribution of responsibilities in the field of radiation protection.

The basic requirements for radiation protection of outside workers and main factors that help to enhance the radiological safety culture within Ignalina NPP and outside workers are discussed in the paper.

### **Legislation**

The radiation protection requirements of outside workers when they are performing their activities within the controlled areas are established by the following legislation:

- Lithuanian Hygiene Standard HN 73:2001 “Basic Standards of Radiation Protection” (2001);
- Lithuanian Hygiene Standard HN 87:2001 “Radiation Protection in Nuclear Power Plant” (2001);
- Lithuanian Hygiene Standard HN 83:1998 “Radiation Protection and Safety of Outside Workers” (1998);
- Government Resolution No. 653 “On Regulations of Licensing the Practices Involving Sources of Ionizing Radiation” (1999);
- other legal acts.

The local instructions establishing radiation protection requirements at Ignalina NPP are prepared on the base of above-mentioned regulations.

The principal requirement established by [2] is that the radiation protection of outside workers working within the controlled area of the Ignalina NPP shall be at the same scale as of permanent workers. According to [2], the employers whose workers are performing their activities within the controlled area of the nuclear power plant, shall establish the co-operation agreements with license holders, where the order and procedure of registration and estimation of workers exposure, measures for exposure reduction, the order of allocation of tasks and distribution of responsibilities between employer and license holder and other significant means from the radiation protection point of view shall be described.

The activities of outside organizations within the controlled area are licensed according to [3]. The Radiation Protection Centre is the regulatory body that according to the provisions set out in the Law on Radiation Protection, among other functions, is empowered to issue the licenses to conduct the practices involving sources of ionizing radiation or under the influence of ionizing radiation. The Radiation Protection Centre carries out periodical radiation protection inspections of outside organizations.

### Passbook of Outside Workers' Exposure

The activities within the controlled area of the Ignalina NPP are not allowed without the license and without the Passbook of Outside Worker's Exposure. The Passbooks of Outside Workers' Exposure are issued only for those workers of particular license who are included into the license annex. The exposure results of outside workers, after they are finished work connected with ionizing radiation, are recorded to the Passbook of Outside Workers' Exposure. There are a number of advantages for use of the Passbook. For the license holder, the Passbook gives all information about the worker, his medical suitability to work and his exposure results during the previous activities connected with ionizing radiation. After the outside worker has finished his activities connected with ionizing radiation, all information on exposure results is submitted to the State Register of Radiation Sources and Exposure to Workers according to the procedure established by [4]. The form of the Passbook of Outside Worker's Exposure is presented in Picture 1.

