AGA 7: Disposition of Excess Weapon Plutonium

Time: Wednesday 15:00–17:00 Location: EMH 225

Invited Talk AGA 7.1 Wed 15:00 EMH 225

Disposition of excess weapon grade plutonium: Status of the Russian program. — •Anatoly Diyakov — Center for Arms Control, Energy and Environmental Studies, Moscow, Russia

During the Cold War, the Soviet Union and United States produced huge quantities of plutonium for weapons. Substantial cuts in their nuclear arsenals released of huge amounts of weapon grade nuclear materials. This put into the agenda the problem what to do with the excess weapon materials. In 2000 Russia and the United States concluded a Plutonium Management and Disposition Agreement (PMDA), committing each to eliminate 34 tons of excess weapon plutonium. It was expected that the implementation of the PMDA Agreement will start in the second half of the year 2009 and the disposition programs finalized in 2025. But from the very beginning the practical implementation of the PMDA agreement met with substantial difficulties.

After the consultations held in 2006-2007 the PMDA Agreement was modified. In compliance with the modified Agreement each side pledged to start the disposition of 34 tons of excess plutonium (25 tons in the form of metal and 9 tons in dioxide) in 2018 and to finalize the process in 15 years. Both sides were supposed to use the same disposition method through use in the MOX fuel and its subsequent irradiation in civil nuclear reactors: in light reactors for the USA and in fast neutron reactors for Russia.

The presentation is going to provide the current status of the disposition program

AGA 7.2 Wed 16:00 EMH 225

Evaluating the BN-800 as a Reactor-Based Option for Plutonium Disposition — •Matthias Englert[1], Friederike Friess[2], and Moritz Kütt[2] — [1]Öko-Institut, Darmstadt — [2]IANUS, Technische Universität Darmstadt

In 2000, Russia and the United States concluded the Plutonium Management and Disposition Agreement to dispose an amount of 34 tons excess weapon plutonium. Over the last decades, different options to render this plutonium unusable for weapons were discussed. Currently, both states plan to use the plutonium as mixed oxide fuel (MOX) in commercial nuclear reactors. Russia foresees to use it in its sodium cooled fast reactors BN-600 and BN-800, the latter currently still under construction.

Both reactors were originally designed as breeder reactors. During the disposition of plutonium, production of fresh plutonium is undesirable. It would take place at least in blankets of depleted or natural uranium. The agreement states that the BN-800 should be operated with a breeding ratio of less than one. We calculate the depletion effects of weapon-grade MOX fuel in the BN-800 for different configurations, with and without breeding blankets. All reactor configurations shift the isotopic composition of spent fuel from core regions to higher Pu isotopes and make the material less weapon-usable, with a Pu-239 content of less than 90 wt%. We analyze the breeding ratios of different configurations and present the resulting spent fuel composition, as well as an estimate of the possible fissile material throughput in the BN-800.

AGA 7.3 Wed 16:30 EMH 225

PRISM reactor: An Option for Plutonium Disposition? — •Sebastian Fehlinger, Friederike Friess, and Moritz Kütt — IANUS, Technische Universität Darmstadt

The Power Reactor Innovative Small Module (PRISM) is sodium cooled fast reactor model. The energy output depends on the core configuration, however with an energy output of approximately 300 MWe, the PRISM reactor belongs to the class of small modular reactors.

Beside using the reactor as a breeder reactor or for the transmutation of nuclear waste, it might also be used as a burner reactor for separated plutonium. This includes for example U.S.-American excess weapon-grade plutonium as well as separated reactor-grade plutonium. Recently, there has been an ongoing discussion in GB to use the PRISM reactor to dispose their excess civilian plutonium.

Depending on the task, the core configuration varies slightly. We will present different layouts and the matching MCNP models, these models can then be used to conduct depletion calculations. From these results, analysis of the change in the plutonium isotopics in the spent fuel, the amount of fissioned plutonium, and the possible annual plutonium thoughputs is possible.