Director
WANO-MC

_____ Vasily Aksenov
“___” _____ 2018

APPROVED
Deputy Director in NPP production and operations – Director of emergency preparedness and radiological protection department
JSC "Concern Rosenergoatom"

_____ Vladimir Khlebtsevich
“___” _____ 2018

RCC REPORT
ON PARTICIPATION IN EMERGENCY EXERCISE AT ARMENIAN NPP

13 March 2018

Topic: EMERGENCY EXERCISE AT ARMENIAN NPP (ARMENIA)

Moscow 2018

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ABBREVIATION LIST

ftp	file transfer protocol – протокол передачи файлов
NPP	nuclear power plant
JSC «Consist-OS»	joint stock company "Consist – Telecoms operator"
WANO-MC	WANO Moscow Centre
VVER	water-cooled water-moderated power reactor
VCC	Video-conference
VNIIAES	joint stock company "All-Russian scientific and research institute for NPP operations"
CC	crisis center of JSC Rosenergoatom
NRC Kurchatov Institute	National Research Center ”Kurchatov Institute”
OKB "Gidropress"	Experimental Design Bureau “Gidropress”
SPC "Taifun"	scientific and production company "Taifun"
OPAS	NPP emergency support group
DG	Diesel Generator
EDG	Emergency Diesel Generator
EE	emergency exercise
RCC	regional crisis center
RF	reactor facility
SCC Rosatom	Situational and crisis center of Rosatom
CC&OPAS FG	functional group ensuring CC and OPAS functioning
RCC FG	functional group ensuring RCC functioning
TSC	technical support center
UT	utility (operator), nuclear power plants

Introduction

Pursuant to the Regional Crisis Center working plan for 2018, the RCC took part in the emergency exercise at Armenian NPP (Armenia) on 13 March 2018, from 9:00 till 13:00 Moscow time.

The main EE objective was to practice Regulations on functioning and Regulations on information exchange between participants of the WANO-MC Regional Crisis Center while responding to a simulated accident at Armenian NPP (Armenia).

The RCC EE supervisor – V.A. Golubkin, the chief technologist of the CC and OPAS functioning unit of the Emergency preparedness and radiation protection department.

Objectives of the EE were:

- RCC – Armenian NPP communication channels (phone, fax, e-mail) test in the frames of response to a simulated accident at Armenian NPP;
- evaluation of Armenian NPP personnel readiness and skills in terms of ability to send and transfer RCC formats;
- to practice provision of expert/advisory and logistical support to Armenian NPP.

The simulated accident at Armenian NPP occurs at unexpected moment of time.

Emergency Exercise participants

The OPAS group members (RCC FG, CC&OPAS FG), TSC (VNIIAES, SPC "Taifun". OKB "Gidropress", NRC Kurchatov Institute), fast-response dispatching department of technological branch JSC “Concern Rosenergoatom”, SCC Rosatom, JSC "Consist – OS" took part in the emergency exercise from Russian side.

Armenian NPP (Armenia), Loviisa NPP (Fortum Company, Finland), Mochovce NPP and Bohunice NPP (Slovenske Elektrarne, Slovakia), Dukovany NPP and Temelin NPP (CEZ Company, Czech Republic), Tianwan NPP (Corporation JNPC, China), NNEGC Energoatom (Ukraine), Kozloduy NPP (Bulgaria), Paks NPP (Hungary), Bushehr NPP (Iran), Belorussian NPP (Republic of Belarus) took part in the emergency exercise as foreign organizations.

World Association of Nuclear Operators, Moscow Centre took part in the emergency exercise as an international organization.

1 Results analysis of the emergency exercise

1.1 In course of the emergency exercise the information exchange procedures had been practiced between the RCC and RCC member utilities/NPPs in accordance with the Regulations on information exchange between the participants of the WANO-MC Regional Crisis Center (hereafter – the Regulations on information exchange).

1.2 E-mail have been used as the main communication channel in frames of the exercise; in addition, all messages on the exercise shall be duplicated at the ftp-server of the Crisis Center. Videoconferencing, e-mail and phone were used for communication with the TSCs (NRC KI, OKB "Gidropress" and RPA "Typhoon").

In course of the emergency exercise certain gaps were noticed in communication equipment performance, such as:

- No possibility to reach the direct numbers of the ANPP from the phones placed in RCC room 201. The phone call to the CC at ANPP (1019) 33-51 and (1019) 35-37 was forwarded to a number belonging to the Concern Rosenergoatom. Thus in place of voice connection a cell phone was used to reach the phone number of the RCC interface officer at ANPP. The cell phone connection was instable, the connection and sound transfer quality was low;
- The emergency phone number of the CC shift supervisor was not specified in the EE program.

