Technology Safety Data Sheet
Alternative HEPA Filtration CeraMem

Section 1: Technology Identity

Technology Name(s):		Emergency Contact:	
Alternative HEPA Filtration CeraMem Ceramic HEPA Filter DOE OST TMS # 2091		Robert L. Goldsmith (781) 899-4495	
Manufacturer's Name and Address:		**Information Contact:**	
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Section 2: Technology Diagrams

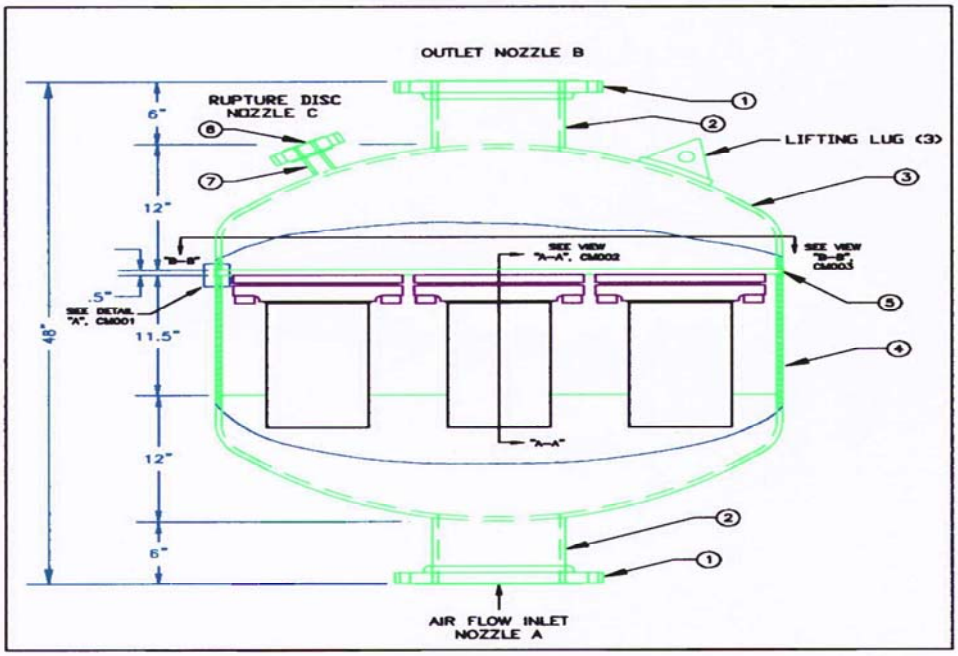

Figure 1: Schematic of CeraMem HEPA Filter Elements with Stainless Steel Filter Vessel.

Key:

1 – 150# R.F. Slip on Flange
2 – SCH 10S Pipe
3 -- ASME Elliptical Head
4 – Rolled Plate Shell
5 – Tubesheet Assembly with Seven Cans Attached Via Flanges
6 – 150# R.F. Slip on Flange
7 – SCH 10S Pipe

Section 3: Technology Description

The CeraMem alternative high efficiency particulate air (HEPA) filter is a ceramic HEPA filter; developed to replace conventional glass filters. Unlike the older filters, which must be thrown away when clogged, the CeraMem unit can be cleaned in place and reused. The new ceramic HEPA filters are designed to be integrated into the existing Savannah River Site (SRS) HEPA filter skid design.

The ceramic HEPA filter consists of seven (7) filter elements in individual stainless steel cans, contained in a stainless steel filter vessel. Each flanged can is attached to the tube sheet via a drilled and tapped studded outlet. The only hole that exists in the tube sheet is the filter-opening hole for clean gas passage. The seven filter elements are bolted onto the tube sheet in a closely packed hexagonal array. The tube sheet is welded into the vessel between the top head and shell course joint in the filter vessel forming clean and dirty air plenums above and below the tube sheet, respectively. Filter vessel weight including the seven filter cans is approximately 1200 lbs.

