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ANALYSIS OF THE RESULTS OF PROFICIENCY TESTING SCHEMES OF KOZLODUY NPP METROLOGY LABORATORIES THROUGH INTERLABORATORY COMPARISON

Nikolova Elena, Kunov Svetoslav

Metrological Assurance Department Nuclear Power Plant, Kozloduy, Bulgaria

Abstract

The article provides an analysis of the results of interlaboratory comparative tests (ICT) of the laboratories of the metrological service of the Kozloduy NPP over the past ten years.

Laboratory proficiency testing is an important element of ensuring the quality of its work and one of the requirements of BDS EN ISO/IEC 17025:2018 “General requirements for the competence of testing and calibration laboratories”. Laboratory proficiency testing through ICT is one of the most effective means of ensuring confidence in the laboratory results.

By participating in ICT, the laboratories of the Kozloduy NPP receive an independent assessment of the quality of the results, which makes it possible to prove their technical competence, control and improve their activities, and, if unsatisfactory results are obtained, take adequate corrective measures.

Keywords: interlaboratory comparative tests, proficiency testing, laboratory competence.

1. Introduction

Thousands of measurements are perfomed every second at Kozloduy NPP. Tens of thousands of Measuring Instruments (MI) and Information and Measurement System (IMS) are used for this purpose. The total number of MI and IMS at Kozloduy NPP is about 60 000, and about 20 % of them are subject to calibration and 80 % subject to metrological verification, 25% of them are subject to metrological verification in the area of state regulatory control and 75 % - subject to internal verification.

Metrology Assurance Department performs activities aimed at ensuring uniformity, required accuracy and reliability of the measurements at Kozloduy NPP.

Metrology Assurance Department is a separate structural unit within Safety and Quality Directorate. Metrology Department consists of 5 laboratories differentiated by measurement types and activities performed. The number of personnel in the Department is 45 specialists, 90% of them are college graduates. Average age of employees is about 40 years.

The Metrology Department is provided the necessary standard and auxiliary equipment with guaranteed traceability to the national measurement standards of Bulgaria, UK, Germany, Russia, Netherlands, Check Republic and Denmark for 13 types of dimensions and ensures traceability of measurements in NPP (Table 1).

Laboratory proficiency testing is an important part of laboratory quality assurance and one of the requirements of ISO/IEC 17025:2018 standard “General requirements for the competence of testing and calibration laboratories”. The laboratory proficiency testing through interlaboratory comparisons (ILC) is one of the most effective tools for ensuring confidence in laboratory’s results.

In order to confirm their technical competence, all the metrology laboratories of Kozloduy NPP participated in a number of interlaboratory comparisons organised by the Bulgarian Institute of Metrology, German Federal Office for Radiation Protection (BfS) and International Atomic Energy Agency (Table 1).

Table 1 – Schedule of interlaboratory comprising of metrology laboratories of NPP Kozloduy

Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Field of Interlaboratory comparisons	Ionising Radiation Measurements	Ionising Radiation Measurements	Ionising Radiation Measurements	Ionising Radiation Measurements	Ionising Radiation Measurements	Ionising Radiation Measurements	Ionising Radiation Measurements	Ionising Radiation Measurements	Ionising Radiation Measurements	Ionising Radiation Measurements	Ionising Radiation Measurements
	Weight&Mass Measurements		Dimentional Measurements		Weight&Mas Measurements		Weight&Mass Measurements			Weight&Mass Measurements	Weight&Mass Measurements
	Pressure Measurements			Temperature measurements		Temperature Measurements	Temperature Measurements		Temperature Measurements	Pressure Measurements	Temperature Measurements
		Electrical Measurements			Electrical Measurements					Electrical Measurements	Relative Humidity Measurements

The providers, organisers of the interlaboratory comparisons, usually use the following criteria for evaluating the laboratory performance in compliance with ISO/IEC 17043 standard [1]:

- E_n number:

$$E_n = \frac{x - X}{\sqrt{U_{lab}^2 + U_{ref}^2}}, \quad (1)$$

where: x – the result of the participant; X – the assigned value determined by the reference laboratory; U_{lab} – expanded uncertainty related to the result of the participant; U_{ref} – expanded uncertainty of the assigned value determined by the reference laboratory.

