Technology Safety Data Sheet
Porous Crystalline Matrix Gubka

Section 1: Technology Identity

Technology Name(s):	Emergency Contact:
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Section 2: Technology Pictures

Figure 1: Gubka Cylinder.

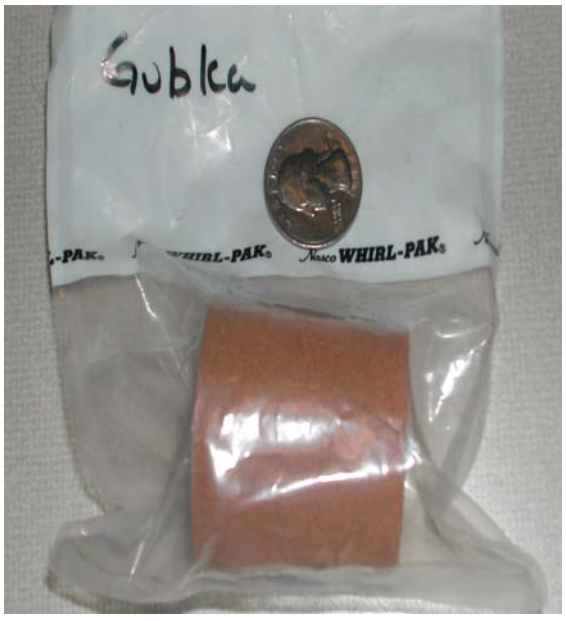

Figure 2: Waste Loaded Gubka in Plastic Bag.

Section 3: Technology Description

Radioactive solutions exist throughout the DOE complex. Future cleanup could generate additional actinide residue solutions requiring stabilization at facilities where processing capabilities have been dismantled. The Porous Crystalline Matrix, Gubka, or “sponge” in Russian, is a new technology for stabilizing radioactive and hazardous solutions. The “Gubka” process uses a new open-cell porous material derived from coal-fired power plant fly ash. The primary goal of this technology is to bring all residues, including solutions, to a stable condition.

The Gubka material consists of extremely fine glass-crystalline hollow mineral spheres. It is prepared from coal power plant fly ash and has a high, uniform, open-cell structure. This material will absorb components such as plutonium, americium, curium and High Level Wastes (HLW) from waste solution at ambient to moderate, below boiling, temperatures. The stabilized material can be packaged and shipped to other facilities for processing. The actinide salts can be recovered from the Gubka material, and the Gubka matrix can be further compacted to a dense, durable glass or ceramic material. The final waste form is a stable ceramic material, suitable for safe, long-term storage, transportation, and disposal.

This technology can be applied using two different methods to stabilize a solution. In both methods, the dried components of the solution are absorbed in the pores of the Gubka block while the water phase is evaporated. In the first method, the porous blocks are repeatedly saturated with solutions containing the radioactive tracers and waste simulants, alternating with drying. The time for each liquid sorption for the Gubka is about 30 seconds, and then the drying process is generally finished in about one hour at 100^{o}C. In the second method, rather than successively adding and evaporating small quantities of solution on the Gubka block, a larger quantity, typically one-half liter is placed in an open container in a fume hood and the Gubka block added to float on the surface. This method requires longer times to complete stabilization; however, it is a simple passive approach that minimizes direct solution handling, active heating, manpower requirements, and personnel exposure.

Section 4: Safety Hazards

Hazard Category:

(Adapted from Appendix A to MIL-STD-882D, February 10, 2000, Department of Defense Standard Practice for System Safety.)

4 - Could result in death or permanent total disability

3 - Could result in permanent partial disability or injuries or occupational illness that may result in hospitalization of at least three persons

2 - Could result in injury or occupational illness resulting in one or more lost work days

1 - Could result in injury or illness not resulting in a lost work day

N/A - Is not applicable to this technology and poses no appreciable risk

A.	Buried Utilities, Drums, and Tanks	Hazard Rating:	N/A

Is not applicable to this technology and poses no appreciable risk.

B. Chemical (Reactive, Corrosive, Pyrophoric, etc)	Hazard Rating: 2
• May be corrosive depending on the solutions the Gubka block contacts in the absorption process. • Site specific as the technology may be applied to a number of situations.	
C. Confined Space	**Hazard Rating: N/A**
Is not applicable to this technology and poses no appreciable risk.	
D. Electrical	**Hazard Rating: N/A**
Is not applicable to this technology and poses no appreciable risk.	
E. Explosives	**Hazard Rating: N/A**
Is not applicable to this technology and poses no appreciable risk.	
F. Fire Protection	**Hazard Rating: N/A**
Gubka, itself, is not a fire hazard, although site-specific hazards where the process is used may exist that need to be addressed.	
G. Gas Cylinders	**Hazard Rating: N/A**
Is not applicable to this technology and poses no appreciable risk.	
H. Ladders/Platforms	**Hazard Rating: N/A**
Is not applicable to this technology and poses no appreciable risk.	
I. Lockout/Tagout	**Hazard Rating: N/A**
Is not applicable to this technology and poses no appreciable risk.	
J. Mechanical Hazards	**Hazard Rating: N/A**
Is not applicable to this technology and poses no appreciable risk.	
K. Moving Vehicles	**Hazard Rating: N/A**
Is not applicable to this technology and poses no appreciable risk.	
L. Overhead Hazards	**Hazard Rating: N/A**
Is not applicable to this technology and poses no appreciable risk.	

