RECORD OF MEETING

JOINT U.S. - RUSSIAN WORKSHOP/DEMONSTRATION OF CRYSTALLINE POROUS SILICA "GUBKA" APPLICATIONS
CINCINNATI, OHIO, JUNE 19-21, 2001
and
IDAHO FALLS, IDAHO, JUNE 25-29, 2001

Participants:

U.S.: Dr. Jenya Macheret (U.S. Department of Energy, DOE), Dr. Dieter Knecht, Troy Tranter and Terry Todd (Idaho National Engineering and Environmental Laboratory, INEEL), and Liliya Petrachenkova (SAIC International support to OST, DOE-HQ).

Russia: Dr. Albert Aloy (Khlopin Radium Institute, KRI), Prof. Alexander Anshits and Dr. Olga Sharonova (Institute of Chemistry and Chemical Technology of the Siberian Branch of the Russian Academy of Science (RAS), ICCT), and Mr. Alexander Tretyakov (Mining and Chemical Combine, MCC).

Workshop Agenda and Attendees: Lists of agendas and attendees of Ohio and Idaho Workshops are attached.

Interpreters: Sergei Silichtchev (Thomas E. Albert and Associates, TEA), Kevin Kelly (TEA).

Purpose: The purpose of the workshop was to (1) demonstrate and discuss laboratory tests using the porous silicate Gubka material to trap and stabilize actual laboratory radiological standard solutions at Fernald, (2) demonstrate laboratory tests to stabilize actual laboratory radioactive and hazardous waste solutions at INEEL, (3) identify other potential solution stabilization needs at other DOE laboratories, including needs of the Transuranic and Mixed Waste Focus Area, (4) discuss test results with representatives of other DOE laboratories of U.S. and Russian experience with new waste processing and stabilization applications, including ion-specific trapping from solutions, sludge stabilization, and gas-phase trapping of volatile materials, (5) identify potential U.S.-Russian collaboration in large-scale testing and discuss Russian experience with Gubka scale-up production tests, (6) discuss and propose potential commercialization opportunities and (7) develop draft scope of work for future testing to meet DOE needs.

Major Results of the Workshop/Demonstration and Path Forward:

(1) Demonstrated Stabilization of Fernald Laboratory Solutions in Preparation for Deployment: Radiological liquid standards used previously at Fernald are no longer needed and must be moved from the site (Ohio Operations need OH-F177). The Fernald and Nuclear Materials Focus Area staff developed a proposed path forward under Fernald's and NMFA's scope/costs, to demonstrate the technology to solidify the liquid standards in preparation for offsite shipment. As part of a joint U.S.-Russian workshop/demonstration held in Cincinnati on June 19-21, Fernald scientists demonstrated the stabilization of a portion of the 25-liter inventory of the radiological standards. This demonstration used Gubka porous crystalline matrix blocks developed in Russia in a passive mode reducing manpower needs and radiation exposure and involved neutralization of the acidic Cs-Ba solution prior to stabilization. After the required regulatory notification time period, the remaining acidic radiological standard solutions containing isotopes of Cs, Ba, Ra, Eu, U, Am, Po, Ru, Sr, Th, Pb, Pu, and Np will be stabilized directly with an expected ten-fold volume reduction. The resulting waste forms have been approved for disposal in shallow land burial at the Nevada Test Site. The solution stabilization tests will be completed in 2001 and will result in a successful deployment of the Gubka technology.

(2) Demonstrated INEEL Laboratory Tests to Stabilize Actual Laboratory Radioactive

and Hazardous Waste Solution: A laboratory test, currently under way, was demonstrated at the INEEL to stabilize a laboratory waste solution containing both hazardous and radioactive components. Because the laboratory solution is classified as hazardous waste, the test is run as a Treatability Study under the requirements of hazardous waste regulations of the U.S. Environmental Protection Agency and State of Idaho. To confirm that Gubka was itself not hazardous, samples were tested using standard EPA test protocol, and the results show that all hazardous metals were measured below the hazardous action limits and also below the more stringent Universal Treatment Standards. If successful, this approach will result in reduced volume solid waste forms to replace the current practice of liquid waste accumulation and disposal.

