Technology Safety Data Sheet
RAHCO International, Inc. Continuous Perimeter Barrier

Section 1: Technology Identity

Technology Name(s):	Emergency Contact:
Continuous Perimeter Barrier Subsurface Containment System DOE OST TMS # 1772	Gregory S. Barber Phone: (509) 467-0770 Fax: (509) 466-0212 Email: rahco@rahco.com
Manufacturer's Name and Address:	**Information Contact:**
RAHCO International, Inc. PO Box 740 Spokane, WA 99207 USA Phone: (509) 467-0770 Fax: (509) 466-0212 Email: rahco@rahco.com Website: http://www.rahco.com	Gregory S. Barber Phone: (509) 467-0770 Fax: (509) 466-0212 Email: rahco@rahco.com

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Section 2: Technology Pictures and Diagrams

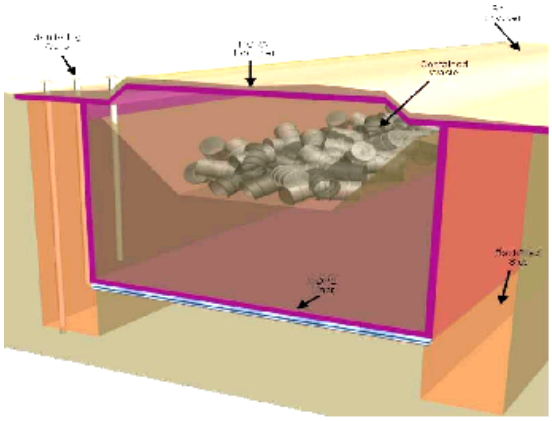

Figure 1: Completed Subsurface Containment System.

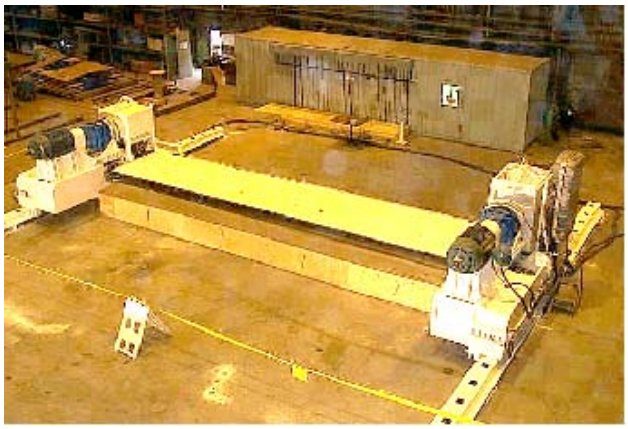

Figure 2: Slot Construction Unit.

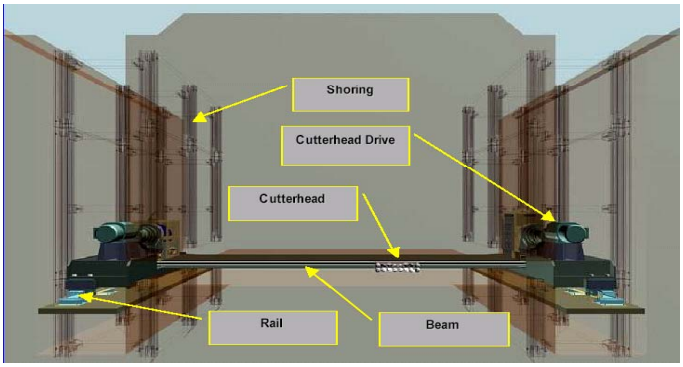

Figure 3: End View of SCU in Trench.