- quantitative index ζ :

$$\zeta = \frac{x - X}{\sqrt{u_{lab}^2 + u_{av}^2}}, \quad (2)$$

where: u_{lab} – combined standard uncertainty related to the result of the participant; u_{av} – combined standard uncertainty of the assigned value.

2. The Pressure, Flow Rate and Level Management laboratory

The Pressure, Flow Rate and Level Management laboratory (PFLM) participated twice in interlaboratory comparisons for the last ten years. In 2022, the laboratory performed calibration of pressure transmitter S-20 type manufactured by WIKA in seven points in the range from 0 to 60 bar. The reference laboratory, the National Centre of Metrology, Bulgaria, calibrated the object of comparison prior to, during and after the participation of laboratories with metrological traceability to the Czech Metrology Institute. The comparative method of measurement used is a routine method of the laboratory.

The summarised results of the interlaboratory comparison are presented in the Table 2.

Table 2 – The summarised results of the interlaboratory comparison ($|E_n|$ number)

Measurement points, bar	Individual participant codes						
	22P1	22P3	22P5	22P7	22P9	22P11	22P13
10	1,0	0,7	0,7	0,3	0,2	1,5	0,0
20	0,9	0,7	0,7	0,0	0,0	0,8	0,7
30	0,7	0,7	0,7	0,0	0,0	0,9	0,4
40	0,6	0,3	0,3	0,3	0,2	1,0	0,4
50	0,7	0,4	0,4	0,6	0,4	1,6	0,0
60	0,8	0,4	0,4	1,2	0,4	1,7	0,5

The value $|E_n| \leq 1$ indicates satisfactory performance of the laboratory and does not require any actions. The laboratory confirmed the stated uncertainty of the measurement.

3. The Temperature Measurements laboratory

The Temperature Measurements laboratory (TM) has repeatedly participated in interlaboratory comparisons for the last ten years on calibration of digital thermometer and thermocouple.

In 2021 the laboratory calibrated a thermocouple S type with a measuring range from 0 °C to 1000 °C. The reference laboratory calibrated the object of comparison at the beginning and after the participation of the laboratories, its metrological traceability to PTB, Germany.

The E_n number was used as a criterion for performance evaluation, and the summarised results of the interlaboratory comparison for 2021 are presented in the Table 3.

Table 3 – The summarised results of the interlaboratory comparison for 2021 ($|E_n|$ number)

Measurement point, °C	Individual participant codes	
	22TC5	22TC6
1000	0,43	0,07
800	0,23	0,03
600	0,46	0,02
400	0,28	0,36
200	0,06	0,08

The value $|E_n| \leq 1$ indicates the satisfactory performance of the laboratory, but comments in the interlaboratory comparison report were made to the uncertainty budget that the budget did not include contributions from non-uniformity of the conductors of the thermocouple subject to calibration and drift of the reference voltmeter. All these comments were taken into consideration during the update of the calibration methodologies.

The Temperature Measurement laboratory participated in interlaboratory comparison on digital thermometer calibration in 2018. The reference laboratory was the National Center of Metrology which performed the calibration of the object of comparison at the beginning and after the participation of all laboratories.

The E_n number was used as a criterion for performance evaluation in compliance with ISO/IEC 17043 standard [1], and the summarised results of the interlaboratory comparison for 2018 are presented in the Table 4.

Relatively low values of $|E_n|$ indicate satisfactory performance of the laboratory and do not require any actions.

In September 2023 the Temperature Measurement laboratory participated in interlaboratory comparison on calibration of digital thermometer and moisture meter. The final reports of the interlaboratory comparison are awaited.

