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CHEMICAL WEAPONS

Issues Involving Destruction Technologies

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Mr. Chairman and Members of the Subcommittee:

I am pleased to be here today to discuss our recent report on technological processes that have been identified as potential alternatives to the incineration of chemical weapons.[1] Specifically, we evaluated the development status of these alternative technologies with respect to meeting the legal deadlines for destroying the chemical weapons stockpile, the cost of the technologies, and their advantages and disadvantages. Additionally, as you asked, I will discuss the operational safety of the Army's incineration facility on Johnston Atoll and address several issues regarding cryofracture. The cryofracture process involves soaking munitions in liquid nitrogen to make them brittle. The munition is then fractured in a large hydraulic press prior to incineration.

SUMMARY OF RESULTS

Our review showed that the alternative disposal technologies identified as most likely to be feasible are in the initial stages of development and over a decade away from full-rate operations. It is unlikely that any of these technologies will reach maturity in time to destroy the entire U.S. chemical weapons stockpile by the congressionally mandated deadline of December 31, 2004.

Any one of these alternative technologies would not be sufficient, by itself, to dispose of an entire chemical weapon. Thus, multiple technologies would have to be developed and tested. Because the alternative technologies are in the earliest stages of development, cost estimates are either nonexistent or unreliable. Similarly, their performance compared with incineration cannot be determined yet. However, we did identify certain advantages and disadvantages to each technology.

Our prior work on chemical demilitarization identified mechanical and training problems at the Johnston Atoll facility which have slowed its destruction rates, but during these reviews we identified no problems associated with destroying chemical agents within federal requirements.[2] According to the Environmental Protection Agency (EPA), the Army's incineration program fully complies with or surpasses EPA requirements for environmental and public health protection. However, on March 24, 1994, about 12 milligrams of chemical agent were released during a maintenance operation. While this amount exceeded EPA standards, no injuries occurred. The only chemical agent-related injury to date occurred

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[1]Chemical Weapons Destruction: Advantages and Disadvantages of Alternatives to Incineration (GAO/NSIAD-94-123, Mar. 18, 1994).

[2]EPA established limits on the quantity of agent that may be emitted. A confirmed agent emission occurred during OVT1, however, it was within the EPA limit.

in March 1993 when a worker suffered a minor mustard gas burn while moving bagged contaminated material. The accident happened while the facility was shut down for maintenance.

We addressed cryofracture in two previous reviews of the Johnston Atoll facility. Our work at that time indicated that cryofracture had not proven to be less expensive or safer than the current incineration technology, but because of the baseline program's increasing costs the Army should reconsider alternatives.

Concerning the Assistant to the Secretary of Defense for Atomic Energy's recommendation not to use cryofracture at Pueblo, Colorado, our preliminary work shows documentation exists to support the recommendation; estimates to develop and build a cryofracture plant at Pueblo range from $683 million to $1.2 billion; and the Assistant to the Secretary believes cryofracture is well suited for destroying degraded munitions.

Before discussing these matters in more detail, I would like to provide some background on the issue and information on our scope and methodology.

BACKGROUND

The fiscal year 1993 Defense Authorization Act (P.L. 102-484) requires that the U.S. stockpile of chemical weapons and bulk agent be destroyed by December 31, 2004. Previous legislation had established earlier deadlines. The deadline could change in the future as well. Under the Chemical Weapons Convention, an international treaty that would ban the production, stockpiling, and use of chemical weapons, the deadline for destroying the stockpile could change to January 2005 or later. The United States has signed the convention but has not ratified it.

Since the Army established its incineration program in 1988, about $1.5 billion has been expended. Currently, the total program life-cycle cost is projected to be $8.6 billion through 2004. An additional $700 million is expected to be spent to enhance the emergency preparedness of communities near chemical weapon storage sites.[3]

Army studies state that the risks posed by continued chemical weapon storage, while very small, far exceed the risk of disposal. The greatest risk from the chemical weapons stockpile is to communities located near the storage sites. The number of people within about 10 kilometers (6 miles) of the eight chemical weapon

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[3]Chemical Weapon Stockpile: Army's Emergency Preparedness Program Has Been Slow to Achieve Results (GAO/NSIAD-94-91, Feb. 22, 1994).

storage sites in the continental United States ranges from 101 in Tooele, Utah, to 44,054 in Aberdeen, Maryland.

