PREFACE

Accident management is very important for prevention and mitigation of severe accidents in Nuclear Power Plants and is widely discussed in the world. The processes that could occur during severe accidents in vessel-type Light Water Reactors are rather well understood, however, some uncertainties remain. The knowledge about severe accidents is used for development of accident management strategies. Most of the Nuclear Power Plants that operate vessel-type reactors in the world have already developed or are developing severe accident management programs. The processes that could occur during severe accidents in channel-type reactors are not so well understood. The Chernobyl disaster demonstrated necessity to achieve the same level of knowledge and to develop accident management programs for RBMK-type reactors as well.

RBMK reactor belongs to a class of graphite-moderated nuclear power reactors that were designed in the Soviet Union in 1950s. Usage of materials with low neutron absorption in RBMK design allows improving the fuel cycle by using cheap, low-enriched nuclear fuel. In total there have been built 17 RBMK reactors and 1 reactor is still under construction at Kursk NPP. All three surviving reactors at Chernobyl NPP have been shutdown (the fourth was destroyed in the accident). Units 5 and 6 at Chernobyl NPP were under construction at the time of the accident, however further construction was stopped due to the high contamination level at the site and political pressure. One of two reactors at Ignalina NPP in Lithuania was shutdown in 2004. In 2009, there were 11 RBMK reactors operating in Russia (4 reactors in Saint Petersburg, 3 – in Smolensk and 4 – in Kursk) and 1 – in Lithuania, however there are no plans to build new RBMK type reactors.

At Ignalina NPP is the only Nuclear Power Plant located in Lithuania. It consists of two units, commissioned in December 1983 and August 1987 respectively. Both units are equipped with channel-type graphite-moderated reactors RBMK-1500. Ignalina NPP Unit 1 was shutdown for decommissioning at the end of 2004 and Unit 2 is to be operated until the end of 2009. Ignalina NPP has implemented symptom-based Emergency Operating Procedures that were developed in 2000 by RBMK reactor design institute NIKIET (Russia). These procedures together with the event-based Emergency Operating Procedures cover Design Basis Accidents and a range of Beyond Design Basis Accidents, which do not lead to reactor core damage, i.e. they do not include management of severe accidents. In order to ensure coverage of the whole spectrum of accidents and meet the requirements of IAEA the severe accident management guidelines have to be developed and integrated into the general accident management strategy of Ignalina NPP.

In order to ensure the safe operation of the Nuclear Power Plant a fundamental safety principle of defense-in-depth is applied. Accident management is one of the key components of effective defense-in-depth. The strategy for defense-in-depth is twofold: 1) to prevent accidents and 2) if prevention fails, to limit the potential consequences of accidents and to prevent their evolution to conditions that are more serious.

Around the world, there are several approaches to the accident management. The approach of Westinghouse Owners Group, which is developed for Pressurized Water Reactors, but is also applied to Boiling Water Reactors, is well known and widely applied. However, this approach is not easily applicable or transferable to channel-type RBMK-1500 reactors. The framework of the emergency response procedures at Ignalina NPP is also different from that in the NPPs developed by Westinghouse Owners Group. Therefore, a specific approach has to be developed for the accident management at RBMK-1500 reactors.

The objective of this book is to present the basic principles and approach to accident management at Ignalina NPP with

RBMK-1500 reactor. In general, this approach could be applied to NPPs with RBMK-1000 reactors, that are available in Russia and partially for other channel-type reactors, but the design differences should be taken into account. As well, this book presents the current status of knowledge regarding the severe accident phenomena and possibilities of accident management at NPPs with RBMK reactors. This book also includes the results of the performed severe accident analyses to justify the suggested accident management strategies as well as information on the suggested NPP improvements, which would enhance the safety of RBMK reactors.

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