Electromagnetic Mixed-Waste Processing System for Asbestos Decontamination

Developer: KAI Technologies
Contract Number: DE-AC21-94MC29249
Crosscutting Area: N/A

Deactivation & Decommissioning FOCUS AREA

Problem:

Department of Energy (DOE) sites contain a broad spectrum of asbestos containing materials (ACM) such as cloth, pipe lagging, sprayed insulation, and other substances, which are contaminated with a combination of hazardous and radioactive wastes. These wastes consist of cutting oils, lubricants, solvents, PCBs, heavy metals, and radioactive contaminants. The radioactive contaminants are the activation, decay, and fission products of DOE operations.

The asbestos must be converted by removing and separating the hazardous and radioactive materials to prevent the formation of mixed wastes and to allow for both sanitary disposal and effective decontamination. Currently, no technology exists that can meet these sanitary and other objectives.

Solution:

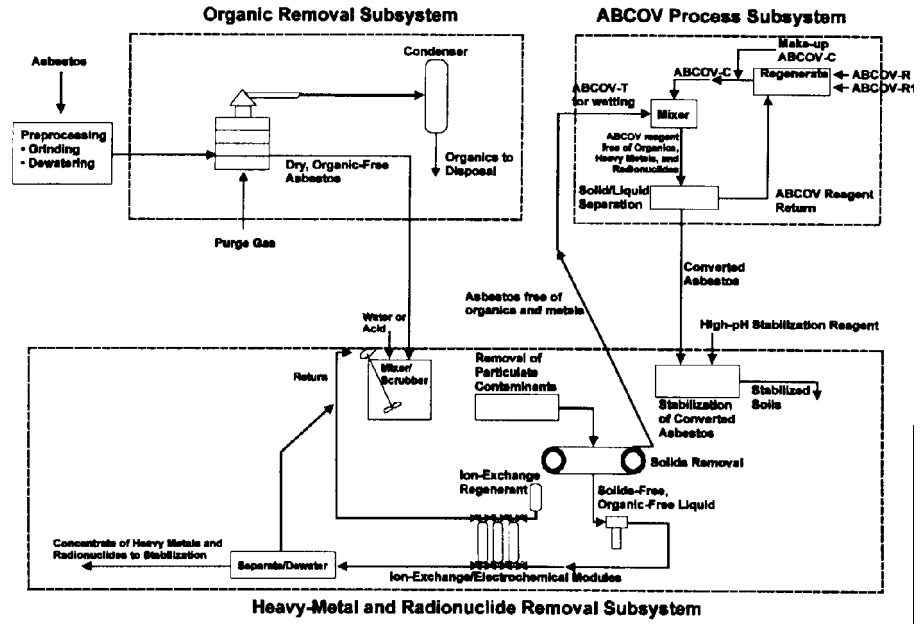
Apply techniques that have already proved successful in the mining, oil, and metals processing industries to the development of a multi-stage process to remove and separate hazardous and radioactive materials from asbestos. This process uses three methods: electrochemical processing for the removal of heavy metals and radionuclides; dielectric heating to volatilize or destroy the organic materials; and acid attack which converts the asbestos to a sanitary waste.

This process will result in the destruction of over 99% percent of the asbestos; limit radioactive metal contamination to 0.2 Bq alpha per gram and 1 Bq beta and gamma per gram; reduce hazardous organics to levels compatible with current Environment Protection Agency (EPA) policy for Resource Conservation and Recovery Act (RCRA) delisting; and achieve Toxicity Characterization Leaching Procedure (TCLP) limits for all solidified waste.

Benefits:

- Over 99% of asbestos converted for sanitary disposal and effective decontamination

- Separation of radioactive and hazardous materials prevents formation of mixed wastes



▸Stabilizes hazardous and radioactive wastes according to the RCRA and radionuclide material requirements of the EPA and Nuclear Regulatory Commission (NRC)

▸Closed system-process assures that public, worker, and environmental risks are minimized

▸Much lower operating costs than comparable state-of-the-art alternatives such as plasma fired thermal destruction combined with molten salt separation

Technology:

The electromagnetic mixed-waste processing system employs three patented technologies to convert DOE asbestos to a non-hazardous, radionuclide-free, sanitary waste: electrochemical separation of radionuclides (Westinghouse), radio-frequency heating to remove organics (KAI Electromagnetic Process), and high-shear acid decomposition (ABCOV Process).

In the process, radiofrequency heating is used to volatilize or destroy organic contaminants. Radionuclides in the resulting solution are separated by physical methods and ion exchange. The radionuclide and organic-free asbestos is treated by the acid-based ABCOV technology to destroy the asbestos fibers. The amorphous silica (containing heavy metals, if they were present in the contaminated asbestos) resulting from this treatment, is solidified with lime, sodium silicate, and possibly other reagents for disposal.

Project Conclusion:

The project was concluded in May 1997, at the end of the Phase 2 effort. As it turned out, the processing options proposed in Phase 1 could not be implemented with the actual contaminated waste of Phase 2. Rather, much of Phase 2 focused on establishing effective chemistry for processing select radionuclides.

Specific conclusions of the project include: some individual small lots of ACM within the DOE can be processed for the removal of radionuclides; conventional chemical regeneration of ion-exchange resins is preferred over electro-chemical processing; the apparent quantity of low-level radionuclide contamination in the DOE's waste inventory is relatively small and precludes the construction of a major processing facility; and, the radioactive contaminated ACM in DOE's inventory is heterogeneous and this contamination includes over a dozen different radionuclides, while the waste forms include: scrap wood & metals, concrete rubble, and plastics. This heterogeneity also contributes to the impracticality of a large-scale process.

Owing to the aforementioned Phase 2 conclusions, opportunities for a Phase 3 demonstration were non-existent. Thus, the project was concluded at the end of Phase 2.

Contacts:

KAI Technologies, Inc. is actively engaged in the innovative use of electromagnetics for this and other environmental problems. For information on this project, the contractor contact is:

Principal Investigator:
Mr. Raymond S. Kasevich
KAI Technologies
170 West Road
Portsmouth, NH 03801
Phone: (603) 431-2266
Fax: (603) 431-4920
E-mail:
73443.630@compuserve.com

DOE's Federal Energy Technology Center supports the Environmental Management - Office of Science and Technology by contracting the research and development of new technologies for waste site characterization and cleanup. For information regarding this project, the DOE contact is:

DOE Project Manager:
Mr. John R. Duda
Federal Energy Technology Center
3610 Collins Ferry Road
P.O. Box 880
Morgantown, WV 26507-0880
Phone: (304) 285-4217
Fax: (304) 285-4403
E-mail: jduda@fetc.doe.gov