

## SUMMARY

A reasonably large number of published studies have considered the link between reactor-grade plutonium and non-proliferation. Nevertheless some aspects of this problem have not been sufficiently studied and not all priorities have been correctly stated. In the present authors' view an adequate approach should be based on the answer to the following question: "What does the actual difference consist of between 'military' and 'civilian' plutonium?" According to the current and widely adopted view, this difference is mainly determined by the content of the isotope plutonium-240. The present book offers an in-depth analysis showing that plutonium-240 is not the only crucial parameter that should define this difference, and that, in fact, the difference is determined by the presence of other plutonium isotopes.

This book presents the results of analysis spanning the inventory of civilian or reactor-grade plutonium and its characteristics that determine the technical risks of its proliferation.

In distinction to other studies related to reactor-grade plutonium and non-proliferation, this book puts a greater emphasis on the reactor-grade plutonium isotopic composition that depends on the type of a nuclear reactor, the burnup of nuclear fuel and the cooling time before fuel reprocessing. The authors have analyzed the effects of plutonium isotopic composition on such material parameters as critical mass, neutron multiplication rate, material radiation load, ingrowth of decay products, heat generation, and radiative properties.

The main conclusion reached is that there is no sharp boundary between reactor-grade and weapon-grade plutonium, and that the content of the isotopes plutonium-241 and plutonium-238 primarily determine the plutonium material technical properties crucial from the nuclear non-proliferation standpoint.

Within an approach developed to estimate the influence of properties of reactor-grade plutonium on technical risks of nuclear proliferation, the authors compared different categories of reactor-grade plutonium produced in nuclear power reactors. This allowed to "mark off" the types of nuclear reactors and generated spent nuclear fuel as possible elements of proliferation potential.

The developed approach combined with the IAEA data on nuclear electricity generation allowed the authors to estimate in a unified manner the amount of reactor-grade plutonium generated worldwide as well as its isotopic composition.

The authors also studied the issues related to the transmutation of reactor-grade and weapon-grade plutonium in MOX-fuel of nuclear power reactors and determined the main parameters showing that such transmutation decreases the technical risks of nuclear proliferation.

The present book is the result of studies carried out over several years at the Analytical Center for Non-proliferation in Sarov. It has been made possible by the financial support of the John D. and Catherine T. MacArthur Foundation. The authors hope that the book will be both interesting and useful to Russian and foreign experts in nuclear non-proliferation.