Public opposition to incineration has come from several citizens groups, states, and environmental organizations. They have raised concerns about incineration because of questions about adverse health effects, such as birth defects, respiratory diseases, neurological damage, and cancer. For example, dioxins and furans that are in some emissions have been linked to cancer and other long-term health problems.[4]

I would like to say a few words on how we selected alternative technologies for review and what our methodology was for analyzing them. We met with representatives of numerous agencies, organizations, and private companies to discuss the development status, cost, and performance of possible alternative technologies, as well as their advantages and disadvantages. Based upon conversations with, and writings by, these knowledgeable individuals, we identified eight technologies that appeared to be the most likely candidates as alternatives to incineration.

To develop information and analysis for our report, we held discussions with officials from the National Research Council (NRC), the Army, EPA, and the Office of Technology Assessment. We also met with representatives of companies developing the technologies, environmental groups, state officials, and concerned citizens living near the Army's chemical weapon storage sites. In addition, we analyzed agency documents, correspondence, laws and regulations, computerized data bases, and reports by our office, other governmental agencies, environmental groups, and private companies.

Now let me discuss the results of our review in turn.

ALTERNATIVE TECHNOLOGIES ARE MANY YEARS AWAY FROM MATURITY

The alternative technologies we reviewed would require at least 13 years--until 2007--to proceed sequentially through all stages of development and reach maturity. For example, two technologies often mentioned as feasible alternatives to incineration--steam gasification and plasma arc pyrolysis--are at the conceptual design stage of development, according to several authoritative sources. It is estimated either of these alternatives would take about 13 to 16.5 years to reach full-rate operations capacity.

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[4]Chemical Weapons Destruction: Issues Related to Environmental Permitting and Testing Experience (GAO/T-NSIAD-92-43, June 16, 1992).

NRC has stated that the time estimates for various research and development efforts could be reduced if they were performed concurrently. For example, the full-scale demonstration plant could be built while work at the pilot plant was still under way. NRC acknowledged that there would be some financial risk in this approach, but stated that some alternatives, given sound management and sufficient funding, could be developed and demonstrated in as little as 5 to 7 years.

We have some concerns about using a concurrent development approach because it has certain cost and performance risks--especially when complex or novel technologies are involved. Moreover, a concurrent schedule may not be possible because of constraints such as (1) lengthy mandatory EPA reviews and analysis of technical performance, (2) the need to demonstrate the technology to show it meets EPA standards for protecting public health and the environment, and (3) state permitting.

Furthermore, a concurrent development approach is not consistent with the sequential development approach that has been used by the Army in developing the baseline incineration process for use at the Johnston Atoll and Tooele, Utah, facilities. Baseline incineration has faced rigorous, lengthy testing and permitting to ensure technical performance and compliance with EPA requirements. EPA points out that any alternative technology would have to undergo the same type of demanding testing, analyses, and evaluation that baseline incineration did--a process that took at least 9 years. The failure of a given technology in a full-scale test is conceivable.

COST ESTIMATES OF ALTERNATIVE TECHNOLOGIES ARE UNAVAILABLE OR PRELIMINARY

According to industry officials, in the initial stages of research and development of a complex technology, there are too many unknown factors to be able to make reliable cost estimates. NRC conducted a nationwide search for companies involved in developing alternative disposal technologies, but 70 percent of the companies responding to the NRC solicitation for information did not offer any cost data. The cost estimates that were furnished were very rough and could be considered only partial at that time.

We attempted to obtain more detailed and complete cost estimates, but companies were reluctant to provide them. The companies told us that they could not furnish reliable cost estimates until they had researched and developed their processes through the pilot plant stage, which would be years away.

PERFORMANCE OF ALTERNATIVE TECHNOLOGIES

None of the potential alternative technologies we reviewed would alone be able to render the entire weapon--chemical agent, explosive, metal parts, and dunnage--unusable and decontaminated, as required by the Chemical Weapons Convention. In contrast, baseline incineration will destroy the entire weapon by itself.