<table border="1" style="width:100%; border-collapse: collapse;"> <tr> <td colspan="2" style="text-align: center;">Ministry of Health Care of the Republic of Lithuania Radiation Protection Centre, Kalvarijų 153, Vilnius, ph. 77 86 51, fax. 75 46 92</td> <td style="text-align: center;">IOK</td> </tr> <tr> <td colspan="2" style="text-align: center;"><b>PASSBOOK OF OUTSIDE WORKER'S EXPOSURE</b></td> <td style="text-align: center;">VDK</td> </tr> <tr> <td colspan="2"></td> <td style="text-align: center;">Form No. 710/a</td> </tr> <tr> <td colspan="3">Identification Number: _____</td> </tr> <tr> <td colspan="3" style="text-align: center;"><b>Data about Outside Worker</b></td> </tr> <tr><td colspan="3">Name _____</td></tr> <tr><td colspan="3">Surname _____</td></tr> <tr><td colspan="3">Other Surnames (including Maiden Name) _____</td></tr> <tr><td colspan="3">Date of Birth (Year, Month, Day) _____</td></tr> <tr> <td colspan="2">Sex <input type="checkbox"/> Female <input type="checkbox"/></td> <td><input type="checkbox"/> Male <input type="checkbox"/></td> </tr> <tr> <td colspan="3" style="text-align: center;"><b>State of Health</b></td> </tr> <tr> <td colspan="3" style="text-align: center;">Conclusions of Examination of State of Health</td> </tr> <tr> <td colspan="2"><input type="checkbox"/> Suitable to work</td> <td><input type="checkbox"/> Suitable to work in special conditions</td> </tr> <tr><td colspan="3">Health institution, carried out the examination of state of health _____</td></tr> <tr><td colspan="3">Date of the last examination of state of health (year, month, day) _____</td></tr> <tr> <td colspan="3" style="text-align: center;"><b>Workplace of Outside Worker</b></td> </tr> <tr><td colspan="3">Title _____</td></tr> <tr><td colspan="3">Address _____</td></tr> <tr><td colspan="3">Phone, fax _____</td></tr> <tr> <td colspan="8" style="text-align: center;"><b>Registered Dose of Ionizing Radiation</b></td> </tr> <tr> <td rowspan="2">Year</td> <td colspan="4" style="text-align: center;">Equivalent of measured doses (mSv)</td> <td colspan="3" style="text-align: center;">Internal exposure</td> <td rowspan="2">Total eff. dose, mSv</td> </tr> <tr> <td>H<sub>p</sub>(10) whole body</td> <td>H<sub>p</sub>(0,07) skin</td> <td>H<sub>p</sub>(3) lens of the eyes</td> <td>H<sub>p</sub>(n) neutrons</td> <td>Committed effective dose, E(30)</td> <td>Radio-nuclide</td> <td>Activity of radio-nuclide, Bq</td> </tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> </table>	Ministry of Health Care of the Republic of Lithuania Radiation Protection Centre, Kalvarijų 153, Vilnius, ph. 77 86 51, fax. 75 46 92		IOK	<b>PASSBOOK OF OUTSIDE WORKER'S EXPOSURE</b>		VDK			Form No. 710/a	Identification Number: _____			<b>Data about Outside Worker</b>			Name _____			Surname _____			Other Surnames (including Maiden Name) _____			Date of Birth (Year, Month, Day) _____			Sex <input type="checkbox"/> Female <input type="checkbox"/>		<input type="checkbox"/> Male <input type="checkbox"/>	<b>State of Health</b>			Conclusions of Examination of State of Health			<input type="checkbox"/> Suitable to work		<input type="checkbox"/> Suitable to work in special conditions	Health institution, carried out the examination of state of health _____			Date of the last examination of state of health (year, month, day) _____			<b>Workplace of Outside Worker</b>			Title _____			Address _____			Phone, fax _____			<b>Registered Dose of Ionizing Radiation</b>								Year	Equivalent of measured doses (mSv)				Internal exposure			Total eff. dose, mSv	H <sub>p</sub> (10) whole body	H <sub>p</sub> (0,07) skin	H <sub>p</sub> (3) lens of the eyes	H <sub>p</sub> (n) neutrons	Committed effective dose, E(30)	Radio-nuclide	Activity of radio-nuclide, Bq																																														<table border="1" style="width:100%; 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**Explanations:**  
H<sub>p</sub>(10) - individual dose equivalent for strongly penetrating ionizing radiation. This value can be calculated using the equivalent dose.  
H<sub>p</sub>(0,07) - individual dose equivalent for weakly penetrating ionizing radiation.  
H<sub>p</sub>(3) - individual dose equivalent for measuring of dose of lens of the eye.  
H<sub>p</sub>(n) - individual dose equivalent, corresponding to neutron dose.

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Picture 1. Form of the Passbook of Outside Worker's Exposure [2].

