

Johnston Atoll Chemical Agent Disposal System Mines Its Business

By Gary McCloskey

Type in the words “land mines” on your Internet search engine and initiate the search. In just a matter of seconds, your computer screen will flash hits for more than 37,000 Web sites, including several news articles and books. Even before the late Princess Diana made the destruction of land mines her personal crusade, land mines had been a hot issue around the world and were one of the harshest legacies of war.

Now type in “chemical agent land mines,” or even more specifically “VX land mines.” Hit search and you only find two entries under the VX land mine term, none under chemical agent land mines. Yet these land mines were made to contaminate with deadly nerve agent O-ethyl S-diisopropylaminomethyl methylphos-phonothiolate (VX). Fortunately, while the United States produced and maintained a stockpile of chemical weapons, they never were used.

While there has been public outcry against conventional land mines, the U.S. Army has systematically moved forward to destroy the U.S. stockpile of chemical agent weapons, which includes nerve (VX and GB) and blister agents, bombs, mortar rounds, rockets, ton containers, spray tanks, and projectiles. This stockpile also originally included more than 100,000 M23 VX-filled land mines stockpiled at four continental U.S. sites, as well as on Johnston Island, which is located more than 800 miles southwest of Hawaii. More than 13,000 of these land mines were destroyed recently in the first U.S. M23 VX land mine disposal campaign at the Johnston Atoll Chemical Agent Disposal System (JACADS) on Johnston Island. The continental U.S. chemical weapon stockpile sites storing the remaining U.S. M23 land mines are Umatilla, Oregon; Tooele, Utah; Anniston, Alabama; and Pine Bluff, Arkansas.

JACADS has been the site of many firsts in the Army’s chemical weapons disposal program. It now has set yet another first with its final campaign: the destruction of the last remaining chemical agent munitions stored on Johnston Island—the M23 VX land mines.

Destroying conventional land mines in a safe and environmentally friendly manner is not easy. Adding to the complexity of JACADS’s disposal process, the M23 VX land mines were filled with approximately 10.5 pounds of VX nerve agent in addition to the normal fuzes, bursters,



JACADS is the world’s first full-scale facility built to destroy chemical weapons.

activators, and charges. Not only did the Army have to safely destroy the explosive components, but it also had to remove and destroy the VX and then clean the metal of explosives and agent contamination while maintaining worker safety and protecting the environment.

VX is an organophosphate-based (common household insecticides also are organophosphate-based), rapid-acting, persistent nerve agent. It also is the deadliest of the nerve agents. Its density is similar to oil, and it evaporates more than 2,000 times slower than water, which is why it is referred to as persistent. VX was designed to kill through skin contact and contaminate any contacted objects for long periods of time.

Mix in nearly a gallon of VX with an antivehicle or antipersonnel land mine and you end up with the M23. As assembled for storage, the M23 land mines are filled with VX nerve agent and have burster charges in the main fuze well and activator well. In storage, the M23s are packed three mines to a 16-gallon drum, and normally 12 drums are in two layers to a pallet. Each drum contains three land mines with three fuzes and three activators in the top packing material. However, at Johnston Island, the Army repalletized the drums in a single, six-drum layer before delivering them to JACADS. This minimized the number of handling steps required in the unpack area during the disposal process and increased operator safety. Repalletizing is a lesson learned that will be shared with the other stockpile sites.

To start the disposal process, eight pallets of M23 mines (a total of 144 land mines) are delivered at a time by truck to the munitions demilitarization building. Here, a visual inspection is performed. Next, a forklift is used to transfer the pallets to the two building elevators. The elevators lift the pallets to the second floor where they are moved to a staging area in the unpack area.

