

**Russia-U.S. Joint Program on the Safe Management of Nuclear Materials:  
Approaches To Prioritizing the Lab to Lab Projects**

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*Summary*

The U.S. and Russian weapons dismantlement process is producing hundreds of tons of excess plutonium (Pu) and highly enriched uranium (HEU) fissile materials. The nuclear operations associated with the final disposition of these materials will be occurring in both countries for decades. A significant accident during these operations could delay the disposition process. Russia-U.S. collaborative efforts to address safety issues associated with disposition processes have been ongoing since 1993. The experience of these collaborative efforts have demonstrated the need for a systematic and formalized approach to identifying and prioritizing collaborative projects. A systematic approach to the successful implementation of a formal program will require the definition of year by year program objectives, specific technical program areas, a process for the prioritization and selection of projects, and identification of performance measures to evaluate the success of projects. Specialized working groups established for each technical area are needed to define research priorities, review research proposals, and recommend proposals for funding. A systematic approach to the establishment of a formal U.S.-Russia cooperative program will serve to ensure the safety and continuity of disposition processes and reduce the nuclear proliferation risks presented by this material.

The U.S. and Russian weapons dismantlement process is producing hundreds of tons of excess plutonium (Pu) and highly enriched uranium (HEU) fissile materials. The U.S. and Russia are both converting and blending HEU into low enriched uranium (LEU) for use in existing reactors. Russia also plans to fuel reactors with excess Pu. The U.S. is on a two-path approach for the disposition of excess Pu: (1) use of Pu in existing reactors and/or (2) immobilization of the Pu in glass or ceramics followed by geologic disposal. The fissile nuclear materials storage, handling, processing, and transportation processes associated with the disposition process will be occurring in both countries for decades. A significant accident at any point in the process could significantly delay the disposition process.

Russia-U.S. collaborative efforts to address safety issues associated with nuclear processes required for the disposition of excess weapons grade nuclear materials were initiated in response to the 1993 Tomsk-7 accident. A joint Russia-U.S. team evaluated the causes of an explosion in a nuclear fuel reprocessing tank at the Tomsk-7

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reprocessing facility. The success of the joint Russia-U.S. Tomsk-7 accident assessment team resulted in a continuation of the collaborative efforts. Table 1 summarizes the major events comprising Russia-U.S. joint efforts to address common safety concerns relating to the disposition of excess weapons grade nuclear material.

<b>Table 1. The history of the joint U.S.-Russia effort to promote the safe management of nuclear materials.</b>		
<b>Date</b>	<b>Location</b>	<b>Activity</b>
June 1993	TOMSK-7 Russia	U.S. DOE Technical Team on-site review of TOMSK-7 incident
September 1993	Hanford, Wa. U.S.A.	First joint U.S.-Russia meeting on Radiochemical processing safety
November 1994	St. Petersburg and Krasnoyarsk-26 Russia	Second U.S.-Russia Joint Workshop on Radiochemical Operational Safety
August 1995	Los Alamos, NM U.S.A.	Third U.S.-Russia Workshop on Non-Reactor Nuclear Safety
August 1996	Seattle, Wa. U.S.A.	Program Review and Planning Meeting for Future Technical Exchanges
March 1997	Amarillo, Tx. U.S.A.	NATO Advanced Research Workshop: Fourth U.S.-Russia Workshop – Nuclear Materials Safety Management Initiative

In addition to the activities listed in Table 1, a number of joint U.S.-Russia pilot projects have been completed. The pilot projects were initiated to evaluate the effectiveness of joint U.S.-Russia research efforts. The technical areas studied in the pilot projects have included investigations into the safety of anion exchange, accident consequence assessment methods, and the application of principles of geological similarity to study alternative methods for the safe disposal of radioactive wastes. The experience obtained from the pilot projects and workshops listed in Table 1 indicates that there would be significant value in establishing a formal U.S.-Russia collaborative program to enhance and ensure the safety of nuclear processes required for the safe disposition of excess weapons grade nuclear material. These initial efforts provide significant groundwork for the establishment of a formal program.

A number of types of nuclear facilities required for the disposition process are not included under existing U.S.-Russia nuclear safety programs and agreements. The types of nuclear facilities and activities not currently covered under existing formal agreements are listed Table 2.

<b>Table 2. Nuclear Material Operations Not Currently Within the Scope of Existing U.S.-Russia Safety Programs</b>	
UF <sub>6</sub> production	Depleted UF <sub>6</sub> storage
Enrichment	Enriched uranium storage
Fuel fabrication	Spent fuel storage
Enriched U fuel	Pu Pit/bulk storage
Conversion and LEU	Vitrification or ceramic packaging
MOX fuel	Pit conversion
HEU/DU conversion/down blending	Radiochemical processing/treatment
HLW geological repository	

During the Krasnoyarsk-26 and Amarillo workshops, subgroups of Russian and U.S. specialists met to discuss specific technical areas of concern. Table 3 lists the topics discussed in the subgroups. The subgroups identified areas of research that could potentially benefit from a collaborative approach. Potential research projects were identified and prioritized in terms of their perceived need. Russian and U.S. institutes best suited for each project were identified. The discussions during the subgroup meetings demonstrated the need for a systematic and formalized approach to identifying and prioritizing collaborative projects.

<b>Table 3. Program areas identified and discussed at Krasnoyarsk-26 and Amarillo.</b>	
<b>Krasnoyarsk-26 Workshop</b>	<b>Amarillo Workshop</b>
Radiochemical modeling and experiments	Nuclear materials (Pu) storage, transportation, and handling
Radiochemical facilities operational safety	MOX production, transportation and handling
Safety and risk assessment	Spent fuel storage, transportation and handling
Radioactive waste management safety	Geologic disposal, wastes, and environmental issues
Nuclear materials storage safety	

A systematic approach to the successful implementation of a formal program will require the definition of year by year program objectives, specific technical areas within the program scope, a process for the prioritization and selection of projects, and identification of performance measures to evaluate the success of projects.

Program areas and annual program objectives could be defined by DOE and MINATOM program managers with input from specialized working groups. An example set of possible program areas is listed in Table 4. Specialized working groups established for each program area could define research priorities, review research proposals, and recommend proposals for funding.

<b>Table 4. Possible Set of Program Technical Areas</b>
Accident phenomenology and analysis
Safety technology and experiments
Operation and system safety
Safety management and regulation
Emergency planning

The working groups could consist of primarily U.S. and Russian subject matter experts but also include specialists from other countries. The Amarillo workshop included participants from Japan, France, Great Britain, and Germany. The international participation demonstrated the valuable expertise relating to material disposition processes that exists in a number of countries. One Russian and one U.S. chairperson could be appointed to coordinate the efforts of the working group.

The objective for the first year of a formal program could be the development of a common joint understanding of the existing nuclear material safety management systems in the Russian Federation and United States. The next logical step would be to develop an understanding of the safety related vulnerabilities in each system and to prioritize these vulnerabilities.

Collaborative projects must provide benefit to both the Russian and U.S. disposition process. Projects should be selected based on criteria such as project cost, potential reduction of operational risks, and the likelihood of project success.

The synergistic application of U.S. and Russian expertise and resources to maximize the safety of nuclear material processes will serve to ensure the successful disposition of excess weapons grade nuclear material in both countries. Collaborative efforts to date have established productive professional relationships between U.S. and Russian nuclear process safety specialists. Valuable experience has been gained that can be applied in the formulation of a successful program structure. A formal U.S.-Russia cooperative program will serve to ensure the safety and continuity of disposition processes and reduce the nuclear proliferation risks presented by this material.