M.	Pressure Hazards	Hazard Rating:	N/A
Is not applicable to this technology and poses no appreciable risk.			
N.	**Slips/Trips/Falls**	**Hazard Rating:**	**N/A**
Is not applicable to this technology and poses no appreciable risk.			
O.	**Suspended Loads**	**Hazard Rating:**	**N/A**
Is not applicable to this technology and poses no appreciable risk.			
P.	**Trenching/Excavation**	**Hazard Rating:**	**N/A**
Is not applicable to this technology and poses no appreciable risk.			

Section 5: Health Hazards

A.	Inhalation	Hazard Rating:	2

- A beaker containing Gubka and the solution to be stabilized is placed inside the hood. Depending on the material, such as acidic solutions, there may be an inhalation hazard if the hood fails or users work inside the hood.
- To ensure protection, laboratory hoods need to be tested for airflow and balanced against general room ventilation.
- The beaker may be knocked over before it is placed under the hood in which case laboratory spill procedures will be followed.

B.	Skin Absorption	Hazard Rating:	1

- Gubka, itself, does not pose a skin absorption hazard.
- Site-specific hazards will apply; acidic solutions contacting the skin will result in corrosion of the skin rapidly.

C.	Noise	Hazard Rating:	N/A
Is not applicable to this technology and poses no appreciable risk.			
D.	**Heat Stress/Cold Stress**	**Hazard Rating:**	**N/A**
Is not applicable to this technology and poses no appreciable risk.			
E.	**Ergonomics**	**Hazard Rating:**	**N/A**
Is not applicable to this technology and poses no appreciable risk.			

F.	Ionizing Radiation	Hazard Rating:	1
There is a presence of ionizing radiation in the solutions to be stabilized. The containers are manually handled during the process and a potential for exposure exists. Follow approved procedures and use appropriate level of PPE.			
G.	**Non-ionizing Radiation**	**Hazard Rating:**	**N/A**
Is not applicable to this technology and poses no appreciable risk.			
H.	**Biological Hazards**	**Hazard Rating:**	**N/A**
Is not applicable to this technology and poses no appreciable risk.			
I.	**Other**	**Hazard Rating:**	**N/A**
None			

Section 6: Phase Analysis

A. Construction/Start-up

- Incorporate procedures into site-specific safety plan.
- Characterize the materials or solutions.

B. Operation

- The stabilization process involves exposing the Gubka block to the contaminated solution, drying at elevated temperatures and rinsing of the containers. Workers handling the containers and material should follow approved procedures and wear appropriate level of PPE.
- Laboratory hoods where Gubka will be used should be regularly tested or provided with a continuous monitoring device to ensure adequate airflow. Appendix A to Occupational Safety and Health Administration's (OSHA) Laboratory standard (*29 CFR 1910.1450*) should be consulted for performance recommendations.

C. Maintenance (Emergency and Routine)

There is no maintenance required in the use of the Gubka block.

D. Shutdown (Emergency and Routine)

The Gubka block, after exposure to the contaminated solution, is considered low-level waste (LLW) and should be handled using approved procedures.

E. Decontamination/Decommissioning

- Bag both the beaker and the Gubka block.
- Place either in a paint can, or in other appropriate container, and seal the can.

Section 7: Worker Protection Measures

A. Exposure Monitoring

Site-specific monitoring determined by site characterization.

B. Worker Training

- Site-specific general lab training to ensure user is familiar with the lab's requirements
- Radiation training, Radiation Worker I & II
- PPE training, use and disposal
- Hazardous Communications (HAZCOM)
- Chemical Hygiene Plan

C. Medical Surveillance

- Site-specific medical surveillance requirements should already be in place based on site characterization.
- Additional medical surveillance may be required if the beaker is spilled exposing users to contaminants.

D. Engineering Controls

Hood ventilation is the main engineering control for vapor generation during absorption and drying of the Gubka. There should be a marker on the side of the hood that indicates the highest level the sash can be lifted and still maintain adequate airflow. Opening the sash higher than that level may allow vapors to escape the hood. Hoods should be inspected periodically and users should ensure proper airflow through the hood.

E. Administrative Controls

- Standard lab procedures that should already be in place with emphasis on handling acids
- Chemical Hygiene Plan may be required by OSHA
- MSDS's should be present as required by HAZCOM

F. Personal Protective Equipment

- Lab coat, splash protective
- Gloves
- Safety Glasses or goggles
- May be performed inside a glove box

Section 8: Emergency Preparedness

In the event of an emergency, users should follow standard lab procedure that should already be in place. MSDS for the acids should be on hand as well as a Chemical Hygiene Plan.

Section 9: Comments, Lessons Learned, & Special Considerations

This document is prepared for the scope of deployment for contact handled LLW. Site-specific hazards should always be identified before use. If Gubka is used with HLW, the TSDS should be re-evaluated.

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