Table 4 – Results of applying the E_n criterion

Measurement points, °C	$\lvert E_n \rvert$					
	DT1	DT2	DT3	DT5	DT6	DT7
-40	-	0,19	-	1,98	1,78	-
-20	0,11	1,24	-	1,21	0,96	0,34
0	0,18	0,17	0,2	0,00	0,48	0,70
25	0,02	0,33	0,14	1,77	0,18	0,10
50	0,01	1,97	0,75	0,29	0,13	0,00
100	0,11	0,78	1,49	3,83	0,31	0,10
150	0,15	3,76	2,07	0,34	0,05	0,12
200	0,05	5,26	2,42	4,13	1,18	0,16

4. The Mechanical, Physical and Chemical Measurements laboratory

The Mechanical, Physical and Chemical Measurements laboratory **(MPCM)** has repeatedly participated in interlaboratory comparisons for the last ten years on calibration of digital non-automatic weighing scale and weights.

In 2019 the laboratory performed calibration of digital non-automatic weighing scale, accuracy class I, AE 240S type, manufactured by Mettler Toledo, Switzerland, with a measurement range up to 200 g, and in 2023 a calibration of digital weighing scale E 5500 S type manufactured by Sartorius, Germany, with a range up to 5 500 g. The reference laboratory, the National Center of Metrology, Bulgaria, calibrated the object of comparison prior to and after the participation of laboratories with metrological traceability to the Bulgarian Institute of Metrology.

The E_n number was used as a criterion for performance evaluation, and the summarised results of the interlaboratory comparison are presented in the following Tables 5,6.

For one result of 150 g, the |En| number is greater than one and requires investigating the reasons for the unsatisfactory result and taking corrective actions.

In 2018 MPCM laboratory participated in interlaboratory comparison on calibration of standard weights with nominal values 2 g, 200 g, 1 kg, 5 kg and 20 kg, and in 2022 – calibration of standard weights with nominal values 200 g, 5 g, 500 g and 5 kg.

Tables 5 – Normalized deviation E_n

Nominal weight, g	E_n						
	NAWI1	NAWI2	NAWI3	NAWI5	NAWI6	NAWI7	NAWI9
0,05	-0,05	0,08	0,09	0,13	0,05	0,00	-
0,1	-0,05	0,12	0,14	0,17	0,18	0,19	0,11
1,0	-0,05	0,04	0,18	0,08	0,05	-0,31	0,03
10	-0,09	0,27	0,13	-0,03	0,85	0,07	0,25
50	-0,77	0,60	0,18	0,00	0,85	0,50	0,62
100	-0,77	0,86	0,46	0,16	0,96	**1,82**	**1,35**
150	**-1,40**	0,59	0,47	-0,07	**1,64**	**2,54**	**1,13**
200	-0,13	0,67	0,08	0,14	**1,36**	**3,27**	**1,48**

Tables 6 – Normalized deviation E_n

Nominal weight, g	Individual participant codes						
	23M1	23M2	23M3	23M5	23M6	23M7	23M8
1	0,0	0,0	0,0	0,0	0,0	0,0	0,0
10	0,0	0,0	0,0	0,0	0,0	0,0	0,0
100	0,0	0,1	0,0	0,1	0,0	0,0	0,1
500	0,0	0,1	0,2	0,2	0,1	0,1	0,1
1000	0,1	0,2	0,1	0,3	0,1	0,2	0,2
2000	0,2	0,3	0,2	0,2	0,2	0,2	0,2
2500	0,1	0,3	0,2	0,2	0,1	0,2	0,2
4000	0,0	0,2	0,1	0,2	0,1	0,1	0,0
5000	0,0	0,2	0,1	0,0	0,2	0,1	0,0
5500	0,0	0,3	0,1	0,3	0,1	0,1	0,3

The summarised results of the interlaboratory comparison are presented in the Tables 7,8.

