INNOVATIVE REACTOR AND FUEL CYCLE AND INTERNATIONAL NON-PROLIFERATION REGIME

O. G. SIYUCHENKO, V. P. KUCHINOV

INTERNATIONAL NON-PROLIFERATION REGIME

- The creation of the Atomic Energy Agency (IAEA) in 1957;

- The Non-Proliferation Treaty was put into force on March 5, 1970;

- In 1974 was established the Zanger Committee;

- The Convention on the Physical Protection of Nuclear Materials during their use, storage and transportation entering into force.

This international regime has facilitated and facilitates the maintaining of stability in the current international relations and constitutes a good basis for international cooperation in the field of peaceful use of atomic energy.

The nuclear power use expands on the basis of the technologies in use it would require to significantly increase the IAEA resources to ensure necessary efficiency of international control over nuclear materials and facilities in the fuel cycles of the states including the task of undeclared activity detection.

The key elements necessary for the nuclear weapons fabrication:

- highly enriched uranium or separated weapon-grade plutonium;

- facilities to produce these materials;

- information necessary to design and construct such facilities;

- trained personnel to calculate and design nuclear weapons;

- trained personnel to design, construct and operate the above facilities.

The innovative reactor and fuel cycle should have such engineered barriers that would protect from unauthorized use of nuclear materials and facilities and would significantly decrease the cost of international safeguards implementation.

The physical and chemical characteristics of a certain fissile material complicating access to it or making it impossible its direct use in the fabrication of a nuclear explosive device, may be viewed as analogues to the physical barriers

The systems for nuclear material physical protection, control and accounting installed at a facility are the first level protecting the engineered barrier. At the national level these systems constitute the second level, the international control being the third one to protect those barriers.

RISKS RELATED TO CRITERIA TO ASSESS EFFICIENCY OF ENGINEERED BARRIERS

- form, quality and quantity of the fissile material used in the fuel cycle operations;
- accessibility of the fissile material during the fuel cycle operations;

- inherent and integral design features of the nuclear fuel cycle;
- number, type and interrelations of the facilities in a country;
- possibilities for undeclared use of a nuclear facility;
- time required for modification to a facility for undeclared use;
- possibility for clandestine modification to a facility for undeclared use;
- possibility for clandestine diversion or theft of fissile materials for weapon fabrication purposes.

<u>An example of the criteria to assess reactor technologies and fuel cycles:</u>

- whether the reactor could use the enriched uranium-235 fuel;
- whether the reactor could use the fuel containing plutonium or uranium-235 mixed with actinides;
- whether the reactor design and its physical characteristics exclude the possibility for the clandestine production of undeclared fissile materials;

- whether the reactor and fuel cycle facility designs exclude the possibility for unnoticeable re-configuration for undeclared use;
- whether the possibility to separate clean plutonium or uranium-235 is excluded at the fuel recovery facilities;
- whether at all stages of fabrication and use the nuclear fuel has the radiation level that prevents it direct handling and poses threat to human;
- whether the reactor and fuel cycle facility designs provide for the efficient application of control measure over physical and engineered barriers preventing proliferation;
- whether the reactor and fuel cycle facility designs provide for the efficient application of nuclear material physical protection, control and accounting measures.