Section 3: Technology Description

The RAHCO Subsurface Containment System (SCS) is able to operate in varying soil conditions without disruption of the buried waste or any adjoining waste while installing a dense clay barrier to surround the waste. The SCS combines the use of conventional construction equipment including an excavator and a mobile crane to excavate the vertical perimeter trenches, install a shoring system, and install curtain wall panels around the trench perimeter. A specialized slot construction unit (SCU), shown in Section 2 is designed to construct a 100-footwide horizontal slot beneath a buried waste area and simultaneously install 24x36x7-inch precast concrete blocks, and cover them with 80-mil geosynthetic clay and high-density polyethylene (HDPE) liner strips at a depth of approximately 40 feet. Upon completion, the SCU has constructed a nearly impermeable barrier around the waste similar to the way a swimming pool holds water. The SCU demonstrated was able to cut a 34-foot-wide horizontal slot through rock and concrete beneath simulated buried waste at a depth of approximately 25 feet. The SCU consists of seven major subassemblies: beam structure, cutterhead assembly (see Figure 2, Section 2), steering system, thrusting unit, block inserter, polyliner inserter, and power and control unit. The SCU unit demonstrated was approximately 48-feet wide by 16-feet long and weighed approximately 75,000 pounds.

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

A site characterization is needed to locate all buried waste before the deployment of the SCS. The SCS technology is designed to contain buried drums and waste without direct contact; however, direct contact may occur. The possibility also exists that contact with contaminants will occur within the excavated soil.

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

Until a site characterization is complete, the buried waste can be assumed to be radioactive in addition to being chemically reactive.

C.	Confined Space	Hazard Rating:	2

Trenches could be deemed confined spaces, depending upon conditions. Air monitoring may be needed depending upon site conditions on the surface and within the trench.

D.	Electrical	Hazard Rating:	2

480-volt electric circuits control the SCS. All electrical connections are within explosion proof enclosures and connectors. All electrical work should be performed only after affected circuits have been locked out/tagged out. All cables used should not exceed the designed load capacity and be certified for use in wet locations. The use of wheeled cable slings will help with the movement of the large electrical cables.

E.	Explosives	Hazard Rating:	2

Explosives are not applicable to this technology; however, the possibility of the SCU cutting into a buried drum containing an explosive mixture does exist, unless the site characterization proves otherwise.

F.	Fire Protection	Hazard Rating:	2

Fire protection is of great concern depending upon the characterization of the buried waste. Possible overheating of a SCU component may cause a fire. Special concerns apply to the use of water, and the amount available for fire fighting in the area of the buried waste. Excess water could spread contamination. Sump pumps should be sized to remove water from the trenches in the event water is used for fire fighting operations.

G.	Gas Cylinders	Hazard Rating:	1

Gas cylinders are not part of this technology; however, gas cylinders could be part of the buried waste. A site characterization should confirm whether any buried cylinders are present.

H.	Ladders/Platforms	Hazard Rating:	1

If ladders are used for access to and egress from the trenches, requirements in *29 CFR § 1926 Subpart P* apply. Ladder duty ratings should be acceptable for use in any location onsite.

I.	Lockout/Tagout	Hazard Rating:	3

Procedures for work on any equipment or power source must include lockout/tagout guidelines. A physical means, such as a keyed lock or a keyed operator control console, must be used to eliminate all possibility of power to or movement of the object of concern to protect personnel during maintenance, inspection, or other operations.

J.	Mechanical Hazards	Hazard Rating:	2

Hoisting and rigging and the use of heavy equipment for the placement and restocking of technology components may pose hazards such as pinch points, struck by, caught between, crush, and fall from above. Personnel should not be permitted under a load that is being lifted or is unsupported. Inspection or repair of any mechanically operated part must be locked out or tagged out before personnel begin.

K.	Moving Vehicles	Hazard Rating:	2

Support vehicles including a crane, an excavator, and re-supply trucks will be present on site. The presence of multiple pieces of heavy equipment in relationship to a small area of operation will pose a hazard to personnel. Warning devices such as horns, bells, lights, and backup alarms must function properly. The swing radius of the crane should be sufficiently marked for all site personnel. The swing radius area will change upon crane movement from one location to another. Designate traffic patterns for re-supply trucks. All workers should be aware of hand signals used to communicate during operational activities.

L.	Overhead Hazards	Hazard Rating:	2

Any work in the trench should be performed in a hardhat to prevent head injury from materials and tools being accidentally knocked into the trench.