Operators wearing Level B chemical protective equipment (butyl rubber hood, apron, gloves, and boots) with supplied-air respirators and backup emergency air bottles prepare the drums to be unpacked. After removing the drum lid, the operators perform a visual inspection and use an automatic continuous-air monitoring system to check for traces of VX nerve agent. These monitors are real-time gas chromatographs capable of detecting VX nerve agent at extremely low levels. If the drum is clean, the mines can be processed normally as described in the paragraphs below. If an agent is detected, the drum is moved into the explosion containment vestibule and unpacked by operators wearing a higher level of protective equipment—a one-piece, sealed demilitarization protective ensemble with supplied air.

Operators in Level D chemical protective equipment (gas mask carried on the hip, butyl rubber gloves, and boots) with rubber aprons remove the fuzes and activators from the top packing of the clean drums and place them into a cardboard dummy mine. This provides a means for the mine handling system to move these explosive components into the deactivation furnace system.

The operators can remove each mine from the drum manually. However, they have to lean over, reach into the drum, and pull out the 23-pound mines by hand. This is especially difficult with the bottom mine, which has a high friction force with the packing material—requiring much more exertion by the operator. Also, the operators must lift at least 20 mines per hour to maintain scheduled destruction rates. This particular operation poses a safety risk to the operators.

To reduce risk of injury, JACADS personnel developed a machine that extends from an overhead crane onto each individual mine and lifts it to the accumulation conveyor line. This mine-gripper device uses three metal gripping fingers to grip the bottom lip of each land mine and lift it from the drum. The pressure from the gripper “fingers” is not enough to damage the mines, and there is enough overlap of the fingers on the mine lip so that no amount of shaking or impact can accidentally release the mine. It takes two signals from the operator (pressing a button and activating the joystick) to release the mine, which

minimizes the risk of dropped mines. Using this lifting device for all the mines also eliminates the lifting strain for workers. From this point forward, the processing of the land mines is remotely controlled or automated.

Once the mines are placed on the accumulation conveyor, it automatically feeds the land mines through an air lock—in a continuous sequence of three M23 land mines and one cardboard dummy—into the explosion containment vestibule. Here, a machine called the arming plug extractor removes the arming plug and exposes the burster. The arming plug extractor also automatically spaces the land mines and cardboard dummy appropriately for feeding into the explosion containment room.

To safely contain any possible explosions, the explosion containment room is specially designed with steel-reinforced concrete walls that are more than 28 inches thick. All work on munitions in this room is controlled remotely, and the explosion containment room’s steel doors must be closed and properly secured for the equipment to operate. Personnel are not allowed in the explosion containment room while the equipment is operating.

The mine machine in the explosion containment room passes the cardboard dummy mines carrying the fuzes and activators to the deactivation furnace system. The mine machine that senses the mine handle to orient the land mines properly orients the real land mines. This is done one land mine at a time. The lift table lowers, and the mine is rotated until it is vertical or standing on its side with the side burster well clear of the punch path. This is the drain position.

In the drain position, the mine is securely clamped in place and the drain punch—a hydraulically-powered cylinder rod—punctures

the side of the mine. The rod is hollow and drains the nerve agent from the land mine. It takes about 20 seconds to drain the agent, which is sent to a holding tank and eventually burned in the liquid incinerator at a temperature of about 2700 degrees Fahrenheit (F). After the agent has been drained, the mine machine rotates the land mine 90 degrees and places it upside down on the trolley transfer station. The mine machine is ready to punch and drain another mine while the already drained land mine is transferred via the trolley to the next station.



Photo courtesy of Joseph Bonfiglio,
U.S. Army, Pacific

JACADS—with the destruction of the nerve agent VX land mines—has destroyed all the chemical munitions in the stockpile at Johnston Atoll.