(3) Identified Potential Solution Stabilization Needs at Other DOE Laboratories: Other DOE laboratories with solution stabilization needs were identified at the Ohio and Idaho Gubka Workshops. Types of solutions, which are potential candidates for treatment with Gubka, include other liquid technical materials, such as are being treated at Fernald, which have been identified at Rocky Flats, LLNL, Brookhaven, Hanford, and Oakland sites. Other solutions, which will require feasibility testing to confirm applicability of the Gubka process, include organic liquids, sludges, and mixed acid wastes. The FY-2002 proposed scope of work will address further characterization of these solutions and feasibility tests of selected compositions. For sites with an identified need to disposition the technical solutions, deployment activities using Gubka will be proposed.

Transuranic and Mixed Waste Focus Area (TMWFA) Hydrogen Getter Needs. Discussions were held with representatives of the TMWFA, Waste Isolation Pilot Plant (WIPP), and NMFA on gas generation and hydrogen getter requirements for transuranic waste shipment and nuclear material storage. Russian experimental data and supporting literature data for a getter system based on copper oxide to trap hydrogen was presented to the WIPP and TMWFA personnel. Preliminary tests from the ICCT indicated that such a system would trap hydrogen under the WIPP transportation conditions. Previous experience also indicated that the material would not be poisoned by most of the expected impurities. Since current TMWFA hydrogen getters under development involve a metallic-based catalyst system, the oxide system, if feasible, could provide a broader basis to WIPP for NRC licensing application. The Russian scientist suggested use of an independent laboratory for the planned comparative testing of the getter candidates and a double-blind system where the different getter test samples cannot be identified by the testing personnel. Potential involvement was discussed of the Russian scientist in the review of the upcoming test plan and in further testing the copper oxide system, but no funding was committed. A proposal for testing and development of the Russian copper oxide-based getter will be submitted to the TMWFA.

Transuranic and Mixed Waste Focus Area (TMWFA) Purex Solvent Waste Disposition Needs. Another TMWFA need was discussed concerning the dispositioning of more than 100,000 liters of Purex solvent wastes at SRS. Similar needs exist at Russian plants, such as MCC, and the potential to use Gubka in a stabilization and dispositioning process was discussed. After obtaining necessary clearances, the Russian scientists will receive additional details of waste compositions and quantities for their evaluation of potential application using Gubka. The composition and quantities of SRS Purex waste solutions will be provided to the Russians. The Russian scientists will review the data and will submit a proposal based on the experience with all applicable technologies.

(4) Discussed and Evaluated Test Results of New Gubka Applications: New Gubka applications that were tested by U.S. and Russian scientists during FY 2001 (funded under a related research program), which were evaluated during the Workshops, included new forms based on the Gubka matrix that selectively trapped Cs and transuranic isotopes by ion exchange from a radioactive waste solution. Methods were developed for coating the Gubka matrix with the active sorbents, ammonium molybdophosphate (AMP) to extract cesium and carbamyl-methyl-phosphine (CMPO) to extract transuranic elements. A simulated INEEL HLW tank solution was tested with added tracer Cs-137, which resulted in a final 700-fold volume reduction from the waste liquid to the sorbed blocks. From Russian tests, the blocks containing the cesium can be further hot pressed to form a dense ceramic with an achievable total 1500-fold volume reduction compared to the initial solution. Potential application of Gubka and derived oxide materials to trap volatile metals under vitrification conditions was discussed. Proposals for selective ion trapping in solutions and for cleanup of volatile metals from vitrification off gas will be developed for application to DOE needs.