M.	Pressure Hazards	Hazard Rating:	1

The thrusting unit and steering system exert extreme force to allow the cutting head to meet with the surface. It is foreseeable that these systems may need adjustment or repair. Any repair attempted on these systems should only be attempted after the systems have been safely purged of the stored pressures they may contain and properly locked out and tagged out.

N.	Slips/Trips/Falls	Hazard Rating:	2

Electrical cables and other site support lines and equipment may pose tripping hazards. Use good housekeeping skills to minimize the likelihood of tripping. Barricade or otherwise make areas containing hazards more visible to personnel.

O. Suspended Loads	Hazard Rating: 3

Installation of the shoring and SCU and restocking of the block inserter and polyliner inserter present overhead hazards to personnel. The SCU requires the use of a crane for placement into the trench. All technology components should be guided into place with taglines and workers should stay back from the trench area when guiding the components. Personnel are never allowed under a load. Areas below the movement of loads supported by a crane should be marked to prevent personnel from inadvertently walking below the load. Safety requirements applicable to hoisting and rigging must be followed.

P. Trenching/Excavation	Hazard Rating: 3

The installation of the technology requires extensive trenching, excavation, and shoring. This can pose several hazards such as trench collapse, fall into trench, and struck by hazards from installing the technology in the trench. All applicable regulations for excavations (*29 CFR § 1926 Subpart P*) shall be followed.

Section 5: Health Hazards

A. Inhalation	Hazard Rating: 2

Excavation may generate nuisance and/or respirable dust. Dust suppression methods, such as wetting, should be used during excavation to minimize dust production. Soil characterization must occur before removal. Excavated soil should be treated carefully to minimize contact with personnel. Proper monitoring and protection are needed to ensure the health of site personnel.

B. Skin Absorption	Hazard Rating: 2

The site characterization must address the issue of skin absorption. Proper PPE may be required for prevention of skin absorption.

C. Noise	Hazard Rating: 2

The technology uses electric motors and does not present a noise hazard. Depending upon the composition of the earth the SCU will be cutting through, an increase in noise production could occur. This increase needs to be monitored to see if it is significant. The heavy equipment used for the installation of the technology does, however, present a noise hazard. A noise survey should be conducted to assure proper protection is provided. The noise may also present hazards associated with lack of communication. All personnel on site should be familiar with hand signals.

D. Heat Stress/Cold Stress	Hazard Rating: 1

Technology does not produce a hazard but ambient conditions need to be considered and monitored. Personal Protective Equipment (PPE) requirements for entering work zone will increase the risk of heat stress.

E. Ergonomics	Hazard Rating: 3

Lifting, bending, and pulling are ergonomic hazards that personnel will encounter during installation of the technology. All these stressors will present the possibility of muscular/back injuries. Hand-arm and whole body vibration represent ergonomic hazards to the heavy equipment operators. Wheeled cable slings will facilitate easier movement of cables as the technology advances forward. For most operations, a crane will need to assist in the movement of the SCU components. Proper lifting techniques, such as bending at the knees, will decrease stresses applied to the back. Two or more persons should be used, when lifting large objects, doing so will decrease the individual burden. The weight of the SCU is 75,000 pounds and most components are large and generally unable to be lifted by hand.

F. Ionizing Radiation	Hazard Rating: 3

The buried waste may pose an ionizing radiation hazard. The site characterization should address this concern. Proper PPE should be used to adequately protect personnel.

G. Non-ionizing Radiation	Hazard Rating: 1

A laser-operated transit may be used for onsite excavation measurements. Read operators manual and understand laser hazards. The area should be labeled properly for laser use.

H. Biological Hazards	Hazard Rating: 1

The buried waste may pose a biological hazard. The site characterization should address this concern. Proper PPE should be used to adequately protect personnel.

I. Other	Hazard Rating: N/A

Not applicable to this technology.