NRC provided the following example to illustrate how multiple technologies would need to be combined:

-- chemical hydrolysis might be used to detoxify the chemical agent drained from the munitions;

-- the product of this process might then be oxidized by supercritical water oxidation;

-- the effluent of this step might require further treatment, for example, in a catalytic oxidizer, before release to the environment; and

-- still other alternative technologies would be required to destroy or detoxify agent residue in the remainder of the munition, and destroy or decontaminate the explosive and the shipping and packaging material.

Another possible option for destroying or decontaminating the remainder of the munition is to use incineration in place of other alternative technologies.

Since the alternative technologies are early in their development, it is not yet clear how they will perform compared with the baseline incineration process. What we do know, however, is that each technology has its own advantages and disadvantages. For instance, steam gasification, which involves treating organic materials with superheated steam to produce more simple organic materials, allows waste streams to be stored until chemical analysis establishes their suitability for disposal. However, the process has a number of disadvantages, such as high energy usage that could be costly. (Attachment 1 provides more information on the advantages and disadvantages of each technology as well as the baseline incineration process.)

<u>JOHNSTON ATOLL INCINERATION FACILITY MEETS EPA STANDARDS</u>

Since November 1991, we have issued three reports and testified once on the status of the Army's disposal program at Johnston

Atoll.[5] We are also currently reviewing the final operational verification tests for the Subcommittee on Environment, Energy, and Natural Resources, House Committee on Government Operations.

As required by Public Law 100-180 the Army conducted full-scale operational tests of the incineration facility to (1) verify that it can safely destroy chemical munitions and bulk agent while meeting applicable state and federal environmental regulations and (2) test the reliability of the mechanical process. The Army has conducted four trial burns, starting with the nerve agent GB and then proceeding to nerve agent VX, one-ton containers filled with the mustard agent HD, and projectiles containing this mustard agent. Our previous reviews covered the first two of these tests.

In summary, our prior work showed a litany of problems that resulted in schedule slippages and cost increases. We also reported on maintenance problems that prevented the Army from meeting its destruction-rate goals. These problems are the same as those reported by NRC. We did differ from NRC, however, in the significance of these problems. NRC concluded in a March 1994 report that they would have little impact on program cost or schedule. We reported that these problems threatened the program schedule and would likely further escalate program costs.

At present, the Army is revising its cost and schedule data to reflect the destruction rates achieved during operational tests. The Army estimates that this new data will be ready by October 1994. We expect it to show an increase in required operating time and program costs. Nonetheless, Army officials believe that the destruction of the chemical weapon stockpile will be completed by 2003.

In addition to the schedule slippage problems, we also reported that the tests had demonstrated the Johnston Atoll facility's ability to destroy nerve agent-filled rockets within environmental standards. A similar conclusion was reached by NRC and EPA's Deputy Director, Office of Solid Waste, who testified before the Congress that the Army's disposal program fully complies with or surpasses EPA requirements for environmental and public health protection. It is EPA's position that the Johnston Atoll liquid incinerator (one of the incinerators at the facility) has the cleanest organic emissions of any incinerator in the United States.

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[5]Chemical Weapons: Stockpile Destruction Cost Growth and Schedule Slippage Are Likely to Continue (GAO/NSIAD-92-8, Nov. 20, 1991); Chemical Weapon Disposal (GAO/NSIAD-92-219R, May 14, 1992); Chemical Weapons Destruction: Issues Related to Environmental Permitting and Testing Experience (GAO/NSIAD-92-43, June 16, 1992); Chemical Weapons Destruction: Issues Affecting Program Cost, Schedule, and Performance (GAO/NSIAD-93-50, Jan. 21, 1993).

For example, concentrations of dioxins and furans have been extremely low--well below the EPA requirements for public health and environmental protection.

I would like to add, however, that on March 24, 1994, a release of about 12 milligrams of nerve agent was detected. The incident occurred during routine maintenance while the facility was shut down. It is probable that a chemical agent feed line had not been properly purged and that the agent was released when a valve was opened by maintenance personnel. While the release was well in excess of EPA standards, no injuries occurred. All operations have been suspended until EPA, the Department of Health and Human Services, and the Army have completed their investigations. To date the only chemical agent-related injury occurred on March 17, 1993, when a worker suffered a mustard burn while cleaning up contaminated trash. The facility was shut down at the time.

