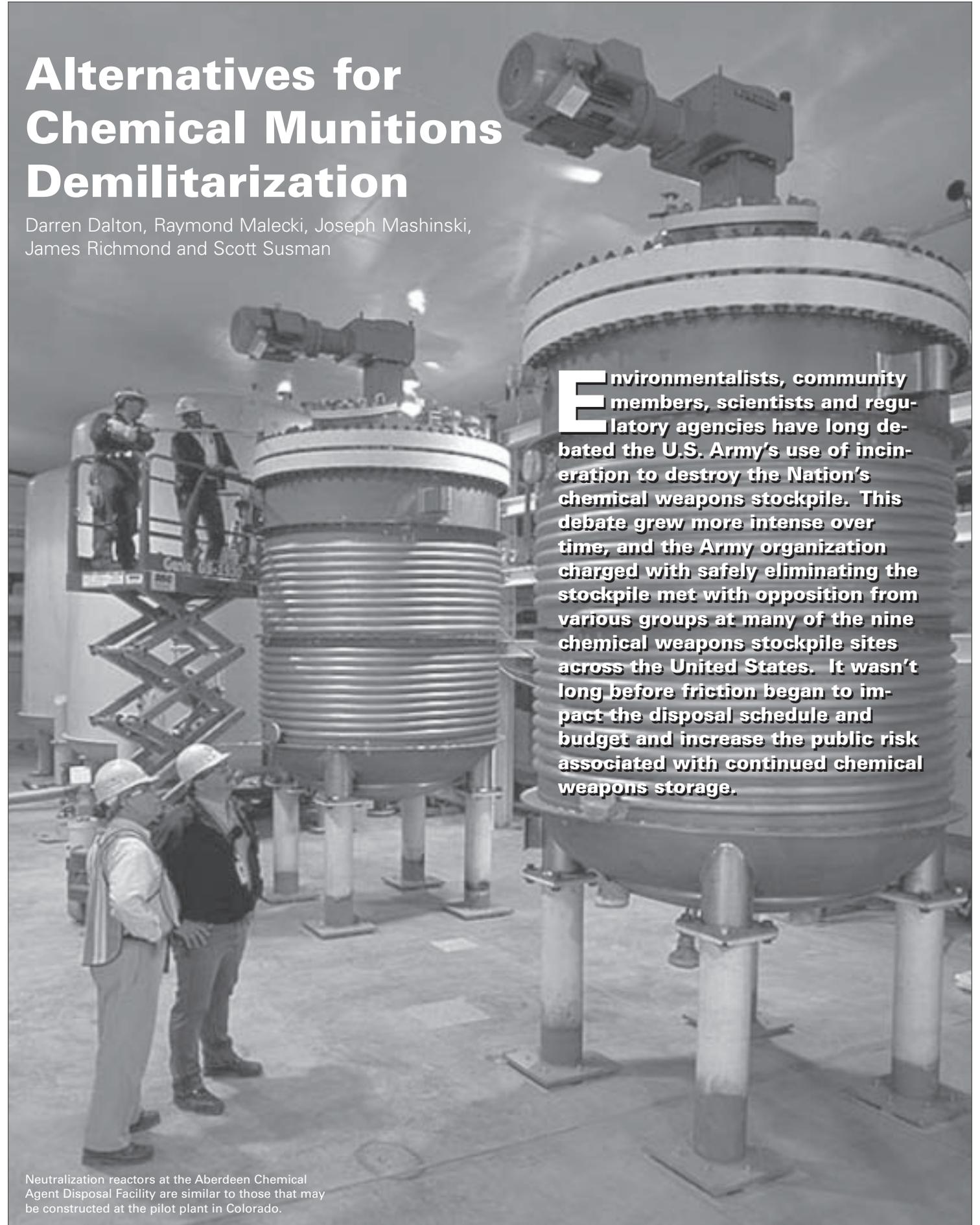


Alternatives for Chemical Munitions Demilitarization

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Environmentalists, community members, scientists and regulatory agencies have long debated the U.S. Army's use of incineration to destroy the Nation's chemical weapons stockpile. This debate grew more intense over time, and the Army organization charged with safely eliminating the stockpile met with opposition from various groups at many of the nine chemical weapons stockpile sites across the United States. It wasn't long before friction began to impact the disposal schedule and budget and increase the public risk associated with continued chemical weapons storage.

Neutralization reactors at the Aberdeen Chemical Agent Disposal Facility are similar to those that may be constructed at the pilot plant in Colorado.