Table 7 – Results of applying the E_n criterion

Nominal weight, g	Individual participant codes				
	M1	M3	M4	M5	M7
2	-0,13	-0,27	-0,34	-0,14	0,16
200	0,12	-0,07	0,07	-0,16	0,39
1000	0,19	-0,14	0,23	0,14	0,84
5000	0,26	0,06	-0,19	0,05	0,28
20000	0,46	1,55	-0,96	0,03	0,07

Tables 8 – Normalized deviation E_n

Nominal weight, g	Individual participant codes				
	22M1	22M3	22M5	22M7	22M9
0,2	0,88	0,13	-	-	0,25
5	**2,03**	**1,27**	0,20	-	0,11
500	0,02	0,39	0,23	-	0,34
5000	0,27	0,14	0,05	1,00	0,21

For one result of 5 g the number $\lvert E_n \rvert$=2,03. The analysis of the results revealed the need to improve the qualification of the laboratory personnel in the area of mass measurement and processing the results of the repeated measurements, revision of calibration methodologies and requirements for laboratory equipment.

5. The Electrical and Radiotechnical Measurements laboratory

The Electrical and Radiotechnical Measurements laboratory (ERTM**)** several times participated in interlaboratory comparisons for the last ten years.

In 2014, 2017 and 2022 the laboratory performed a calibration of multimeter WAVETEK 1281 type. In 2014 the results were satisfactory for all points DCV, DCI, ACV, ACI and DCR, and in 2017 for all points except for 10 MΩ. The summarised results of the interlaboratory comparison for 2023 are presented in the following Tables 9-13.

For all the laboratory measurements results the condition $\lvert E_n \rvert \le 1$ was met except for the values 100 Ω, 1 kΩ, 100 kΩ and 1 MΩ. Method used by the laboratory

Tables 9 – Normalized deviation E_n – DCV

Measuring range	Measurement points	X_{ref}	U_{ref}	X_{lab}-X_{ref}	X_{lab}	U_{lab}	E_n
100 mV	100 mV	-0,00393	0,00088	-0,00015	-0,004 1	0,006 0	**0,0**
1 V	+ 1 V	-0,00041	0,0000059	-0,0000080	-0,000 419	0,000 026	**0,3**
10 V	+ 10 V	0,01242	0,000055	-0,000077	0,012 35	0,000 28	**0,3**
	- 10 V	0,0451	0,000054	0,000059	0,045 16	0,000 28	**0,2**
100 V	+ 100 V	0,00493	0,00046	-0,00018	0,004 8	0,004 0	**0,0**
1000 V	+1000 V	-1,8710	0,0047	-0,0048	-1,876	0,038	**0,1**

Tables 10 – Normalized deviation E_n – DCA

Measuring range	Measurement points	X_{ref}	U_{ref}	X_{lab}-X_{ref}	X_{lab}	U_{lab}	E_n
1 mA	+1 mA	-7,9E-05	0,000026	-0,000019	-0,000098	0,000087	**0,2**
10 mA	+10 mA	0,00088	0,00026	-0,000123	0,00076	0,000699	**0,2**
	-10 mA	0,0007	0,00026	0,000050	0,00075	0,000699	**0,1**
100 mA	+100 mA	-0,0881	0,0026	-0,000595	-0,0887	0,007002	**0,1**
1 A	+1 A	0,0006	0,000055	-0,000009	0,00059	0,000281	**0,0**

Tables 11 – Normalized deviation E_n – DCR

Measuring range	Measurement points	X_{ref}	U_{ref}	X_{lab}-X_{ref}	X_{lab}	U_{lab}	E_n
10 Ω	1 Ω	0,000007	0,000011	0,000033	0,000 04	0,000 06	**0,5**
100 Ω	100 Ω	0,00028	0,00013	0,003820	0,004 1	0,003 0	**1,3**
1 kΩ	1 kΩ	-0,00000858	0,00000047	0,000115	0,000 106	0,000 040	**2,9**
100 kΩ	100 kΩ	0,00007	0,00069	-0,008670	-0,008 6	0,002 9	**2,9**
1 MΩ	1 MΩ	-0,000002	0,000007	-0,000089	-0,000 091	0,000 048	**1,8**
100 MΩ	100 MΩ	0,016	0,0067	-0,021360	-0,005	0,048	**0,4**