The CeraMem filter is housed above ground utilizing an existing SRS skid system design. A vacuum blower draws the air from the top of the tank through the filters. The dirty air with particulate matter travels via pipe to a demister followed by a heater before entering the filter media. The entrained particles are filtered from the air by a microporous membrane. The clean air flows down clean channels and is exhausted from the filter. Conventional HEPA filters are in place behind the CeraMem filter and serve as a back up or failsafe system.

The filters become partially plugged by particles they filter out. The proper cleaning procedure is presently being developed. When the differential pressure across the filter reaches a specified level, the dirty filter is cleaned, in place, by filling both the feed side and downstream side of the filter with nitric acid. The acid is drained into a holding tank and the clean plenum is filled with filtered water. The water is displaced with compressed, clean line air into the waste storage tank. The filter is dried by flowing dry instrument air from the clean side, through the filter, into the headspace of the tank being vented. The acidic wastes are neutralized with sodium hydroxide (concentrations between 5 – 10 percent currently being tested) and pumped into the tank being vented. In refining the cleaning procedure, a water only cleaning protocol may be realized.

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: 2

Buried tanks are present under the filters; personnel will not be required to access them but may be exposed to the contents.

B.	Chemical (Reactive, Corrosive, Pyrophoric, etc)	Hazard Rating:	2

- Nitric acid, used in the cleaning process, is a strong oxidizer and a corrosive. Consult the Material Safety Data Sheet (MSDS) for a listing of incompatibles, handling, and disposal information.
- Sodium hydroxide, used to neutralize the nitric acid from the cleaning process, may be corrosive and irritating to eyes, skin, and mucous membranes. Consult MSDS for a listing of incompatibles, handling, and disposal information.

C.	Confined Space	Hazard Rating:	N/A

No confined spaces associated with the CeraMem filter.

D.	Electrical	Hazard Rating:	2

The CeraMem filter itself does not require electricity to operate but the equipment it is coupled with will. Assure proper grounding of all equipment. Compliance with applicable electrical standards and codes require electricity and lockout/tagout procedures must be followed to assure the safety of personnel.

E.	Explosives	Hazard Rating:	N/A

The CeraMem filter does not pose an explosion threat in and of itself.

F.	Fire Protection	Hazard Rating:	1

- The CeraMem filter does not pose a fire threat in and of itself.
- If nitric acid is used as a cleaning agent, care must be taken to ensure safe handling and storage, as nitric acid is a strong oxidizer. Store in a tightly closed container. Contact with reactive metals (e.g. aluminum) may result in the generation of flammable hydrogen gas. Eliminate all ignition sources, no smoking, flares, sparks, or flames in immediate area.
- If di-octyl phthalate is used as the chemical agent in the DOP test, a slight fire hazard exists. Keep in a tightly closed container, stored in a cool, dry, ventilated area. Eliminate all ignition sources, no smoking, flares, sparks or flames in immediate area.

G.	Gas Cylinders	Hazard Rating:	N/A

No compressed gas cylinders are used in the CeraMem filter system.

H.	Ladders/Platforms	Hazard Rating:	1

- The skid, as currently envisioned, is 1-2ft. above the ground.
- The filter and associated apparatus are assembled on the skid and are 11.6 ft. in height.
- Level of hazard should be evaluated when the technology is deployed.

I.	Lockout/Tagout	Hazard Rating:	2

The CeraMem filter itself does not require electricity to be used but the equipment it is coupled with will require electricity. Assure proper grounding of all equipment. Compliance with applicable electrical standards and codes and lockout/tagout procedures must be followed to assure the safety of personnel.

J.	Mechanical Hazards	Hazard Rating:	1

The filter itself does not have any mechanical parts. Components necessary for the operation of the Alternative HEPA Filter may pose a hazard during maintenance, setup, and dismantlement.

K.	Moving Vehicles	Hazard Rating:	2

Personnel exposure to heavy moving equipment (semi-tractor trailers, cranes, and forklifts) will be experienced during set-up, change of filters, and dismantlement.