1.3 During the exercise, the RCC received and transferred overall amount of 15 messages on simulated accident occurrence and development at Armenian NPP. The chronological consequence of information exchange is provided in tables 1.1 and 1.2.

Table 1.1 – Chronological sequence of information received by RCC from emergency exercise participants (Incoming messages)

Msg. No	Reg. No	Sender	Data transmission channel	Message	Sending time (MOW)
1	1	Armenian NPP	e-mail-fax	RCC-2 format Information on safety significant events at NPP	10:05
2	2	Armenian NPP	e-mail/fax	RCC-3 format Information on accident within the site of NPP	10:30
3	3	Armenian NPP	e-mail/fax	RCC-3a format Data on accident evolution within plant site/general accident	11:05
4	4	Armenian NPP	e-mail/fax	RCC-4 format Request for expert/consultative and engineering support	10:39

5	-	TSC “Typhoon”	e-mail	Evaluation of possibility of transboundary transfer of radioactive cloud	11:10
6	-	TSC VNIIAES	e-mail	Evaluation of radioactive emission source	11:20
7	6	Armenian NPP	e-mail/fax	End of the exercise	12:07
	Messages received in total			7	

Table 1.2 - Chronological sequence of information sent from RCC to emergency exercise participants (Outgoing messages)

Msg. No	**Reg. No**	**Addressee**	**Data transmission channel**	**Message**	**Sending time (MOW)**
1	1	TSC, OO/NPP – RCC members	e-mail/fax, ftp	Form RCC-2 Information on safety-significant events at NPP	11:04
2	-	TSC, OO/NPP – RCC members	e-mail/fax, ftp	Evaluation of possibility of transboundary transfer of radioactive cloud	11:10
3	2	TSC, OO/NPP – RCC members	e-mail/fax, ftp	RCC-3-VVER format Message on accident within the NPP site	11:20
4	-	TSC, OO/NPP – RCC members	e-mail/fax, ftp	Evaluation of radioactive emission source	11:20
5	4	TSC, OO/NPP – RCC members	e-mail/fax, ftp	RCC-3a-VVER format Data on accident evolution within plant site/general accident	12:00
6	5	TSC, OO/NPP – RCC members	e-mail/fax, ftp	RCC-4 format Request for expert/consultative and engineering support	11:45
7	5	TSC, OO/NPP – RCC members	e-mail/fax, ftp	RCC-4 format Response on the request for expert/consultative and engineering support	12:25
8	6	TSC, OO/NPP – RCC members	e-mail/fax, ftp	End of the exercise	12:29
	Messages forwarded in total			8	

Having analyzed the tables 1.1 and 1.2 it should be concluded that the information submission timeframes in accordance with the Regulations on information exchange have been mainly observed.

1.4 The EE allowed revealing certain deficiencies concerning filling out the RCC formats:

– Violated incoming and outgoing messages order, in particular, message No4 was sent later than message No5. Incoming and outgoing messages No3 are absent, duplicated numeration of messages No5 was revealed;

– Message No1 comprised in RCC-2 format did not contain information about the total

number of EDGs and the number of failed DGs. The ANPP presented information, which was insufficient to capture current situation at ANPP;

– Messages, containing the probability assessment of transboundary transfer of radioactive cloud and emission source were not included into the information exchange between the NPPs/OOs – RCC participants;

– A different format was used to send request for emergency means and support, not the RCC-5 format, which is specially designed and intended for this purpose. Use of outdated information exchange formats;

– Message No1 comprised in RCC-2 format, obtained from ANPP, did not contain sending time and the sender's data;

– Meaningful self-assessment of ANPP allowed revealing a failure to send to the RCC the full information intended within the EE scenario. In particular, there was no message on recovering of the vital bus 3, 4 РБ-2 and ANPP power restoration via 110 kV overhead line «БЖНИ»;

– Incoming and outgoing messages were not fully duplicated on the CC server;

– Some of the RCC participants (NPPs/OOs) have not confirmed receiving of messages during the EE information exchange;

– Message on the EE termination was sent as to the EE scenario, although the ANPP did not inform on successful work through the EE scenario events ("full SBO", "loss of all EDG and back-up DG", "reactor core started to simmer"), which were declared in the first messages.

2 Evaluation of the emergency exercise

The results of comprehensive evaluation show good convergence of the EE assessment conducted by RCC and ANPP.

It is also worth noting that a request to RCC to provide emergency support, which was received at 10:40 (GMT+3), was successfully worked through. In respond to this message the DGs from Rostov branch of ETC SE Rosatom were declared to be available for supply in case of a positive decision of SE Rosatom. The request and respond were sent to all RCC participants.

