



Neutralization Followed by Biotreatment Process

The [Program Executive Office, Assembled Chemical Weapons Alternatives \(PEO ACWA\)](#), the [U.S. Army Pueblo Chemical Depot](#) and the surrounding communities worked together to select [neutralization followed by biotreatment](#) to destroy the chemical weapons stored at the depot. PEO ACWA was responsible for completing stockpile destruction operations by the [Chemical Weapons Convention](#) treaty commitment of Sept. 30, 2023. U.S. public law mandates stockpile destruction by Dec. 31, 2023.

Prior to destruction operations, the stockpile comprised 2,613 U.S. tons of weaponized [mustard](#) agent in three types of munitions: 105mm and 155mm projectiles and 4.2-inch mortar rounds.

The process of neutralization followed by biotreatment at the [Pueblo Chemical Agent-Destruction Pilot Plant \(PCAPP\)](#) used hot water to neutralize the chemical agent, effectively destroying the [mustard agent](#) molecules. The resulting [hydrolysate](#) is mostly water and thiodiglycol, a common industrial chemical that is readily biodegradable. Ordinary sewage treatment bacteria, or microbes, consume the organics in the hydrolysate.

Step One: Removing the Energetics

Robotic equipment removed the weapon's energetic components, including the fuze and the burster. Removing these parts first makes the remaining processes safer. The energetics were shipped and destroyed in the [Static Detonation Chamber \(SDC\)](#) unit in Anniston, Alabama.

Step Two: Removing the Mustard Agent

Once the energetic components were removed, the weapon body containing chemical agent was processed. To remove the agent, the body was robotically accessed, and then the agent was washed out with pressurized water and collected for destruction.

Step Three: Neutralization of Mustard Agent

The mustard agent was mixed with hot water and a caustic solution. The product from this process is called hydrolysate and has a high pH requiring acid to be added to reduce the pH to neutral, making it suitable for digestion by the microbes used in biotreatment, which is the next step.

Step Four: Biotreatment

The hydrolysate generated in step three went through the [biotreatment process](#), which consisted of large tanks containing microbes that digested and further broke down the solution.

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Water released from the process was recycled, leaving various salts and biosludge. Biosludge, which is made up of microbe waste products and other bacterial matter, was filtered to remove water and disposed of at an off-site, permitted Treatment, Storage and Disposal Facility (TSDF).

Step Five: Disposing of Metal Parts

The final step was treating the weapon's metal parts. Although the metal parts were cleansed of energetics and agent in step one and step two, they still may contain traces of energetics and agent, and need to be decontaminated to a higher level. To reach this level of decontamination, the metal parts were heated to 1,000 degrees Fahrenheit for 15 minutes. The metal was then recycled.

Secondary Waste

Secondary wastes, which include both solid and liquid products coming from the PCAPP SDC units, were stored in either a less than 90-day hazardous waste accumulation area or a permitted storage area, pending shipment to a TSDF for further treatment and/or ultimate disposal.