### Tasks and Responsibilities of Administration of Outside Organization

The administration of outside organization is responsible for the following measures as regards the assurance of radiation protection of outside workers:

- competent preparation and improvement of qualification of outside workers in the field of radiation protection;
- conducting periodical medical examination of outside workers working within the controlled area of Ignalina NPP;
- training, education and instructing of outside workers in the field of radiation protection;

- registration of exposure results and their presentation to the Radiation Protection Centre according to order established by [4];
- presentation of results of outside worker's exposure to the Ignalina NPP, in case if the worker has been previously worked in another outside organization;
- reduction of collective dose for outside workers (implementation of ALARA principle);
- control that maximum established targets of individual and collective dose for outside workers are not exceeded;
- avoidance of unjustified exposure of outside workers;
- establishment of investigation levels for outside workers and their agreement with the Ignalina NPP and the Radiation Protection Centre;
- preparation of radiation protection instructions for outside workers;
- acquaintance of outside workers with general work management procedures that are performed under the influence of ionizing radiation.

#### Tasks and Responsibilities of Outside Workers

Outside workers have the responsibility to perform the work according to local radiation protection and work safety rules that are established by the license holder, to ensure the proper use of individual protective and radiological equipment. Furthermore, in case of any non-compliance with radiation protection and work safety requirements, the outside workers shall notify the administration of outside organization and Work Safety Department of Ignalina NPP without any delay.

#### Tasks and Responsibilities of Ignalina NPP

The Ignalina NPP, as the license holder, controls how internal rules on radiation protection and work safety are being followed by outside workers.

The license holder is also responsible for setting up of the main dosimetric parameters (collective dose and maximum individual dose) for jobs performed by outside organizations, it has to provide the outside workers with sufficient amount of individual protective equipment and to instruct them how to use it. Furthermore, the Ignalina NPP has:

- to record and to control the individual exposure results of outside workers;
- to control the radiological situation in workplaces and to provide recommendations how to perform the works safely;
- to record the results of workplace monitoring and individual monitoring and to provide the information to the outside workers and administration of outside organization;
- if the outside worker may receive internal exposure, to perform the monitoring of committed dose (to estimate the internal dose by the whole body counter);
- to present the data about the outside workers exposure to the administration of outside organization not rare than once per quarter and not later than 15 days after the outside worker has finished the work at Ignalina NPP.
- to record the individual dose of each outside worker in the Passbook of Outside Workers' Exposure.

The Ignalina NPP personnel also directly interacts with outside workers in following areas:

- in training and education in the field of radiation protection;
- in planning of works that are performed within the controlled area of Ignalina NPP;
- in evaluation of exposure results and planning of measures for exposure reduction.

It shall be recognised that proper training and education of outside workers is one of factors that allows to enhance the radiological safety culture at the Ignalina NPP. Training and education of outside workers in the field of radiation protection is organized according to requirements set out in [5]. The established frequency of training is 5 years. Training programmes prepared for training of Ignalina NPP workers are also applied for the training of outside workers. The programmes are approved by the Radiation Protection Centre. The duration of training is 30 hours. The contents of the training programme are presented in Table 1.

Table 1  
Contents of the Training Programme

Item No.	Subject	Number of hours
	<b>Theoretical Training</b>	
1	Basics of Nuclear Physics	2
2	Types of Ionizing Radiation and Measuring Quantities	2
3	Biological Impact of Ionizing Radiation to Humans	3
4	Sources of Ionizing Radiation at Ignalina NPP and their Characterization	2
5	Methods for Protection against Ionizing Radiation	4
6	Basic Principles of Radiation Protection. ALARA Principle	4
7	Legal Base of Radiation Protection	2
8	Organizational – Technical Measures Ensuring Radiation Protection when Conducting Activities within the Controlled Area	3
9	Dosimetric Control at Ignalina NPP	2
10	Decontamination, Collection, Storage, Transport and Disposal of Radioactive Waste	2
11	Duties and Responsibilities of Workers in Case of Radiological Accident Instructions on Emergency Preparedness at Ignalina NPP	2
	Total:	28
	<b>Practical Training</b>	
12	Methods for Protection against Ionizing Radiation	1
13	ALARA Principle	1
	Total:	30
	<b>Examination</b>	2

Additionally, according to requirements of [5], every year the outside workers are instructed by the personnel of Work Safety Department of Ignalina NPP in the field of radiation protection according to programme approved by the Ignalina NPP administration.