In 1996, Congress responded to the controversy by passing *Public Law 104-208*, leading to the creation of the Program Manager Assembled Chemical Weapons Assessment (PM ACWA). Through this legislation, PM ACWA was authorized to identify alternatives to incineration for the destruction of “assembled” chemical weapons — munitions configured with fuzes, explosives, chemical agents and packaging materials — at the Blue Grass Army Depot in Kentucky and the Pueblo Chemical Depot in Colorado. Specifically, *Public Law 104-208* required PM ACWA to develop a process for evaluating, selecting and demonstrating these technologies while incorporating significant and diverse public participation.

Led by PM Michael A. Parker, ACWA personnel realized early on that an ambitious public participation program is as critical to disposal mission success as its technical program. This article outlines the steps PM ACWA took to identify innovative alternatives to incineration and the unique approach the organization took to effectively involve concerned community members and elected officials throughout the technology selection process.

Soliciting Public Support

To facilitate the process of working with various stakeholders, program personnel enlisted support from Keystone Center, a nonprofit public policy organization located in Keystone, CO, specializing in mediation to have various stakeholders meet for a Dialogue on ACWA. Keystone Center identified key DOD, state and federal

regulators and national activist group stakeholders and a diversity of citizen interests from each stockpile site. The stakeholders participating in the Dialogue worked side-by-side with the

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PM ACWA staff through the original technology identification process and continued with testing, evaluating and reporting of the technologies being demonstrated. This cooperative effort culminated with the selection of two alternative technologies for implementation at chemical demilitarization (chem demil) sites in Colorado and Kentucky.

Dialogue meetings were open to the public, and attendees had the opportunity to provide comments. Meetings were held at or near stockpile sites to encourage local residents to attend, or, in Washington, DC, to facilitate DOD and congressional participation.

One key mechanism that helped PM ACWA conduct a successful program was a combination of four Dialogue members and a support contractor forming a Citizens’ Advisory Technical Team (CATT). The CATT became integral to the process by providing an independent program review for the Dialogue. CATT members signed

confidentiality agreements, allowing them to serve as the Dialogue’s “watchdog” at many PM ACWA internal meetings, including those dealing with sensitive information. By participating in meetings normally open only to PM ACWA staff, the CATT provided Dialogue members with assurances that the technical program was being executed per the commitments PM ACWA had made to the Dialogue. The CATT also provided a mechanism for stakeholder input into the program’s technology selection and evaluation process. Thus, the CATT ensured maximum communication between PM ACWA and stakeholders while respecting the government’s legal and ethical responsibility to protect proprietary and trade secret information contained in proposals and other documents submitted by technology providers.

Requesting and Selecting Technologies for Demonstration

With the Dialogue and public participation program in place, PM ACWA focused on developing criteria to solicit and select technologies for assessment, evaluating technologies for demonstration and conducting technology demonstrations.

PM ACWA compiled criteria necessary to solicit and select proposed technologies in less than 3 months by using input gathered at public meetings and



Transportable Propellant Conversion Unit (U.S. Army photo.)

leveraging existing expertise. In October 1997, PM ACWA awarded contracts to seven companies offering potential disposal technology alternatives. Paring down the applicant number to six technology providers, PM ACWA awarded a second round of contracts enabling each finalist to submit technology demonstration work plans.

Ensuing demonstrations tested technology-critical unit operations. In addition, test plans focused on methods to validate technology process performance, characterize process intermediates and final effluents and establish confidence that these could be incorporated into a "total system solution."

To ensure critical stakeholders supported the testing methodology phase, program staff included test installation representatives, support contractors, CATT members and the technology providers.

Together with the Dialogue, PM ACWA submitted two supplemental reports to Congress announcing validation of four alternative chem demil technologies:

- Neutralization followed by biotreatment.
- Neutralization followed by supercritical water oxidation (SCWO).
- Electrochemical oxidation with silver and nitric acid.
- Neutralization followed by transpiring wall SCWO and gas phase chemical reduction.

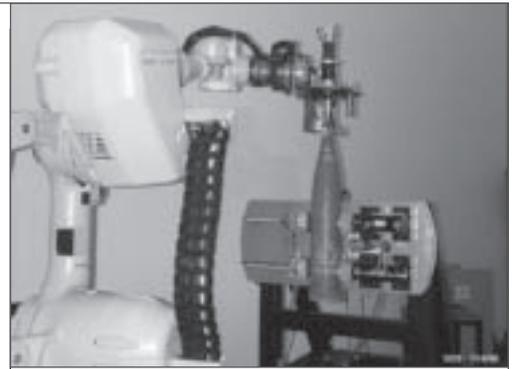
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Once it became clear that alternative technologies could be demonstrated successfully, Congress directed PM ACWA, through supplemental legislation, to carry out activities necessary to ensure that an alternative technology for lethal chemical munition destruction could be implemented. As a result, PM ACWA expanded its focus and established program requirements; prepared procurement and environmental documentation; awarded a contract for the design, construction, testing, operation and closure of a pilot facility for the technology; and initiated a series of engineering design studies for the four validated technologies.

