XA0102795

IAEA-CN-82/19

SAFETY STATUS OF RUSSIAN RESEARCH REACTORS

MOROZOV, S. I.
Division for Safety Assessment and Licensing of Research Reactors,
Federal Nuclear and Radiation Safety Authority of Russia (GOSATOMNADZOR)
Taganskaya Street 34, RU-109147
Moscow, Russian Federation
Fax: +70959124041; Email: msi@crusader.gan.ru

Abstract

Gosatomnadzor of Russia is conducting the safety regulation and inspection activity related to nuclear and radiation safety at nuclear research facilities, including research reactors, critical assemblies and sub-critical assemblies. It implies implementing three major activities: 1) establishing the laws and safety standards in the field of research reactors nuclear and radiation safety; 2) research reactors licensing; and 3) inspections (or license conditions tracking and inspection).

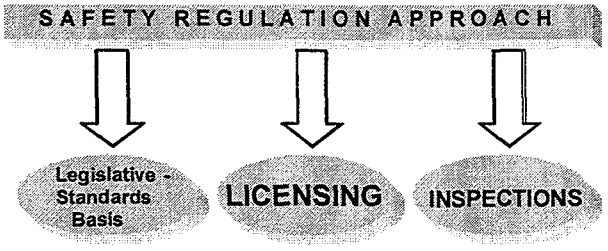
The database on nuclear research facilities has recently been updated based on the actual status of all facilities. It turned out that many facilities have been shutdown, whether temporary or permanently, waiting for the final decision on their decommissioning. Compared to previous years the situation has been inevitably changing. Now we have 99 nuclear research facilities in total under Gosatomnadzor of Russia supervision (compared to 113 in previous years). Table I. explaining their distribution by types and operating organizations is presented.

The licensing and conduct of inspection processes are briefly outlined with emphasis being made on specific issues related to major incidents happened in 2000, spent fuel management, occupational exposure, effluents and emissions, emergency preparedness and physical protection.
Finally, a summary of problems at current Russian research facilities is outlined.

1. INTRODUCTION

This paper has been written on the basis of the annual report on nuclear and radiation safety status of nuclear facilities in Russia submitted to the Russian Federation Government by the Federal Nuclear and Radiation Safety Authority of Russia (Gosatomnadzor of Russia) in 2001 [1]. According to this report Gosatomnadzor of Russia is conducting the safety regulation and inspection activity related to nuclear and radiation safety also at nuclear research facilities, including research reactors (RR), critical assemblies (CA) and sub-critical assemblies (SCA).

The safety regulation process is based on three major aspects as shown below:



Only two items, licensing and inspections, are addressed in this paper to show the current status of safety of Russian nuclear research facilities.

In the beginning of 2001 the database on nuclear research facilities has been updated based on the actual status of all facilities [2]. It turned out that many facilities have been shutdown whether temporary or permanently waiting for the final decision on their decommissioning. Compared to

previous years the situation has been inevitably changing due to reasons explained below. Now we have 99 nuclear research facilities under Gosatomnadzor of Russia supervision (compared to 113 in previous years). They are distributed by the current status as presented in Table I.

Table I. Status of Russian research facilities

Type	Operational	Extended Shutdown	Decom.	Construction or Reconstruction	TOTAL
RR	25	4	6	2	37
CA	26	16	3	1	46
SCA	7	6	2	1	16
TOTAL	58	26	11	4	99

In 1994 Gosatomnadzor of Russia made its first attempt to establish a nuclear research reactor safety classification based on the level of hazard a facility may represent as follows:

Group 1: nominal power up to 100 MWt for which there is a potential for severe accidents in all INES scale;

Group 2: nominal power up to 20 MWt, devoted to a nuclear core physics study, training, and isotope production with a moderate nuclear and radiation risk;

Group 3: nominal power up to 1 MWt where it may not be necessary to organize a forced cool-down of the reactor core in an emergency situation and with a small risk.

In Table II. a list of operating organizations and research facilities divided into above-said groups is presented.