Attachment 1 provides comprehensive assessment of the emergency exercise performed at Armenian NPP on 13.03.2018 г.

Expert/advisory support to the ETC Concern Rosenergoatom.

The work of ETC of Concern Rosenergoatom was arranged in response to the request for expert/advisory support, which was sent by ANPP to the RCC (per Format RCC-4).

TSC of SPC "Taifun" made the probability assessment of transboundary transfer of radioactive cloud in case of radiation accident (Attachment 2.1).

According to available data on RF condition and taking into consideration the meteorological situation, the TSC of VNIIAES assessed the source of emission (Appendix 2.2) and developed recommendations on protective measures for personnel and local people (Appendix 2.3).

The results of the TSC analysis were used to develop the appropriate answers-recommendations, which were sent to the ANPP.

Conclusion

In course of the emergency exercise the information exchange procedures had been practiced between the RCC and RCC member utilities/NPPs in accordance with the Regulations on information exchange. During the exercise, the RCC received and transferred 7 messages from Armenian NPP on simulated accident occurrence and development at Armenian NPP. The messages were processed and forwarded to the OO/NPPs - RCC participants.

Positive elements of the emergency exercise to be mentioned are:

- the information submission timeframes in accordance with the Regulations on information exchange have been mainly observed;
- the results of a comprehensive two-sided evaluation showed good convergence;
- request from Armenian NPP on technical support had been successfully worked out;

However, the emergency exercise allowed revealing certain deficiencies connected with RCC formats filling process. It is recommended to brief personnel on RCC formats filling.

Analysis of communication means functioning brought a recommendation to bring in order the settings for short numbers of ANPP, and to specify an emergency phone number of CC shift supervisor in the next EE programs.

Based on the analysis results of the EE at Armenian NPP it should be concluded that the main EE objective has been achieved. The RCC shift on duty and the contact person responsible for Armenian NPP interaction with the RCC have practiced the actions according to the Regulations of information exchange between participants of the WANO-MC Regional Crisis Center.

Attachment 1 – Evaluation of emergency exercise at Armenian NPP on 13.03.2018

No.	Evaluation criteria	RCC evaluation	Armenian NPP evaluation	Summative evaluation	Remarks
1	Adherence to the timeframes of messages sending to the RCC according to the Information Exchange Regulations.	SAT	SAT	SAT	The information submission timeframes in accordance with the Regulations on information exchange have been mainly observed.
2	Correctness of forms filling out and sequence of information exchange	NOF	NOF	NOF	The sequence of format filling out met the Regulations on information exchange. Some deficiencies were revealed (see section 1).
3	Number of received by RCC and forwarded forms	NOF	NOF	NOF	Number of messages sent does not correspond with the planned massages number.
4	Sufficiency of data to understand situation at the plant.	NOF	SAT	NOF	Technical information provided by Armenian NPP was insufficient to understand the situation.
5	Correctness of the initiating event description in accordance with the EE scenario.	SAT	SAT	SAT	A technological scenario was not provided by Armenian NPP
6	Use of proper forms	NOF	SAT	NOF	Not up-to-date forms of information exchange were used
7	Organization of interaction within emergency drills and exercises (audio/video conference communication).	NOF	SAT	NOF	A part of communication channels used during the exercise were not functioning
8	Availability of backup communication channels	SAT	SAT	SAT	Backup communication channels were available for use
9	Provision of expert / advisory support to the utility / NPP.	SAT	SAT	SAT	Request from Armenian NPP on expert/advisory support from the RCC had been worked out, several responses were forwarded.

No.	Evaluation criteria	RCC evaluation	Armenian NPP evaluation	Summative evaluation	Remarks
10	List of the forces and means engaged into the emergency exercise.	SAT	SAT	SAT	Request from Armenian NPP on technical support had been successfully worked out in full scope.
11	Acknowledge receipts by the RCC	SAT	SAT	SAT	RCC was sending acknowledge receipts to Armenian NPP

***SCORE:**

SAT: Satisfactory fulfillment of the criterion. Minor deficiencies could exist that do not impact the overall fulfillment of the criterion.

NOF: Criterion is not fully fulfilled. Efforts are needed to resolve deficiencies.

UNSAT: Unsatisfactory fulfillment of the criterion. Performance criterion is not fulfilled.

NOT: Not applicable to the RCC member (depends on the participation level).

Attachment 2.1

Противоаварийная тренировка !!! EXERCISE !!!