Identifying a Technology

Following extensive review of presentations, reports, independent studies and community input, DOD selected neutralization followed by biotreatment as the preferred chemical weapons destruction alternative for the Pueblo chemical weapons stockpile. In September 2002, a systems contract was awarded to Bechtel National Inc. to design, construct, pilot test, operate and close the Pueblo Chemical Agent-Destruction Pilot Plant using neutralization followed by biotreatment technology.

Five months following the Pueblo contract award, DOD selected neutralization followed by SCWO as the official disposal technology for the Blue Grass chemical weapons stockpile. Four months thereafter, in June 2003, a



Robotic Disassembly (U.S. Army photo.)

contract was awarded to joint venture Bechtel Parsons Blue Grass to design, construct, pilot test, operate and close the Blue Grass Chemical Agent-Destruction Pilot Plant.

PM ACWA will continue to oversee the safe destruction of the Colorado and Kentucky chemical weapons stockpiles using neutralization followed by biotreatment and neutralization followed by SCWO, respectively. The neutralization followed by biotreatment involves the following processes:

- **Removing the Energetics.**

Technicians manipulating robotic equipment will remove the weapon's energetic components, including the fuzes and bursters. Removing these parts first makes the remaining processes safer.

- **Removing the Mustard Agent.**

Highly trained workers manipulating robotic equipment will mechanically access munition bodies and wash out present agent with pressurized water.

- **Neutralization.** After energetics and chemical agent have been separated from their metal parts, they will be treated in separate tanks with a caustic solution and water. The by-products from this process are called hydrolysates.

- **Biotreatment.** Workers will channel the hydrolysate through large tanks containing microbes that digest and

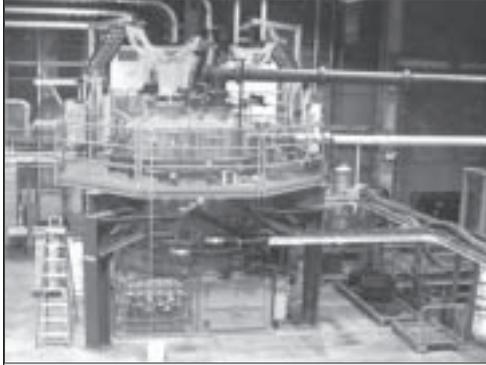
further break down the solution. Water released from the process will be recycled, leaving various salts and biosludge. Biosludge, made up of microbe waste products and other bacterial matter, will be filtered to remove water and shipped off-site to a permitted treatment, storage and disposal facility.

- **Disposing of Metal Parts.**

Although metal parts were cleansed of energetics and chemical agent at the beginning of this process, they may still contain energetics and agent and will need to be decontaminated to a higher level. This level is called "5X," a military decontamination standard that ensures the metal is clean and can be disposed of safely. To reach this decontamination level, the metal parts will be heated to 1,000 degrees Fahrenheit for a minimum of 15 minutes. The metal parts can then be recycled.

The neutralization followed by SCWO process involves the following steps:

- **Neutralization.** Munitions are disassembled by modified reverse assembly. Agent and energetics are separated. Agent and energetics are chemically decomposed and neutralized by caustic or water hydrolysis. The resulting chemical compounds are known as hydrolysates.
- **SCWO.** The agent and energetic hydrolysates are destroyed using SCWO units. SCWO subjects the hydrolysate to very high temperatures and pressures, breaking them down into carbon dioxide, water and salts.
- **Disposing of Metal Parts.** Metal parts are thermally decontaminated by heating to 1,000 degrees Fahrenheit for a minimum of 15 minutes.
- **Disposing of Solids.** Solid effluents are recycled or tested prior to disposal in permitted landfills. Gas



Stationary plasma furnace (U.S. Army photo.)

effluents are recycled or filtered before being released into the atmosphere.

The Future

PM ACWA met its initial mandate from Congress by demonstrating six technologies in fewer than 5 years. Looking toward the future, PM ACWA is implementing full-scale pilot testing of alternative disposal technologies and, in June 2003, changed its name to PM Assembled Chemical Weapons Alternatives (ACWA) to better reflect this evolving mission. Despite shifting responsibilities, the program remains committed to active and open public participation.

PM ACWA regards public participation as pivotal to its past and future successes. "We accomplished our mission through partnership with the government, the military and the public," said Parker. "I think that speaks volumes, not only for our approach, but also for the future."

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