Safe Disposal of Chemical Weapons

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Content on this page is from 1997. It was adapted from an interview with Harvey Rogers, an environmental engineer with the National Center for Environmental Health (NCEH), Centers for Disease Control and Prevention (CDC). He was responsible for reviewing the public health implications of Department of Defense (DOD) plans and activities associated with the destruction of chemical warfare munitions and materials. He reviewed public health implications and worker protection particularly as related to the potential for exposure to chemical warfare agents, including nerve gases and blister agents.

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Selected in 1982, incineration is a safe baseline technology

DOD is required to dispose of chemical weapons stockpiles by Public Law 99-145.

Public Law 99-145 (1986) and the earlier public laws, 91121 (1970) and 91-441 (1971), required that the Department of Health and Human Services (DHHS, formerly DHEW) provide public health review and oversight of the DOD's plans and activities to test, transport, and dispose of chemical and biological weapons The chemical weapons are stored at eight locations in the continental United States Pueblo, CO; Tooele, UT; Anniston, AL; Newport, IN; Pine Bluff, AR; Umatilla, OR; Aberdeen, M D; and Lexington, KY; and on Johnston Island, an atoll located in the central Pacific Ocean about 800 miles WSW of Honolulu, HI. Currently, there are no more stockpiles of biological weapons and biological/chemical weapons arc no longer being tested. It is also unlawful for DOD to transport stockpile chemical weapons; we focus our attention on the destruction of chemical weapons where they are stored.

The oversight responsibility was ultimately delegated to CDC.

CDC approached this task by identifying the key professional areas that would be necessary to address public health and safety concerns associated with the DOD s program for demilitarization of chemical weapons. Those key disciplines include medical science, engineering, chemistry, and statistics.

We have an in-house physician who reviews medical preparedness capabilities of workers at demilitarization facilities, as well as local medical response capabilities in communities near stockpile sites. I am the in-house engineer who works on this project. I review plans and physical facilities for safeguards, provisions, and procedures designed to prevent agent release or contain agent in a way that protects workers and the public from exposure to agents. We also have an in-house chemist who reviews agent-monitoring techniques and related quality assurance activities to ensure that any agent release will be detected and quantified both rapidly and accurately. Our in-house statistician works closely with the chemist to review and interpret QA data. In addition to our in-house resources, we can and do convene expert panels to help us with issues needing highly specialized review (e.g., air dispersion modeling. or setting of safe agent exposure levels).

To meet the requirements of Public Law 99-145, DOD must set up and operate disposal plants at each storage site. So far, three incineration plants are in operation: a small-scale research facility at Tooele, UT, which has operated since 1979; a full-size prototype disposal plant at Johnston Island, which opened in 1990; and a full-scale incineration plant, also located at Tooele, which started processing agent munitions in August 1996.

Incineration becomes the disposal choice

Incineration was selected in 1982 as the method of choice for disposal of chemical agent and munitions after long and careful consideration of several technologies. The National Research Council endorsed this selection in 1984 and continued to regard incineration as a demonstrated safe “baseline technology” in 1994. It is appropriate for several major reasons:

- It effectively breaks down any type of agent to relatively harmless or controllable end products.
- The technology has been around long enough to have matured into a reasonably well-controlled and understood body of knowledge.
- The technology has been demonstrated to be capable of being operated in a manner that is safe to workers and the public.

Nonincineration Technologies

The Army currently has a program to evaluate non-incineration technologies for possible application with certain portions of the stockpile of chemical warfare agents. Five technologies have been identified as candidates for further evaluation:

- neutralization,
- neutralization followed by biodegradation,
- electrochemical oxidation (neutralization with hot water and nitric acid, followed by oxidation of the products to CO2, H2O, and inorganic compounds in the presence of silver),
- molten metal technology or catalytic extraction process (dissolution of organic and inorganic elements, reform industrial gases, ceramics, alloys), and
- high-temperature gas-phase reduction (steam and excess H2 break carbon bonds and re-form less hazardous products).

From these technologies, the Army’s Program Manager for Chemical Demilitarization will select one for pilot-scale trials. If these trials prove the technology is successful, judged by criteria that include effective treatment of the of the chemical warfare agent, reasonable cost, reasonable scheduling, safety, and environmental soundness, then it can be applied full scale.

Some of the stockpile consists of actual munitions that may contain not only agent, but also propellants or explosives that may no longer be stable. When such munitions are drained of their contents, the empty casings may still contain residual materials that need to be treated effectively. Currently we believe that this can best and most safely be accomplished in the metal parts furnace and the deactivation furnace that make up the demilitarization incineration system. Nevertheless, that portion of the chemical agent stockpile comprising bulk liquid storage is potentially suitable for nonincineration technologies I mentioned.

Minimizing Risk of Exposure

No one can say that there is absolutely no chance of significant agent release with any alternative, be it incineration, one of the alternative technologies, or just doing nothing and continuing to store the stockpiles of agent. What we seek is a method of minimizing the risk potential for agent exposure to people.

occupational exposure (TWA).

Monitoring Incinerators

All demilitarization incinerators are equipped with many operating monitors, such as for temperatures in the combustion chambers, pressure drops across critical operating components, and emissions of certain gases after the pollution abatement system. Correct operating ranges for these and many other parameters are established during trial burns when the incinerator is tested to demonstrate safe operation in accordance with all regulatory requirements. Many of the key monitoring parameters are keyed into an interlock system; that is, if a key operating parameter strays outside of the acceptable range, the interlock automatically activates a stop-feed action so that no more waste agent can be put into the incinerator until the condition causing the stop is corrected.

Dioxins and Heavy Metals

Dioxins and heavy metals are always a concern for any kind of incinerator and for many other forms of combustion as well. Before allowing the incineration of chemical agent, we must be confident that the levels of these waste gas constituents do not exceed levels of health concern. To evaluate this concern, we examine actual stack emission data to determine maximum concentrations of the contaminant that could be found in the breathing zone of workers or the local community. For heavy metals and dioxins, our examinations to date have shown emission levels to be safe. In fact, the dioxin emission levels for the Army incinerators have typically been among the lowest we have seen for all types of incinerators.

Workers Protective Equipment

There are generally three levels of PPE for workers at demilitarization plants. When workers must go into areas known or likely to be contaminated with agent, they use the Level A Demilitarization Protective Ensemble (DPE) This single-use, positive pressure suit is heat sealed and air supplied; there is also an escape air canister. It also features a communication system and a heart-rate monitor.

Workers who assist DPE workers or who may come into contact with agent in the performance of their duties wear Level B rubber suits with hood, gloves, and boots. The suit is taped, and workers wear an agent mask.

Workers who are not likely to be exposed to chemical agents wear Level F protection comprising street clothes with a slung agent gas mask. Gas masks must be available at all times in case of an emergency.

Future Plans

In addition to moving forward with the destruction of the stockpiled chemical munitions, we are now getting involved in a parallel effort to manage and dispose of non-stockpiled chemical agent items, things such as “found” training munitions, chemical agent training sets, and items that were used to make chemical agents. This program may involve transport of such “found” materials, on-site destruction, analysis of unidentified items, and so forth. It has been estimated that more than 200 sites, most of which are in the continental United States, will have to be managed in some manner. It will be our mission to ensure that the manner chosen is safe to the workers and the nearby communities.

Adapted from Gottschall C, ed. Safe disposal of chemical weapons. Chem Health Safety. Jan/Feb 1997;38-41.

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