Section 6: Phase Analysis

A. Construction/Start-up

A site characterization of the entire area surrounding the buried waste is needed to fully understand the contaminants present and the possible and likely outcome for the deployment of the SCS. Knowledge of the excavation standard *(29 CFR § 1926 Subpart P)* is paramount before the start-up of this technology. Training on the installation process for the shoring and the SCU is needed for site personnel.

B. Operation

The use of several pieces of heavy equipment for extensive trenching and excavation presents the opportunity for pinch points, slips/trips/falls, struck by/caught between, muscular/back injury, fall from above, excavation collapse, and restricted communication. Before operation of the SCU, all personnel should exit the trenches. Advancing the SCU will require planning to ensure all personnel are familiar with the intended process if parts such as the index rail and shoring are to be leapfrogged for reuse. Exposure monitoring should be conducted during the entire construction process. The re-supply of the blocks and polyliner may present contamination hazards to personnel.

C. Maintenance (Emergency and Routine)

All maintenance procedures must be performed only after the appropriate systems have been locked out/tagged out. Lockout/tagout should be accomplished by the use of a keyed lock and/or keyed operators panel. All forms of energy must be safely released before maintenance on a pressurized system. Two or more persons should be used to move or lift large objects. Consideration should be given to the use of the onsite lifting equipment. PPE use may be required for maintenance operations. Proper selection is imperative for personnel protection.

D. Shutdown (Emergency and Routine)

Normal shutdown procedures conducted at the operators control station should eliminate all power sources to the SCU. Emergency stop devices should be located around the trenches. These devices should eliminate all movement and power to the SCU.

E. Decontamination/Decommissioning

The decommissioning phase presents several hazards including possible exposure to contaminants, pinch points, slips/trips/falls, and muscular/back injury. If contamination was encountered during deployment, all SCU components must be surveyed after decontamination. It may not be possible to decontaminate various components of the SCU due to design, size, and weight considerations.

Section 7: Worker Protection Measures

A. Exposure Monitoring

The site characterization should reveal the exposure concerns on the site. Continuous air monitoring should occur in and around the site to ensure the health of personnel in the general area of operation. Soil sampling is necessary to detect the presence of soil contamination.

B. Worker Training

All site personnel should be trained on the normal operation and shutdown procedures for the SCU. Further training is needed for personnel responsible for other operations such as shoring installation/removal and crane operation. Radiation training (Radworker I and II) is required due to the buried waste contents. All personnel need training for lockout/Tagout, PPE, respiratory protection, heat stress, ergonomics, hearing protection, and other safety and health topics as deemed necessary.

C. Medical Surveillance

All site personnel should be medically monitored according to the contaminants found from the site characterization. Surveillance requirements may include hearing and radiation.

D. Engineering Controls

The shoring is an integral part of deploying the SCU. Extensive design engineering must be done to enable the SCU to be inserted and extracted from the end trenches. The re-supply modules for the blocks and polyliner may need further design modifications to protect personnel from radiation exposure during re-supply operations.

E. Administrative Controls

It is imperative that the SCU is not operated until all personnel exit all trenches. The use of cameras and microphones may be needed to fully monitor trench activities.

F. Personal Protective Equipment

The required PPE will depend upon site characteristics and the intended operation by personnel. Exposure monitoring must be done to ensure the health of site personnel.

Section 8: Emergency Preparedness

The buried waste, until fully characterized, may require different fire fighting procedures. The use of water should be limited, but may be the only recourse for fire protection.

Section 9: Comments, Lessons Learned, & Special Considerations

Special considerations for personnel should be made for an unexpected encounter with radiation. Sump pumps should be sized to remove additional water used in the event of a fire.

This Technology Safety Data Sheet Was Prepared By:

Team Leader:
Aaron A. Ondo
Operating Engineers National Hazmat Program
3775 Morgantown Industrial Park Bldg. 400
Morgantown, WV 26501
(304) 284-9129 FAX (304) 2849130

Team Member:
Pat Bell
Operating Engineers National Hazmat Program
1293 Airport Road
Beaver, WV 25813
(304) 253-8674 Fax: (304) 253-1384

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.