Форма 6 (на 2-х страницах) **стр. 1 из 2**

исх. №1

Оценка возможности трансграничного переноса радиоактивного облака в случае возникновения радиационной аварии на Армянской АЭС

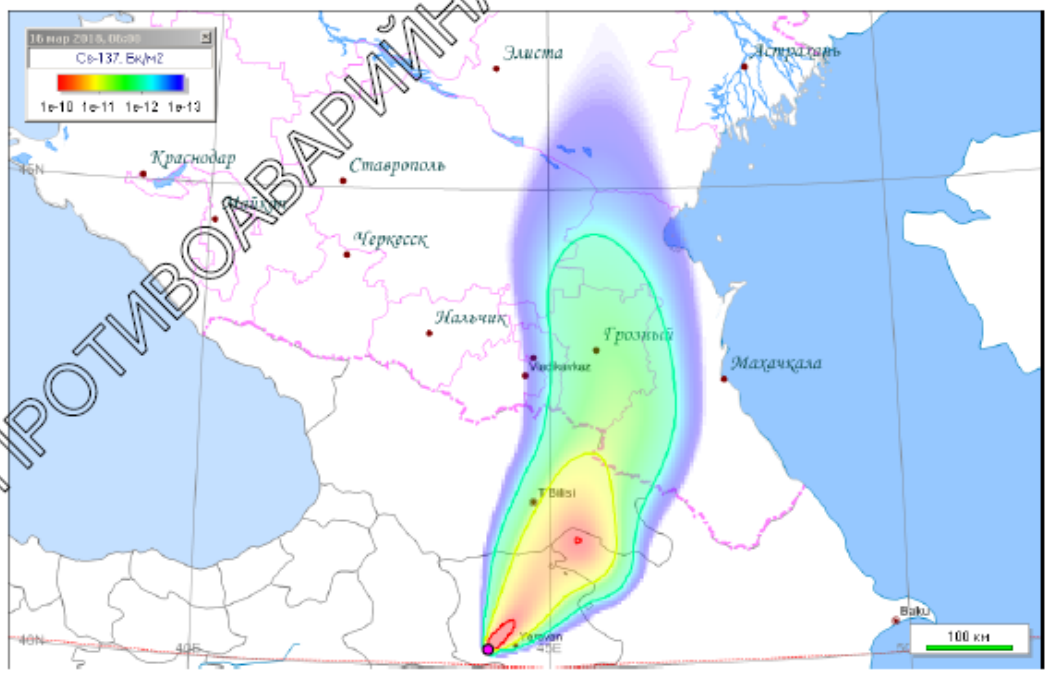
ЦТП НПО «Тайфун»

Наименование ЦТП, представляющего данную информацию

Вводная №

Запрос или вводная, по которой представляется данная информация

1. Время начала выброса: "13" марта 2018 г. в 09:00 МСК
2. Величина выброса: Cs-137, 1 Бк
3. Высота выброса: 0-500 м
4. Длительность выброса: 6 часов
5. Длительность прогнозируемого периода от начала аварии: 72 часа
6. Интегральная плотность выпадения Cs-137 за прогнозируемый период



ПРОТИВОАВАРИЙНАЯ ТРЕНИРОВКА

Противоаварийная тренировка !!! EXERCISE !!!

ЦТП НПО «Тайфун»

Противоаварийная тренировка !!! EXERCISE !!!

Форма 6 (на 2-х страницах) **стр. 2 из 2**

исх. №1

Результаты расчета показывают, что ожидается трансграничный перенос на территорию государств:

Страна	День, месяц, год, время (МСК) достижения передним фронтом радиоактивного облака границы государства
Армения	13.03.2018 09 часов
Азербайджан	13.03.2018 18 часов
Грузия	13.03.2018 19 часов

Радиоактивному загрязнению подвергнутся субъекты Российской Федерации:

Субъект РФ	День, месяц, год, время (МСК) достижения передним фронтом радиоактивного облака границы субъекта РФ
Республика Дагестан	14.03.2018 03 часа
Чеченская республика	14.03.2018 05 часов
Республика Ингушетия	14.03.2018 07 часов
Республика Северная Осетия	14.03.2018 10 часов
Ставропольский край	14.03.2018 17 часов
Республика Калмыкия	15.03.2018 06 часов

Руководитель экспертной группы А.И. Бурков

Исполнитель: И.В. Стогова

Время и дата отправки формы (по Москве) 11:10 " 13 " марта 2018 г.

ПРОТИВОАВАРИЙНАЯ ТРЕНИРОВКА

Противоаварийная тренировка !!! EXERCISE !!!

ЦТП НПО «Тайфун»

Attachment 2.2

Тренировка! Тренировка! Тренировка! Тренировка!