The Ignalina NPP provides the outside workers with the material needed for training in the field of radiation protection. Improving the level of qualification of outside workers in radiation protection area, the Ignalina NPP and the Radiation Protection Centre are actively participating in organizing of various training courses, issuing the radiation protection handbooks etc. Various projects are implemented in order to enhance the level of knowledge of outside workers in the field of radiation protection. Jointly with Swedish Nuclear Training and Education Centre (KSU), the Ignalina NPP and the Radiation Protection Centre have prepared and adopted the educational book "Radiation Protection" that is also used for training of outside workers.

The outside workers are directly involved in planning and evaluation of works that are performed within the controlled area of Ignalina NPP, in planning of doses and evaluation of exposure results, in planning of measures for exposure reduction. Involvement of outside workers in planning activities also allows to enhance the radiological safety culture.

The occupational exposure results can be used as indicator for evaluation of achieved level of radiological safety culture. The occupational exposure results of Ignalina NPP and outside workers during the year 1997-2001 are presented in Annex 1.

## Conclusions

1. One of crucial factors that helps to enhance the radiological safety culture between the license holder, employer and outside workers is the clear allocation of tasks and distribution of responsibilities in the field of radiation protection.
2. The occupational exposure results can be used as indicator for evaluation of achieved level of radiological safety culture.

## References

- [1] Lithuanian Hygiene Standard HN 73:2001 “Basic Standards of Radiation Protection” (2001);
- [2] Lithuanian Hygiene Standard HN 83:1998 “Radiation Protection and Safety of Outside Workers” (1998);
- [3] Government Resolution No. 653 of the Republic of Lithuania “On Regulations of Licensing the Practices Involving Sources of Ionizing Radiation” (1999);
- [4] Order of the Minister of Health of the Republic of Lithuania No. 335 “On Procedure Submission about Sources of Ionizing Radiation and Workers Exposure to the State Register of Sources of Ionizing Radiation and Workers Exposure” (1999).
- [5] Order of the Minister of Health of the Republic of Lithuania No. 171 “On Procedure of Mandatory Training and Instructing for Persons, Responsible for Radiation Protection and Workers, whose Work Involves Sources of Ionizing Radiation” (1999).

## Occupational exposure Results of Ignalina NPP Workers and Outside Workers (1997 – 2001)

	Ignalina NPP Workers					Outside workers					Ignalina NPP Workers and Outside Workers				
	1997	1998	1999	2000	2001	1997	1998	1999	2000	2001	1997	1998	1999	2000	2001
Number of Workers	3232	3268	3315	3269	3187	986	956	830	575	1188	4218	4224	4145	3844	4375
Collective dose, man· mSv	11457	11481	10333	8516	5097	7046	3578	2458	2191	1180	18502	15059	12791	10707	6277
Average individual dose, mSv	3,55	3,51	3,12	2,61	1,60	7,15	3,74	2,96	3,81	0,99	4,39	3,56	3,09	2,79	1,43
Maximum Individual Dose, mSv	42,47	37,51	31,89	24,02	19,30	44,85	36,80	33,30	19,66	18,41	44,85	37,51	33,30	24,02	19,30
Dose Range, mSv	Number of Workers														
0.0 – 0.5	1482	1355	1716	2041	2165	485	465	482	345	1007	1967	1820	2198	2386	3172
0.5 – 1.0	513	526	318	209	225	100	98	78	33	33	613	624	396	242	258
1.0 – 5.0	657	717	617	478	439	144	188	116	44	69	801	905	733	522	508
5.0 – 10.0	201	293	326	197	200	34	67	64	40	37	2351	360	390	237	237
10.0 – 20.0	217	254	237	296	158	64	92	68	113	42	281	346	305	409	200
20.0 – 30.0	85	85	91	48	-	55	31	12	-	-	140	116	103	48	-
30.0 – 40.0	72	38	10	-	-	59	15	10	-	-	131	53	20	-	-
40.0 – 45.0	5	-	-	-	-	45	-	-	-	-	50	-	-	-	-
>45.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-