



Pueblo Chemical Agent-Destruction Pilot Plant

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A Partnership for Safe Chemical Weapons Destruction



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Biotreatment Process

The Pueblo Chemical Agent-Destruction Pilot Plant, or PCAPP, has been built and is now being readied to safely and efficiently destroy a stockpile of chemical weapons currently stored at the U.S. Army Pueblo Chemical Depot (PCD). A two-step technology - neutralization followed by biotreatment - is the process selected to destroy the chemical agent stored at PCD.

Neutralization

During the neutralization process, munitions are taken apart and energetics (explosives and propellants) are removed. The chemical agent is drained and the munitions bodies are rinsed. The agent is then mixed vigorously with hot water and sodium hydroxide, which destroys or neutralizes the agent. The resulting byproduct, known as hydrolysate, is held and tested to ensure agent destruction before proceeding to secondary treatment.

Biotreatment

Following confirmation of agent destruction, the hydrolysate will be treated in the Immobilized Cell Bioreactor (ICB) system -- a system composed of 16 rectangular reaction tanks. Each tank is an aerobic, fixed-film bioreactor packed with two-inch polyurethane foam cubes where biological organisms reside.

Four reactors are grouped together to form an ICB module. Each module is equipped with a feed tank, aeration system, nutrient-addition system, pH control system, effluent tank and an off-gas treatment system. A mix-culture of bacterial microorganisms attached to the ICB foam cubes will break down thiodiglycol, also called TDG, and other organics in the hydrolysate, converting them to carbon dioxide, water and minerals (chlorides and sulfides). Pilot testing at other sites has shown that this process will remove more than 98 percent of the TDG. The resulting effluent (biotreated water) will then go to three Brine Concentrator Feed Tanks.



Sandwiched between the various immobilized cells in the PCAPP bioreactors, is an assortment of polyurethane foam cubes, in which the wastewater eating microbes will reside.



The bioreactors located on the PCAPP site will use common microbes to treat hydrolysate, the wastewater byproduct resulting from the chemical agent neutralization process.

Environmental Conservation

PCAPP's innovative and environmentally-friendly approach to chemical agent destruction includes the conservation of water, a precious commodity in Colorado's arid terrain. During its life cycle, the Pueblo plant will recover, recycle and reuse the equivalent of 80 percent of its water.

Brine Reduction System

The Brine Reduction System, or BRS, plays an important role in PCAPP's conservation efforts. It is a process that incorporates three technologies: evaporation, crystallization and solids dewatering. Biotreated effluent is held in the Brine Concentrator Feed Tanks prior to pumping it to the BRS for further processing. An 86-foot tall evaporator is used to boil water from the biotreated effluent and recover the water through condensation. The water is filtered and then recycled back into the plant.

After evaporation, the concentrated brine is pumped to a crystallizer to further reduce the brine volume and to prepare this salt slurry for filtration. With additional evaporation in the crystallizer, the dissolved salt concentrations increase to a critical point where salt crystals form.

As in the evaporator, the water vapor is condensed and recovered water is filtered and sent to the Process Water Tank. The salt crystals and other solids in the concentrated slurry are filtered out and compressed. The resulting filtered "salt cake" will be shipped to an off-site permitted hazardous waste disposal facility. Approximately 5,000 tons of salt cake are expected to be produced during the life of the project.

PCAPP Explosive Destruction System

It is recognized that secondary wastes will also result from the processing of problematic munitions that are unable to be treated at the main destruction plant. These wastes, which will include both solid and liquid byproducts coming from [PCAPP's Explosive Destruction System](#) (EDS), will be stored in an approved less than 90-day hazardous waste storage area at the PCAPP EDS site, pending shipment to permitted Treatment, Storage and Disposal Facilities for further treatment and/or ultimate disposal.



The Brine Reduction System is the final stage of the PCAPP biotreatment process. A secondary waste of dried salt cakes will be shipped off-site to a permitted hazardous waste facility.