Tables 12 – Normalized deviation E_n – ACV

Measuring range	Measurement points	X_{ref}	U_{ref}	X_{lab}-X_{ref}	X_{lab}	U_{lab}	E_n
100 mV	100 mV, 50 Hz	0,016	0,0066	-0,002	0,014	0,026	**0,1**
100 mV	100 mV, 1 kHz	0,017	0,0053	0,000	0,017	0,026	**0,0**
1 V	1 V, 50 Hz	0,00322	0,000052	0,00000	0,00322	0,00025	**0,0**
1 V	1 V, 1 kHz	0,003241	0,000037	0,0000	0,00322	0,00025	**0,1**
10 V	10 V, 50 Hz	-0,00336	0,00053	-0,000010	-0,0034	0,0024	**0,0**
10 V	10 V, 1 kHz	-0,00316	0,00038	0,00005	-0,0031	0,0024	**0,0**
100 V	100 V, 50 Hz	0,0169	0,0062	0,0021	0,019	0,025	**0,1**
100 V	100 V, 1 kHz	0,0188	0,0047	0,0033	0,0221	0,024	**0,1**
1000 V	1000 V, 50 Hz	-2,84	0,094	0,14	-2,70	0,36	**0,4**
1000 V	1000 V, 1 kHz	-2,83	0,09	0,18	-2,65	0,36	**0,5**

Tables 13 – Normalized deviation E_n – ACI

Measuring range	Measurement points	X_{ref}	U_{ref}	X_{lab}-X_{ref}	X_{lab}	U_{lab}	E_n
1 mA	1 mA, 50 Hz	-0,00029	0,00021	0,00000	-0,0003	0,0007	**0,0**
	1 mA, 1 kHz	-0,00024	0,00022	-0,00011	-0,0004	0,0007	**0,2**
10 mA	10 mA, 50 Hz	0,00210	0,00150	0,00040	0,0025	0,0042	**0,1**
	10 mA, 1 kHz	0,00280	0,00160	0,00016	0,0030	0,0041	**0,0**
100 mA	100 mA, 50 Hz	-0,02000	0,01600	0,00440	-0,0160	0,0420	**0,1**
	100 mA, 1 kHz	-0,01100	0,01600	-0,00060	-0,0120	0,0410	**0,0**
1 A	1 A, 50 Hz	-0,00073	0,00031	0,00020	-0,0005	0,0007	**0,3**
	1 A, 1 kHz	-0,00056	0,00030	0,00030	-0,0003	0,0007	**0,4**

for resistance measurement is not a routine method for the laboratory and a decision was made that the laboratory should participate more frequently in interlaboratory comparisons in order to gain experience in use of non-standard methods of measurement.

6. The Ionizing Radiation Measurements laboratory

The Ionizing Radiation Measurements laboratory (IRM) participates annually in interlaboratory comparisons on measurement of anthropogenic radionuclides in water, soil and surface contamination of the filters. The summarised results of the interlaboratory comparisons, organised by the German Federal Office for Radiation Protection “43. Ringversuch Fortluft 2022” on the measurement of gamma-emitting nuclides during the control of gaseous radioactive releases to the environment are presented in Tables 14.

In 2022 the laboratory participated also in an interlaboratory comparison organised by the International Atomic Energy Agency (IAEA, Austria) on measurement of surface alpha and beta contamination in simulated filter: $|\zeta| \le 2$ – satisfactory result; $2 < |\zeta| < 3$ – questionable result; $|\zeta| \ge 3$ – unsatisfactory result which requires taking corrective actions The IRM laboratory obtained satisfactory results in all interlaboratory comparisons.