Исх. № 3 от «13» 03 2018 г.

Форма 2

Результаты оценки источника выброса

ЦТП ВНИИАЭС	Армянская АЭС НПО «Тайфун»
Наименование ЦТП, представляющего данную информацию	Запрос или модель, по которой представляется данная информация

В случае разгерметизации 100 % твэлов в активной зоне

Таблица 1. **Оценка длительности и эффективной высоты выброса**

Эффективная высота выброса, м	30
Время формирования выброса, с	1800
Длительность выброса, с	3600

Таблица 2. **Радионуклидный состав и активность выброса**

Радионуклид	Активность, Бк
Радионуклиды йода	
^{131}I	4,0E+15
^{132}I	3,6E+15
^{133}I	3,3E+15
^{134}I	1,1E+15
^{135}I	1,3E+15
ИРГ	
^{85m}Kr	1,8E+14
^{87}Kr	2,7E+14
^{88}Kr	5,1E+14
^{133}Xe	1,0E+16
^{135}Xe	4,1E+14
Аэрозоли	
^{134}Cs	5,7E+14
^{137}Cs	4,5E+14

Таблица 3. **Соотношение различных физико-химических форм йода в выбросе, %**

Молекулярная	Органическая	Аэрозоль
40	20	40

Исполнитель (фамилия, подпись) А.Д. Косов

Время и дата отправки формы (по Москве) 11 20 “ 13 ” марта 2018 г.

Тренировка! Тренировка! Тренировка! Тренировка!

Attachment 2.3

Дата проведения противоаварийной тренировки 13-03-18

Форма 4

Результат оценки радиационной обстановки на местности

ЦТП **ВНИИАЭС**

Наименование ЦТП, представляющего данную информацию

Армянская АЭС

Место проведения противоаварийной тренировки

Метеоусловия

Ветер Направление 45° **Осадки** **Категория устойчивости F**

Скорость 1 м/с интенсивность мм/ч

тип осадков

Характеристика территории в направлении ветра

Параметр шероховатости (z_0) 0,1

Таблица 1. **Прогнозируемая доза за первые 10 суток после аварии, мГр**

Расстояние от АЭС, км	*Доза на ЩЖ*		*Доза на все тело*	
	взрослые	дети	С внутр. обл.	Без внутр. обл.
1	1,1E+4	2,5E+4	9,0E+2	3,3E+2
2	2,0E+4	4,5E+4	1,6E+3	5,9E+2
3	1,5E+4	3,4E+4	1,2E+3	4,5E+2
4	1,1E+4	2,5E+4	8,7E+2	3,2E+2
5	8,1E+3	1,8E+4	6,4E+2	2,3E+2
6	6,2E+3	1,4E+4	4,8E+2	1,7E+2
7	4,8E+3	1,1E+4	3,7E+2	1,3E+2
8	3,9E+3	8,6E+3	3,0E+2	1,0E+2
10	2,7E+3	6,0E+3	2,0E+2	6,9E+1
12	2,0E+3	4,4E+3	1,5E+2	4,9E+1
14	1,6E+3	3,5E+3	1,1E+2	3,6E+1
16	1,3E+3	2,8E+3	9,1E+1	2,7E+1
20	9,0E+2	2,0E+3	6,2E+1	1,7E+1
25	6,6E+2	1,4E+3	4,3E+1	1,1E+1
30	5,1E+2	1,1E+3	3,3E+1	7,1E+0
40	3,6E+2	7,7E+2	2,2E+1	3,7E+0
50	2,8E+2	5,9E+2	1,6E+1	2,1E+0

Учение!!!

Таблица 2. **Расстояния, на которых следует применить экстренные меры защиты взрослых и детей (критерий таблица 6.3 НРБ-99/2009), км**

Меры защиты	*Взрослые*	*Дети*
Укрытие	59	
Йодная профилактика	11	32
Эвакуация	11	

Исполнитель (фамилия, подпись) Косов А.Д.

Время и дата отправки формы (по Москве) “ ” 2018 г.

AGREEMENT SHEET

On behalf of the JSC "Concern Rosenergoatom"

Deputy Director of the emergency preparedness and radiation protection division – head of CC and OPAS performance department	A.P. Markov
Chief technologist of the CC and OPAS functioning unit of the Emergency preparedness and radiation protection department	V.A. Golubkin

On behalf of the WANO-MC

WANO – MC T&D Programme Manager	A.I. Lukyanenko
WANO-MC Advisor	S.A. Loktionov

On behalf of the VNIIAES

Head of radiological safety and emergency response department	A.D. Kosov