CRYOFRACTURE

In March 1987 we testified before the Subcommittee on Military Construction, Senate Committee on Appropriations, that the Army was testing cryofracture to determine if it was less costly and safer than baseline incineration.[6] Our observations, at that time, were that cryofracture had not proven to be a less expensive or safer technology than baseline incineration. We reported that cost estimates showed cryofracture would be significantly more expensive than baseline incineration and that risk assessments had not been completed to quantitatively compare the safety of the two disposal technologies. We also observed that cryofracture was a new technology and thus posed more uncertainties than baseline incineration, and that the process offered little or no advantages when used on munitions other than projectiles. In November 1991,[7] we reported that the Army was continuing to test cryofracture and expected to complete testing by March 1992. This report also pointed out that the Army was experiencing significant cost growth and schedule slippage in its baseline incineration program and that the Army should determine whether other faster and less costly alternatives exist for disposing of the chemical weapon stockpile.

I would now like to address four specific questions you asked on cryofracture. The information we have now is preliminary, and we are working to verify the various statements and data.

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[6] Department of the Army's Chemical Munitions Disposal Program (GAO/T-NSIAD-87-6, Mar. 3, 1987).

[7] Chemical Weapons: Stockpile Destruction Cost Growth and Schedule Slippages Are Likely to Continue (GAO/NSIAD-92-18, Nov. 20, 1991).

Question 1. Given that the Army had earlier indicated Pueblo, Colorado, was the best location for cryofracture, what new information has become available that would show this is no longer the case?

Between 1985 and 1991, congressional conferees repeatedly directed the Army to build a cryofracture plant at Tooele, Utah. However, a baseline incineration plant was already under construction there. This would have meant a ninth disposal plant. In 1992, the Army suggested that Pueblo, Colorado was a better location for the proposed plant since cryofracture has the potential to handle Pueblo's stockpile of mustard-filled projectiles--105 millimeter, 155 millimeter, and 4.2 inch mortars--more efficiently than baseline incineration. The congressional conferees agreed.

However, on March 1, 1994, the Assistant to the Secretary of Defense for Atomic Energy recommended baseline incineration over cryofracture at Pueblo for the following reasons: (1) cryofracture is less mature than baseline and would require lengthy, rigorous testing; (2) cryofracture presents a risk of propellant fires; (3) the effects of incinerating chemical agent in the same kiln with explosive components (during cryofracture) are not well understood and pose a risk of chemical agent release; and (4) cryofracture could be more costly.

The National Environmental Policy Act requires an environmental impact study which will involve further study of both cryofracture and baseline incineration. A final decision on which technology to use at Pueblo will not be made for approximately 12 to 16 months.

Question 2. What information did the Office of the Secretary of Defense (OSD) use in making its recommendation to use baseline incineration at Pueblo, Colorado and how well was it supported?

On the basis of our review of Army documents and discussions with Department of Defense officials, we found that the Assistant to the Secretary of Defense evaluated cryofracture for over 6 months. The sources he used included (1) cryofracture and baseline test results, (2) OSD and Army recommendations, (3) Army cost estimates, (4) NRC recommendations, and (5) reports by MITRE Corporation and General Atomics.

Question 3. How much money would the government have to spend on cryofracture to bring its status to full rate operation?

In separate studies the MITRE Corporation (July 1993), the Army Audit Agency (September 1993), and the Army Senior Acquisition Review Council (October 1993), separately estimated the life-cycle cost of a cryofracture plant at Pueblo.

We are also aware that a staff report by the House Committee on Appropriations has concluded that cryofracture is less costly than baseline incineration. We have tried to obtain this report, but have not been successful thus far.

Question 4. If the Assistant to the Secretary of Defense believes that cryofracture should not be used to destroy the stockpile at Pueblo, Colorado, why did he recommend cryofracture be used to dispose of non-stockpile material?