Table 14 – Qualitative Bewertung after Labore anhand des ζ-Score Tests

#	^{137}Co	^{60}Co	^{95}Zr	^{95}Nb	#	^{137}Co	^{60}Co	^{95}Zr	^{95}Nb	#	^{137}Co	^{60}Co	^{95}Zr	^{95}Nb
1	0,56	0,49	0,37	1,08	46	0,13	0,16	0,05	0,46	91	0,29	0,54	0,20	0,18
2	0,62	0,49	0,73	0,71	47	0,04	0,01	0,12	2,76	92	0,11	0,86	1,14	0,18
3	0,00	0,36	0,32	0,77	48	0,09	0,46	0,20	3,29	93	0,68	0,56	0,51	1,60
4	0,77	0,14	0,54	0,59	49	0,16	0,15	0,06	2,85	94	0,56	0,99	1,29	1,90
5	0,16	0,05	0,03	0,67	50	0,09	0,08	0,30	3,02	95	0,09	1,34	0,95	2,08
6	0,16	0,06	0,11	0,11	51	2,37	0,93	1,07	1,37	96	1,18	1,21	0,17	0,65
7	0,13	0,06	0,11	0,12	52	0,68	1,41	2,00	3,25	97	1,09	1,68	0,48	0,06
8	-0,04	0,06	0,04	0,02	53	0,10	0,46	0,08	0,25	98	0,09	0,14	0,17	0,01
9	0,77	0,58	0,70	1,40	54	0,01	0,57	0,13	0,35	99	0,24	0,04	0,16	0,34
10	0,29	0,35	0,36	0,17	55	0,06	0,73	0,67	2,35	100	1,17	1,30	0,29	0,31
11	1,88	0,27	0,35	1,31	56	0,85	1,10	0,84	6,65	101	0,59	0,69	0,76	0,94
12	1,23	1,10	0,57	1,65	57	0,28	0,46	0,27	11,26	102	0,22	0,38	0,05	0,21
13	0,16	1,49	0,77	0,02	58	0,50	0,61	0,53	0,36	103	1,51	1,32	1,46	10,10
14	0,15	0,54	0,08	0,76	59	0,22	0,34	0,35	0,11	104	1,38	1,32	0,97	0,83
15	0,12	0,02	0,01	0,14	60	0,15	0,20	0,16	0,91	105	0,51	0,34	0,12	0,13
16	0,03	0,16	0,27	0,24	61	0,11	0,31	0,29	0,01	106	0,16	0,17	0,21	5,24
17	0,62	0,21	0,98	5,43	62	0,71	0,16	0,08	0,76	107	0,58	0,05	0,86	5,75
18	0,79	0,66	0,90	5,89	63	1,28	0,47	0,21	0,27	108	0,10	0,43	0,58	5,51
19	1,70	0,92	0,89	8,46	64	0,85	0,89	0,56	0,09	109	0,07	0,58	0,19	8,08
20	0,89	0,47	0,79	0,59	65	0,36	0,40	0,42	0,09	110	0,06	0,05	0,27	2,84
21	0,61	0,65	0,80	1,63	66	0,00	0,91	0,60	0,19	111	0,12	0,41	0,45	0,02
22	1,46	1,03	0,55	1,35	67	0,14	0,62	0,15	0,08	112	0,61	1,40	0,09	0,17
23	1,25	1,21	1,17	3,00	68	0,26	0,33	0,29	0,28	113	0,00	0,67	0,25	0,03
24	2,68	4,36	3,21	2,25	69	1,65	0,14	0,10	6,02	114	0,27	0,32	0,20	0,10
25	2,05	1,32	1,22	6,93	70	1,24	1,28	1,30	0,67	115	0,80	0,27	0,55	3,49
26	0,30	0,38	0,69	0,98	71	0,51	0,50	0,19	0,42	116	0,57	0,53	0,85	3,00
27	1,04	0,07	1,74	1,32	72	0,96	0,78	0,97	5,26	117	0,78	0,74	0,21	2,92
28	0,50	0,13	0,21	0,02	73	1,25	1,02	1,06	3,88	118	1,15	0,90	1,30	2,91
29	0,04	0,19	0,17	0,05	74	0,03	1,91	2,35	1,84	119	0,08	0,35	0,30	0,02
30	0,20	0,42	0,35	0,66	75	0,32	0,43	1,04	1,25	120	0,73	2,18	0,69	0,69
31	0,74	0,36	0,85	0,78	76	0,52	0,18	0,07	0,41	121	1,37	0,97	0,11	9,46
32	0,54	0,45	0,42	0,51	77	0,64	0,33	0,27	0,34	122	0,70	0,13	0,32	12,60
33	1,11	1,12	1,20	1,44	78	2,19	1,26	2,30	2,02	123	0,01	3,18	3,21	6,12
34	0,29	4,91	0,74	5,58	79	0,53	0,15	0,10	0,08	124	1,19	1,33	1,15	11,46
35	0,40	0,19	0,23	0,13	80	1,33	1,02	0,02	0,24	125	0,42	0,15	1,93	5,63
36	0,21	0,12	0,16	0,96	81	0,47	0,14	0,08	4,49	126	2,10	0,16	1,97	1,63
37	0,84	0,58	0,61	4,79	82	0,27	0,15	0,03	0,44					
38	0,88	0,10	0,53	9,62	83	1,90	0,11	1,49	1,06					
39	0,39	0,31	0,66	0,48	84	1,51	0,15	1,20	0,90					
40	0,00	0,16	0,11	2,46	85	0,84	0,10	0,59	0,45					
41	0,19	0,32	0,24	4,08	86	1,07	1,50	0,98	0,47					
42	0,83	0,37	1,10	0,72	87	1,11	1,22	1,08	0,54					
43	0,05	0,90	0,71	0,67	88	1,15	0,70	0,85	0,72					
44	0,07	0,02	0,10	0,01	89	1,55	0,65	1,00	1,05					
45	0,23	0,23	0,47	0,45	90	0,15	0,23	0,11	0,72					