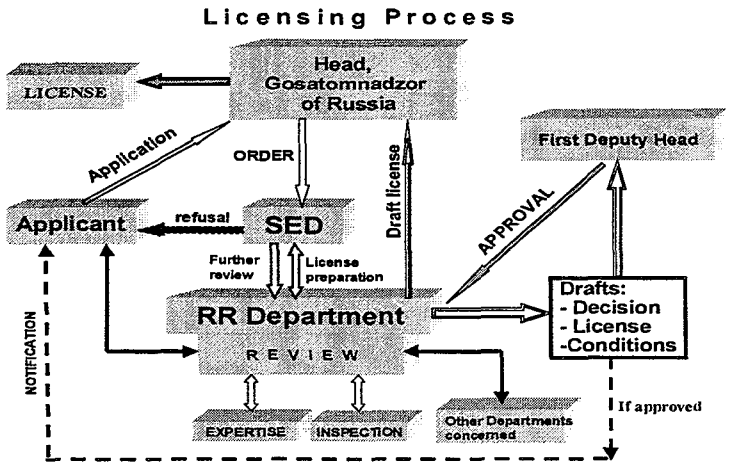
Table II. Operating organizations of research facilities

	OPERATING ORGANIZATION	Number of RR by Safety Groups 1 RR	2 RR	3 RR	3 CA	3 SCA	Total
1	Russian Scientific Center 'Kurchatov Institute'	-	-	7	18	1	26
2	State Scientific Center 'Physics and Power Engineering Institute', Obninsk	2	1	2	11	-	16
3	State Scientific Center 'Scientific and Research Institute of Nuclear Reactors', Dimitrovgrad	7	-	1	2	-	10
4	State Enterprise 'Scientific, Research and Design Institute of Power Techniques', Moscow	-	-	1	-	3	4
5	State Subsidiary Enterprise 'Sverdlovsk filial of Scientific, Research and Design Institute of Power Techniques', Zarechni	-	1	-	-	-	1
6	State Enterprise 'Scientific and Research Institute of Devices', Lytkarino	-	-	5	-	-	5
7	Open Stock Company "Machine Building Plant', Electrostal	-	-	-	7	-	7
8	Design Bureau of Machinery, Nizhni Novgorod	-	-	-	4	-	4
9	State Scientific Center ' Institute of Theoretical and Experimental Physics', Moscow	-	-	1	1	-	2
10	All-Union Scientific and Research Institute of Chemical Technology', Moscow	-	-	-	-	1	1
11	Design Bureau 'Gidropress', Podolsk	-	-	-	-	2	2
12	S.Petersburg Institute of Nuclear Physics after B.P. Konstantinov, Gatchina	1	1	-	1	-	3
13	Tomsk Scientific and Research Institute of Nuclear Physics, Tomsk	-	1	-	-	-	1
14	Moscow State Engineering and Physics Institute (Technical University), Moscow	-	1	-	-	5	6

15	Moscow Power Engineering Institute (Technical University), Moscow	-	-	-	-	1	1
16	Institute of Machinery, S.Petersburg	-	-	-	-	1	1
17	Filial of State Scientific Center 'Scientific and Research Institute of Chemical Physics', Obninsk	-	1	-	-	-	1
18	Central Scientific and Research Institute after A.N. Krylov, S.Petersburg	-	-	1	2	1	4
19	Joint Institute of Nuclear Research, Dubna	-	1	1	-	-	2
20	Joint Stock Company 'Belgorodgeology', Belgorod	-	-	-	-	1	1
21	Joint Stock Company 'Norilsk Mining and Metallurgy Kombinat after A.P. Zavenyagina', Norilsk	-	-	1	-	-	1
	TOTAL	**10**	**7**	**20**	**45**	**16**	**99**

2. LICENSING

The second big chunk of Gosatomnadzor of Russia regulatory activity is a licensing process for nuclear research facilities. A unified scheme of licensing had been established when the Federal Law on Atomic Energy Use was passed by the Russian Duma in 1995. It is pretty similar to licensing processes established in most countries as schematically presented by the following figure:



In 2000 Gosatomnadzor of Russia issued 19 licenses for different activities related to nuclear research facilities.

3. INSPECTIONS

3.1. Self assessment

One of the important issues in this area is to control a self-assessment to be conducted by the operating organizations and be annually presented to Gosatomnadzor of Russia for its review and making decision as a feedback. To effectively control this process a special Order by Gosatomnadzor of Russia has been issued and appropriate requirements are put into the license conditions.

3.2. Major incidents at Russian nuclear research facilities in 2000.

It should be noted that there were no nuclear and radiation incidents at the research facilities which would result in exceeding the limits of safe operation. During 2000 there were 47 (47 in 1999)

incidents related to the scram of the Emergency Control System (Emergency Control Rods). This number can be classified into the following categories:

- operator's error - 8
- malfunction of control or instrumentation systems - 12
- due to unstable power supply from the external grid - 17
- malfunction of the electric equipment - 7
- heat rejection equipment malfunction - 1
- malfunction of experimental devices - 2.