L.	Overhead Hazards	Hazard Rating:	2

Unloading and loading of technology may require a crane or use of a forklift. Proper precautions indicated.

M.	Pressure Hazards	Hazard Rating:	N/A

- During normal filtering operation the vessel will operate between atmospheric and 50 inches water column (wc). The maximum capability of the blower and other vacuum limiting controls will keep this level from exceeding 50 inches wc vacuum.
- During cleaning the vessel will experience a pressure from air and cleaning fluids injected from the clean side discharge piping and into the clean plenum to back wash the dirty plenum. These pressure sources are normally regulated to 10 pressure per square inch gauge (psig) with relief protection devices set to limit pressures to 15 psig maximum. A vessel rupture disk set at 20 psig provides vessel over pressure protection. In the event of rupture, the release of vessel contents is vented/piped back to the HLW tank.
- No pressure hazards evident at this time.

N.	Slips/Trips/Falls	Hazard Rating:	2

- The CeraMem filter does not pose a slip/trip/fall hazard in and of itself. As always, caution is advised when performing work in an environment where vehicles, hoses, electrical wires/lines, and fluids may produce hazards.
- Sodium hydroxide solutions, used in the cleaning process, are slippery to the touch. May produce hazardous slippery conditions if spilled on floors.

O.	Suspended Loads	Hazard Rating:	3

This is not part of this technology during operation. This hazard may be present during set up/dismantlement and change of filters. All applicable standards and precautions must be followed for the type of equipment used.

P.	Trenching/Excavation	Hazard Rating:	N/A

Not part of this technology.

Section 5: Health Hazards

A. Inhalation — Hazard Rating: 2

- The nitric acid used in cleaning may pose an inhalation hazard. Nitric acid may cause irritation of the respiratory tract with burning pain in the nose and throat, coughing, wheezing, and shortness of breath. Use adequate general or local exhaust ventilation to keep airborne concentrations below the OSHA Permissible Exposure Limit (PEL) of two parts per million (ppm).
- The sodium hydroxide used in cleaning may pose an inhalation hazard. Sodium hydroxide may be corrosive and irritating to the mucous membranes. Use adequate general or local exhaust ventilation to keep airborne concentrations below the PEL (5 mg/m^3).
- If di-octyl phthalate (DOP) is used as the chemical agent in the DOP test, the low vapor pressure of this material essentially eliminates inhalation hazards unless the material is heated or misted. Inhalation of mists can cause nausea and is irritating to the respiratory tract. Use adequate general or local exhaust ventilation to keep airborne concentrations below the PEL (5 mg/m^3).

B. Skin Absorption — Hazard Rating: 2

- The nitric acid used in cleaning may cause skin irritation and/or burns. Burns to the eyes with possible permanent damage.
- Sodium hydroxide used in cleaning may cause skin and eye irritation.
- If di-octyl phthalate is used as the chemical agent in the DOP test, slight skin irritation may occur from prolonged skin contact. Low levels may be absorbed through the skin.

C. Noise — Hazard Rating: N/A

- The CeraMem filter itself does not present a noise hazard.
- Based on the current system, the estimated sound pressure level when both the inlet and outlet are ducted is 78.0 dBA at 5.0 feet. The estimated noise level is below 85dBA, the OSHA limit requiring a hearing conservation program, but should be evaluated when the technology is deployed.

D. Heat Stress/Cold Stress — Hazard Rating: 2

The technology does not create a heat stress hazard when in operation. PPE will be required to work on or around the Alternative HEPA filtration system and will compound any heat stress hazards due to the ambient temperature.

E. Ergonomics — Hazard Rating: N/A

Operation of the Alternate HEPA Filtration system does not seem to pose ergonomic hazards. Evaluation of the support components and set-up, maintenance, and dismantlement should be done when deployment plans and details become available.

F. Ionizing Radiation — Hazard Rating: 4

- Ionizing radiation is not used or generated by the CeraMem filter.
- Ionizing radiation is filtered by the technology as a function of it's intended purpose.
- A failure of the gaskets could release radioactive material.

