TechData Sheet

Naval Facilities Engineering Service Center
Port Hueneme, California 93043-4370

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Solvated Electron Chemistry

National Test Location
Naval Facilities Engineering Service Center
Port Hueneme, California

Solvated electron chemistry technology is an innovative environmental cleanup process that uses a solution of ammonia and an "active" metal to create a powerful reducing agent that can chemically transform toxic contaminants, such as polychlorinated biphenyls (PCBs) and pesticides, into relatively benign substances. The technology works for cleaning up soils, sediments, liquids, and other material forms.

The process consists of placing the contaminated soil (or other material) into a reactor (Figure 1) and adding first liquid ammonia and then a metal, usually sodium. When the process is complete, the environmentally harmful elements have been chemically converted to harmless salts and other substances, while the soil has been left clean enough to be returned to the environment.

PURPOSE OF THE DEMONSTRATION

The solvated electron process demonstration is being conducted at the Construction Battalion Center in Port Hueneme, California. It is designed to reveal performance capability, determine potential scale-up costs, and evaluate design parameters. In addition, operational guidance and technology transfer documents will be developed during the investigation.

ADVANTAGES OF SOLVATED ELECTRON CHEMISTRY TECHNOLOGY

Using solvated electron chemistry for environmental remediation has the following advantages:

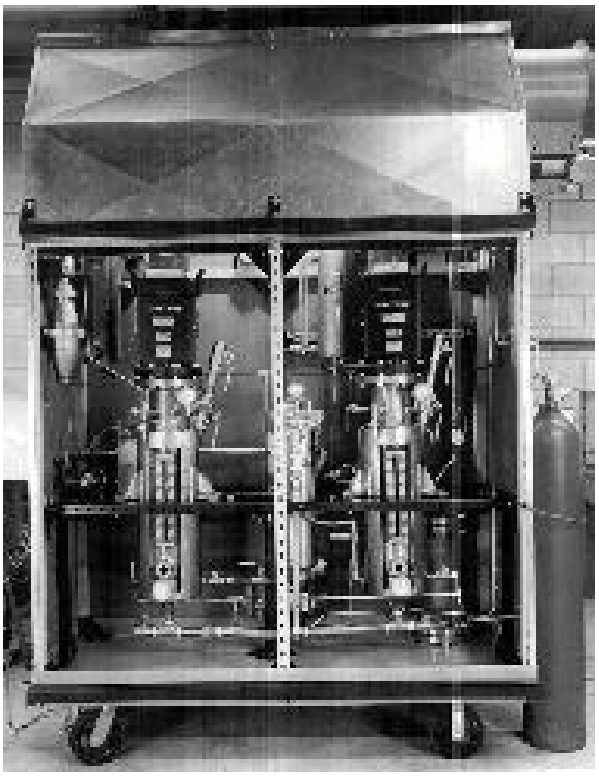

Figure 1. Reactor.

- ***Highly effective technology.*** The process successfully treats what are typically perceived as "hard-to-treat" contaminants.
- ***Can be used on materials in many different forms.*** It will effectively decontaminate soils,

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sludges, sediments, surfaces, oils, hand tools, hardware, protective clothing and more.

- ***Remediates contaminants without producing hazardous by-products.*** Harmful compounds are chemically converted to environmentally friendly salts and the uncontaminated materials are recovered for re-use.

- ***Low cost alternative.*** Costly transportation expenses are avoided because work can be completed on site.

DESCRIPTION OF SOLVATED ELECTRON CHEMISTRY TECHNOLOGY

Soils, sediments, liquids, and other materials that have been contaminated by PCBs, pesticides, and other halogenated compounds can be effectively cleaned upon being combined with a solution of solvated electrons. A solvated electron solution is a liquid homogenous mixture producing a large supply of free electrons. It can be created by combining liquid ammonia with a metal such as sodium, calcium, lithium, or potassium. When a solvated electron solution is mixed with a contaminated material, the free electrons in the solution chemically convert the contaminant to relatively harmless substances and salts.

The solvated electron remediation system consists of components (tanks, pumps and piping) to handle and recover the ammonia, along with reactor vessels for holding the contaminated soil and introducing the solvating solution. The system can be transported to various field sites. However, the process is performed *ex-situ*, which means the contaminated soil, or other material, must be placed in the reactor vessels.

The process begins by putting the contaminated material into a reactor vessel where it is mixed with ammonia. Sodium is then added to the mixture. After the chemical reaction is complete (about one minute), the ammonia is removed to a discharge tank for re-use. *(The ammonia can be reused because it serves as the solute for the solvated electron solution, but never actually enters the chemical reaction).* The treated material is then taken out of the reactor vessel, tested for contamination and returned to the environment. Figure 2 illustrates this process flow.

The amount of contaminated material that can be processed will vary with reactor vessel size and quantity as well as with ammonia handling capacity. However, new design concepts that call for operating in a continuous mode estimate the possibility of treating approximately 50 tons a day.

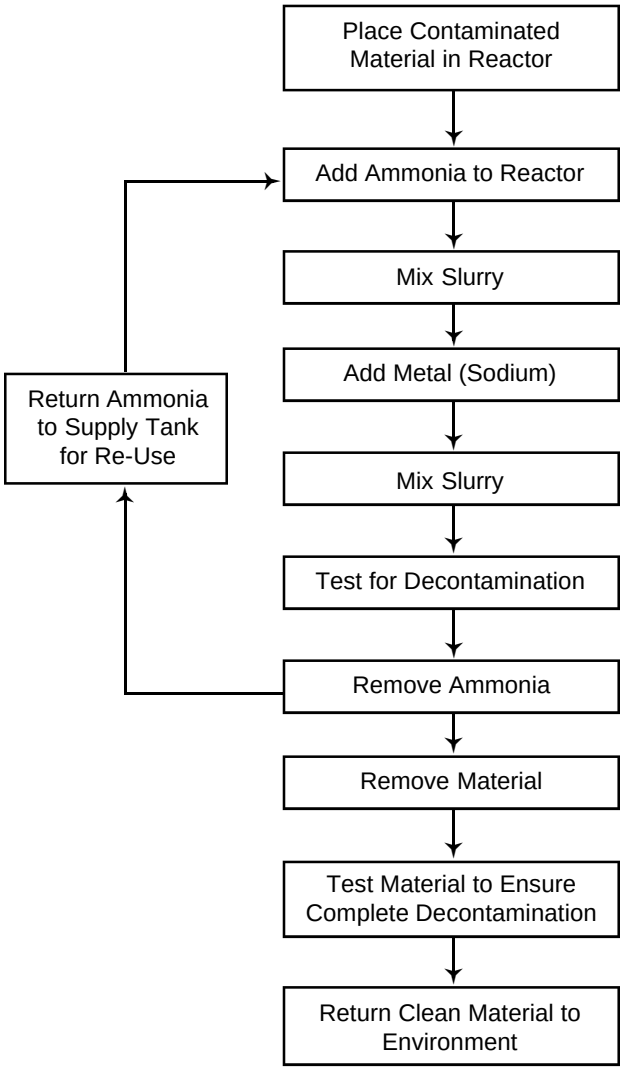

Figure 2. Process flow.

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