The analysis of all incidents happened at research facilities in 2000 has shown that the majority of events was related to:

- aging of I&C equipment;
- aging of Electric Systems equipment;
- instability of the External Electric Power Supply; and
- human/operator's error.

All these reasons represent the main problems at the research facilities. The need for reconstruction to fix the above problems is obvious but would require substantial investments. The other problem, that is becoming a serious one, is a human factor/operator's errors that can be characterized by the following reasons leading to the constant reduction in the number of adequately qualified operating staff:

- lack of prestige;
- decreasing of financial support;
- staff aging/retirement.

3.3. Spent fuel and waste management

From all amount of spent fuel, the following nuclear research reactor sites have the major quantity:

- 'Kurchatov Institute' (Moscow);
- PhEI (Obninsk);
- NIIAR (Dmitrovgrad);
- RDIPE Subsidiary (Sverdlovsk);
- SPINPh (St. Petersburg suburb, Gatchina); and
- NIFHI (Obninsk).

Table III summarizes the status of Spent Fuel storage facilities at different research reactor sites.

Table III. Status of some research reactor sites spent fuel storage facilities

Site and Reactor Name	Occupancy, %	
	1999	2000
'Kurchatov Institute', Moscow: - MR	60	60
- IR-8	36	36
PhEI, Obninsk: - AM-1	60	60
- BR-10	22	22
RDIPE Subsidiary (Sverdlovsk): - WWR-2M	88	80
NIIAR, Dimitrovgrad: - *CM-3*	94	94
- MIR.M1	85	97
- RBT-10/1, RBT-10/2	68	67
- BOR-60	97	95
- VK-50	71	56
SPINPh (St. Petersburg suburb, Gatchina): - VVR-M	37	37
NIFHI (Obninsk): - VVR-ts	53	59

The major problems of the spent fuel and radwaste storage facilities are the following:

- the problem of SF transfer from some reactors to a specialized enterprise for its conditioning and disposal has not been resolved yet;
- a large amount of radioactive equipment having big dimensions is collected at the sites;
- the technology of some SF reprocessing, as well as for non-standard equipment has not been developed up to now;
- liquid RadWastes are not solidified (due to lack of resources) and are stored in temporary storage facilities.

From the above table it can be easily seen that some storage facilities are close to be completely filled with Spent Fuel Assemblies.

3.4. Effluents and emissions

The amount of releases (airborne and waterborne) in 2000 was less than in previous years when summed releases never exceeded the established control levels [3].

3.5. Occupational radiation exposure

The radiation dose rate to the personnel is basically determined by the modes of the reactor operation at nominal power, by the experiments needs, by preventive maintenance and repair of equipment and devices whether irradiated or located in radiation zones.

The current practice at Russian Research Reactors shows that in working rooms of constant presence the radiation dose rate is in between 0,2 to 0,02 μrem, that is well below the permissible one (0,8 μrem).
The average radiation exposure at the facilities was 0,3 rem/a, whereas the regulatory limit is 2 rem.

3.6. Emergency preparedness

All sites have developed appropriate instructions of personnel behaviour during an emergency. There are two plans: On-Site Emergency Plan and Off-Site Emergency Plan. Both plans are connected with each other in some instances. A personnel training to emergency situations is conducted on the regular basis as required by the regulatory body. One problem still exists: lack of contemporary means of communication (including mobile phones).

3.7. Physical protection

This one of the important issues was successfully decided with the help of the IAEA and US Department of Energy assistance at some selected sites. For other sites the problem of a modern hardware needed for physical protection still exists.

4. SUMMARY OF PROBLEMS

General: most of research reactors are 25-30 years old and physically obsolete. Most important problems could be summarized as follows:

- justification of the reactor equipment (structures, elements, cladding, etc.) operability and reliability for the next period of operation;
- replacement of I&C equipment to a contemporary one;
- spent fuel transportation from the sites;
- concept of Research Reactors Decommissioning;
- concept of Research Reactors RadWaste Disposal (out of the site).

References

[1] GOSATOMNADZOR of Russia, Annual Report on Federal Authority Activities in Nuclear and Radiation Safety, Moscow, (2001).
[2] Russian Federation Research Reactors Data Base, GOSATOMNADZOR INTERNAL MEMORANDUM
[3] Major Sanitary Rules when dealing with Radioactive Substances and other Sources of Ionizing Radiation, OCP-72/87, Moscow, (1987).