G. Non-ionizing Radiation	Hazard Rating: N/A
Non-ionizing radiation is not used or generated by the CeraMem filter.	
H. Biological Hazards	**Hazard Rating: N/A**
Biological hazards are not created by the CeraMem filter.	
I. Other	**Hazard Rating: 1**
There may be some ergonomic concerns as the filter is on a platform and some parts of the apparatus are almost 12 feet high. The level of hazard should be determined when deployment plans and details become available.	

Section 6: Phase Analysis

A. Construction/Start-up

The set-up or start-up phase presents several hazards including:

- Pinch points
- Struck by hazards
- Overhead hazards
- Slips/trips/falls
- Muscular/back injury
- Exposure to High Level Waste (HLW)

B. Operation

The CeraMem filter is designed to perform its function in place without operator interaction. Any hazards that exist should be the result of system components that support the CeraMem filter such as:

- Electrical hazards that result from improper grounding or electrical failure of the pumps, condensers, or heaters.
- Material handling hazards associated with nitric acid and sodium hydroxide.

C. Maintenance (Emergency and Routine)

- The developer anticipates cleaning of the filters will be done on a semi- annual basis and that replacement of the filters will not be necessary for 15 years.
- Cleaning and replacement procedures have not been finalized at this time. Further evaluation will be necessary as deployment plans and details become available, taking into consideration site-specific hazards such as radiation and the contents of the HLW tanks.

D. Shutdown (Emergency and Routine)

Standard operation procedures (SOPs) should be developed for both routine and emergency shutdown to prevent the release of HLW. HEPA failure procedures should be included in the SOPs in the event the system fails or has to be shut down in the event of an emergency.

E. Decontamination/Decommissioning

- Properly handling the filter vessel will be a necessity when removing and replacing the existing filter vessel or the entire skid.
- Proper handling, storage, and disposal will be required when working with the spent filter vessel or any components.

Section 7: Worker Protection Measures

A. Exposure Monitoring

- Monitoring for site-specific hazards will be required when working on or around the High Level Waste tanks including personal radiation monitoring.
- Once the final determination has been made with regard to the cleaning solution, additional exposure monitoring may be required.
- Noise monitoring may be required around the system's components especially the pumps.

B. Worker Training

The following should be covered:

- Technology-specific training emphasizing standard operating procedures
- Radiation Training, Rad Worker I & II
- Material Handling with emphasis on hazardous materials, handling contaminated components, and working in hazardous environments
- Personal Protective Equipment use
- HAZWOPER 29 CFR § 1910.120 including respirator training and hazard communication
- Lockout/Tagout

C. Medical Surveillance

Site-specific hazards may require medical monitoring. Specific requirements for personal radiation monitoring need to be reviewed at each site.

D. Engineering Controls

There are not engineering recommendations at this time. Evaluation of the system when deployment plans and details become available may identify a need for engineering controls for the CeraMem filter, the filter skid, or the support components.

E. Administrative Controls

- CeraMem operating procedures
- CeraMem maintenance and cleaning procedures

F. Personal Protective Equipment

- Hard hat
- Eye protection
- Gloves
- Work boots
- Chemical and/or radiation suits based on site characterization and hazard identification
- Hearing protection will be determined based on monitoring conducted in the future on an operational system
- Respiratory protection based on site characterization and hazard assessment.

Section 8: Emergency Preparedness

Failure of the Alternative HEPA Filtration system may result in a need for emergency response. The type of response and level of preparedness will be determined by the contents of the High Level Waste tanks.

Section 9: Comments, Lessons Learned, & Special Considerations

This Technology Safety Data Sheet has been prepared as the result of a design review. Further consideration and evaluation will be required as the technology is developed and inevitably changes. Furthermore, some hazards may not be fully evaluated without a complete system, examples being noise and ergonomics. This sheet should be updated as new information becomes available.

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Copies of this Technology Safety Data Sheet and others developed by the Operating Engineers National Hazmat Program can be found on the internet at: www.iuoeiettc.org.