

CURRENT STATE OF SPENT FUEL MANAGEMENT IN THE RUSSIAN FEDERATION



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Abstract

Twenty nine power units of nine nuclear power plants of total installed capacity 22 GW(e) are now in operation in the Russian Federation. They produce approximately 12% of electric power in the country. The annual spent fuel arising is about 790 tU. The spent fuel from VVER-440 and BN-600 is reprocessed at the RT-1 plant near Chelyabinsk. The VVER-1000 spent fuel is planned to be reprocessed at the reprocessing plant RT-2 which is under construction near Krasnoyarsk. The RBMK-1000 spent fuel is not reprocessed because of its low fissile content. It is meant to be stored in intermediate storage facilities at the NPP sites and in a centralized storage facility during a period not less than 50 years and then to be disposed of in geological formations. State of the art of spent fuel reprocessing, storage and transportation is considered in the paper. Problems of nuclear fuel cycle back-end in Russia are taken into account.

1. STATUS OF SPENT FUEL MANAGEMENT

29 power units of 9 nuclear power plants are now in operation in the Russian Federation. The major reactor types are VVER-440 (6 units), VVER-1000 (7 units), RBMK-1000 (11 units), BN-600 (1 unit) and EGP (4 units) with total capacity about 22 GW. These nuclear power plants (NPPs) produce 12% of the total energy production. The annual spent fuel (SF) arising from Russian reactors amounts to 790 tU. In accordance with the scheduled commissioning of new power units, the SF arising will increase to >950t by 2000, and 1100 t by 2010.

At present Russia continues to realize the closed fuel cycle concept in the relation to the VVER and BN spent fuel. This includes SF reprocessing, U and partially Pu recycling in thermal and breeder reactors, and vitrified radwaste storage in ground-based storage facilities at reprocessing plants.

The VVER and BN spent fuel is cooled in AR pools for no less than 3 years. The spent fuel from VVER-440 and BN-600 is reprocessed at the reprocessing plant RT-1 near Chelyabinsk (enterprise MAYAK). VVER-1000 spent fuel is supposed to be reprocessed at the RT-2 plant which is under construction near Krasnoyarsk. A storage facility of 6000 t capacity has been built at the RT-2 plant site. At present it holds over 1700 t U of spent fuel.

The RBMK-1000 spent fuel is not reprocessed because of its low fissile content. An intermediate spent fuel storage is a necessary step of the fuel cycle. The RBMK SF is stored in AR and the interim storage facility at the NPP site for no less than 10 years. Wet storage remains and will be prevailing in the nearest years. RBMK spent fuel quantities present considerable difficulties. Dispatch of the spent fuel has not been carried out. The storage capacity of operating RBMK facilities (including that obtained with denser FA arrangement) will provide SF reception from NPPs up to 2005. The above situation points out at to the pressing problem of long-term storage.

TABLE 1. CAPACITY OF STORAGE FACILITIES AND SPENT FUEL ARISING FROM MAJOR TYPES OF POWER REACTORS

Type of reactor	VVER-440		VVER -1000				RBMK			
	At- reactor		At-reactor		Away-from-reactor		At-reactor		Away-from-reactor	
Storage facility type	Storage capacity	Arisings	Storage capacity	Arisings	Storage capacity	Arisings	Storage capacity	Arisings	Storage capacity	Arisings
Fuel assemblies, items	3900 (5200 [*])	2670	2760	1047	900	104	31250 ^{**})	23725	78750 ^{**})	43540
Fuel quantities, tU	470 (630 ^x)	320	1200	460	400	46	3560	2700	8970	4960

^{*}) I and II units of NV NPP included

^{**}) Storage capacity with dense storage mode.

The status, as of 01.09.1997, of the spent fuel arisings from the major reactor types in the storage facilities are listed in Table 1.

At the previous meeting of the regular advisory group we informed about long-term storage technology versions considered in Russia. A decision was taken to construct a long-term centralized dry storage facility at the RT-2 plant site. The next technical proposals are considered:

- long-term storage of RBMK spent fuel in stainless steel canisters accommodated in massive concrete structures with residual heat removal by natural (air) convection;
- placing sealed cans with fuel into metal tubes (SGN (France) design of CASCADE type).

Simultaneously dual-purpose metal-concrete casks are being developed. These can facilitate the intermediate dry storage of RBMK spent fuel at the NPP site.

The SF shipping from the NPP sites by railway remains the only transport means. TK-6, TK-10, TK-11, TK-13 are used. Many information about their design and practice is published.

A new generation of containers development has begun because of the end of service life of some types. The new ones will meet all modern requirements. A positive experience available is taken into account while developing the containers. The task is to ensure the maximum capacity for the cost lowering and to increase safety of transportation. At the same time new casks should allow their using at the existing and designed NPPs and nuclear industry facilities. As a rule the casks should be of dual purpose: for transportation and for storage.

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