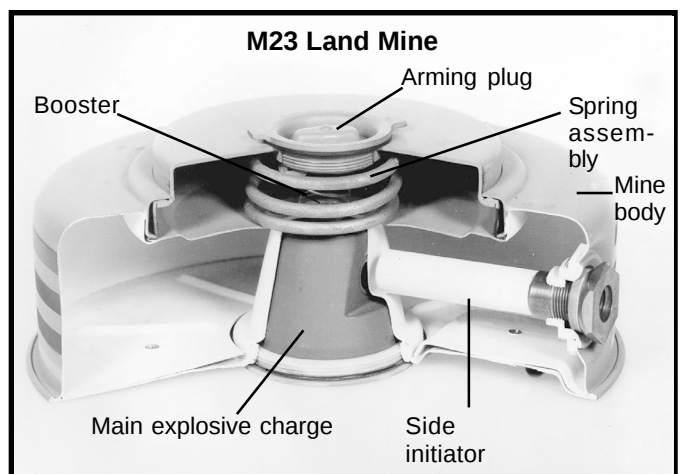
The burster punch station was originally developed to punch through the central burster and punch out a burster pellet in the burster's main explosive charge. However, this station is not used because M23 land mines made before 1964 have a steel, rather than plastic, bottom fuze-well assembly that considerably increases the chance of detonating the burster during the punching process. Instead, the JACADS team, together with the Army's Chemical Demilitarization Training Facility, developed a fuze-well removal station that automatically screws out the fuze-well assembly, exposing the land mine's main explosive charge. This increases the rate of heat transfer in the deactivation furnace system, allowing the explosive to burn safely. Using the fuze-well assembly removal station reduces the detonation risk from an 11 percent probability using the burster punch station to a statistically negligible risk. In other words, it makes the process much safer.

The now furnace-ready land mine is pushed onto the deactivation furnace system's slide gate. The gate opens and the land mine slides down a chute to a second gate. The top gate closes and the bottom gate opens, allowing the land mine to enter the deactivation furnace system's primary chamber. The land mine is thermally processed at 1050 degrees F, which burns the explosives and destroys any residual VX nerve agent.

The metal and ash remaining from the land mine travels through an electrically heated discharge conveyor, is containerized and sampled to verify that it is agent free, and then is shipped to an off-site, permitted hazardous waste landfill. The gases generated in the primary chamber travel through an afterburner and are heat-treated at 2000 degrees F before passing through a pollution abatement system where any residue or agent vapors are permanently destroyed.

Thus ends the life cycle of an M23 VX land mine. The intricate process automatically and safely destroys one land mine at a time. Skilled operators carefully control and monitor the entire disposal process from the control room. All aspects of the process are electronically logged to ensure that the data from this complex process are captured to verify the safe processing of these deadly weapons.

Preparations for the initial M23 land mine processing at JACADS resulted in the repalletization of the M23 land mines, the design and use of the mine gripper, the arming plug extractor, and the bottom fuze-well assembly station as described above. Each of these lessons learned benefit the



JACADS recently completed destruction of more than 13,000 land mines filled with nerve agent VX.

mainland sites at Tooele, Umatilla, Anniston, and Pine Bluff, ensuring maximum safety of the workers, public, and environment as the U.S. stockpile of M23 VX land mines becomes part of chemical weapons disposal history.

"Eliminating chemical weapons from our nation's arsenal works at several levels: it eliminates the risk that a chemical weapons accident could occur within the United States; it frees up soldiers for use other than guarding and monitoring our stockpiles; and it sets the standard for the rest of the world to follow," said James L. Bacon at an environmental forum held 12 through 14 September 2000, in Columbia, Maryland. Bacon continued, "I look forward to the day we no longer have chemical weapons and our grandchildren only know about them through reading history books." Bacon has served as the program manager for chemical demilitarization since July 1997.

JACADS has set a high standard for the other U.S. stockpile sites and the world. Now that the last of 13,302 M23 VX land mines on Johnston Island has been destroyed, it is time to clean up, turn out the lights, and go home. November 29, 2000, marked a historic day for chemical demilitarization, as the first U.S. chemical weapons disposal facility finished its last campaign—the first processing of M23 land mines—and became the first U.S. facility to complete its mission. In doing so, it has made its mark in the history books and produced many lessons learned that will be shared with other U.S. stockpile sites and with the world community.