(5) **Identified Potential U.S.-Russian Collaboration in Large-Scale Applications of Gubka at the Russian Khlopin Gatchina Facility and Zheleznogorsk MCC Plant:** A feasibility study is planned at the KRI Gatchina Facility to stabilize 100 m^3 liquid wastes using about 10 m^3 Gubka blocks at a ten-to-one volume reduction. Studies are also planned at the MCC for applications using industrial quantities of Gubka blocks to stabilize sludge such as found in open waste ponds, immobilize Universal Extractant (UNEX) containing separated high-level waste radionuclides, stabilize Purex solvent, and provide a modified matrix for the high-level radioactive wastes. A potential for U.S.-Russian collaboration was identified in completing the comparison studies. If further testing is planned, joint U.S.-Russian tests could be proposed using the Demonstration Center facilities at MCC.

(6) **Discuss and propose potential commercialization opportunities:** Representatives of several commercial vendors attended the Workshop to obtain information on the Gubka applications. Through individual discussions, potential applications were identified, including the incorporation of Gubka solution stabilization with a commercial pretreatment process, use of Russian expertise in Gubka and related materials science, solution chemistry, sorbents, and catalysis to establish partnerships in further development, and providing scale-up and production support in developing the industrial process to produce Gubka.

(7) **Developed Draft Scope of Work to Meet Future DOE Needs:** A draft scope of work for Gubka-related technology to address future DOE needs was discussed. Elements include liquid waste treatment and stabilization including ion-specific trapping, vitrification offgas purification, hydrogen getter development and testing, and Gubka large-scale production development. A joint U.S.-Russian demonstration is planned at Russian facility(ies) with U.S. participation, as will be specified in the final scope of work.

Action Items:

1. Provide compositions of other DOE laboratory waste solutions for potential demonstration and deployment of Gubka stabilization.
2. Support requested review of hydrogen getter test plan protocol and, if funds are available, feasibility tests with the copper oxide getter.
3. Provide to the Russian scientists the composition of SRS Purex waste solution.
4. Evaluate the SRS Purex waste solution data and determine applicability of Gubka stabilization.
5. Evaluate new methods for chemical trapping and off-gas cleanup capability using modified Gubka.
6. Review Russian plans for large-scale Gubka production and application and coordinate with potential DOE users to establish a joint review and test program to meet DOE needs.
7. Develop with potential commercial vendors application of Gubka and Russian scientist expertise in joint ventures.
8. New proposals will be submitted by the Russian scientists in the areas of hydrogen getter development, Purex solvent treatment/stabilization, selective ion trapping from solutions, and volatile metal cleanup from off gases, after the necessary information has been received.
9. Draft patent submittal for new Gubka applications will be transmitted by the KRI scientist to the U.S. scientists for submission to DOE-HQ.
10. A letter will be transmitted to MINATOM from DOE requesting access by U.S. scientists to the applicable Russian facilities for joint demonstrations as agreed in the scope of work.
11. The U.S. and Russian scientists will prepare joint papers for the 2001 ICEM meeting at Bruges, 2001 Symposium for the Scientific Basis for Nuclear Waste Management at Boston, and Waste Management ’02 at Tucson and published in refereed publications.

The Record of Meeting was signed by:

For the U.S. Department of Energy:

Dr. Jenya Macheret
Program Manager
Nuclear Materials Focus Area
U.S. DOE

Dr. Dieter A. Knecht
Consulting Scientist
BBWI-INEEL

Mr. Troy Tranter
Advisory Engineer
BBWI-INEEL

For the Russian Institutes:

Dr. Albert Aloy
Principal Investigator
Khlopin Radium Institute
MINATOM

Mr. Alexander Tretyakov
Head of Central Laboratory
Mining and Chemical Combine
MINATOM

Prof. Alexander Anshits
Principal Investigator
Institute of Chemistry
and Chemical Technology
Siberian Branch RAS

Dr. Olga Sharonova
Senior Researcher
Institute of Chemistry
and Chemical Technology
Siberian Branch RAS