fragwürdig

nicht akzeptabel

7. Conclusion

Through participation in interlaboratory comparisons, the Kozloduy NPP laboratories receive an independent evaluation of the quality of results, which provides an opportunity to prove their technical competence, to monitor and improve their performance. Unsatisfactory results from the participation in interlaboratory comparison can be obtained by any laboratory. Unfortunately, no one is protected from such a result, but it is very important to understand the reason for obtaining such a result and to take adequate corrective actions.

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ВІДОМОСТІ ПРО АВТОРІВ/ABOUT THE AUTHORS

Олена Ніколова – Головний експерт з метрологічного забезпечення атомної електростанції Козлодуй, Болгарія; e-mail: enikolova2@npp.bg.
Elena Nikolova – Chief expert in metrological assurance of Nuclear Power Plant, Kozloduy, Bulgaria; e-mail: enikolova2@npp.bg.

Светослав Кунов – Експерт інформаційної системи з метрологічного забезпечення атомної електростанції Козлодуй, Болгарія; e-mail: skkunov@npp.bg.
Svetoslav Kunov – Expert information sistem in metrological assurance of Nuclear Power Plant, Kozloduy, Bulgaria; e-mail: skkunov@npp.bg.

Аналіз результатів схем перевірки кваліфікації метрологічних лабораторій АЕС Козлодуй шляхом міжлабораторного порівняння

Олена Ніколова, Светослав Кунов

Анотація

У статті наведено аналіз результатів міжлабораторних порівняльних випробувань (МСВ) лабораторій метрологічної служби АЕС „Козлодуй” за останні десять років. Перевірка кваліфікації лабораторії є важливим елементом забезпечення якості її роботи та однією з вимог БДС EN ISO/IEC 17025:2018 “Загальні вимоги до компетентності випробувальних та калібрувальних лабораторій”. Перевірка кваліфікації лабораторії за допомогою МСВ є одним із найефективніших засобів, що забезпечують довіру до результатів лабораторії. За допомогою участі в МСМ лабораторії АЕС „Козлодуй” отримують незалежну оцінку якості результатів, що дає можливість доводити свою технічну компетентність, контролювати та покращувати свою діяльність, а при отриманні незадовільних результатів проводити адекватні коригувальні заходи.

Ключові слова: міжлабораторні порівняльні випробування, перевірка кваліфікації, компетентність лабораторії.