The Assistant to the Secretary suggested further study of cryofracture for the disposal of some non-stockpile material, specifically buried chemical munitions. The reason this was suggested was that, according to the Department of Defense, the cryofracture process will accommodate irregularities in munitions, such as nonstandard or out-of-specification rounds. Also, cryofracture is not affected by the condition of the chemical agent in the munition. Modifying a cryofracture plant for different types of munitions is a minor process involving changes in the cooling times and the press.

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This concludes my statement, Mr. Chairman. I would be pleased to answer any questions that you or other members of the Subcommittee may have.

ATTACHMENT I

ADVANTAGES AND DISADVANTAGES OF SELECTED ALTERNATIVE TECHNOLOGIES AND BASELINE INCINERATION

Description of technology	Advantages	Disadvantages
Molten salt oxidation: Combines chemical and thermal treatment. Wastes and oxygen are fed into a bath of molten caustic salt--usually sodium carbonate or a mixture of sodium and potassium carbonate. The wastes are oxidized, typically producing emissions of carbon dioxide, water, nitrogen, and oxygen; ash and soot are retained in the melt. Salt can later be removed for disposal or for processing and recycling.	-- A private company, using Army personnel, has considerable laboratory experience and expertise, testing with small amounts of mustard agent and dunnage since 1950. -- No mustard was detected in gas emissions, and destruction and removal efficiency was very high.	-- The possibility of superheated vapor explosions is a safety hazard. -- During tests on mustard agent, small amounts of nitric oxides, organically bound chlorine, and traces of hydrocarbons were found in gas emissions, which could adversely impact the environment. -- The salts removed from the molten salt bath will contain all the normal salts produced by incineration (sodium fluoride, chloride, sulfate, etc.). The total volume will exceed that of incineration because of unreacted material from the salt bath. These salts are all soluble and will have to be treated as toxic waste in a landfill. -- The long-term mechanical operability of the molten salt oxidation reactor has not been demonstrated, and problems may occur.

Description of technology	Advantages	Disadvantages
Fluidized bed combustion: Uses fluidized, granular solid as heat transfer medium. For chemical agent destruction, solid of choice would be aluminum oxide or calcium oxide. The material is kept suspended by gas flow, which is primarily air.	-- Proven technology in civilian hazardous waste incinerators. -- Allows rapid start-up and shutdown of feed stream, increasing safety. -- Use of slurry reduces concern for explosion when destroying propellants and explosives.	-- Difficult to achieve desired destruction and removal efficiency for chemical agents.
Molten metal pyrolysis: Involves use of metals, such as copper, iron, or cobalt, at 3,000 degrees Fahrenheit, to decompose organic compounds like chemical agent.	-- Molten metal furnace could combine functions of three of the incinerators used in the current technology.	-- Gases from the furnace would likely be very dirty, containing soot from the metal pyrolysis and possibly some slag particulate matter. Separate purifier unit would be needed to clean gas before it is released. -- Gases from the furnace are combustible organic materials which must be burned in a separate afterburner or furnace.
Plasma arc pyrolysis: Involves passing an electric current through a low-pressure airstream to split chemical agent into its atomic elements in a thermal plasma field at a very high temperature, e.g. 10,000 degrees Fahrenheit.	-- Short start-up and shutdown times, increasing safety.	-- The arc furnaces produce a combustible gas which would require a secondary burner and gas clean-up system just as with normal incineration. -- Costly labor-intensive operations.

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Description of technology	Advantages	Disadvantages
Steam gasification: Organic materials are treated with super-heated steam under reducing conditions to produce simple organic molecules. Also known as reformation.	-- May be operated as a closed-loop system; waste streams are stored until chemical analysis establishes their suitability for disposal.	-- Another technology would be required because the products of the process would require further oxidation. -- Possible air leakage could lead to fires. -- Chemical agents would be particularly difficult to handle because of their large content of elements such as fluorine and phosphorous (in GB), nitrogen and phosphorous (in VX), and chlorine (in mustard). A large development effort is probable. -- Requires significant costly energy usage. -- Suitable cooling should be used to safely remove heat of reaction.

Description of technology	Advantages	Disadvantages
Wet air oxidation: Based on principle that organic compounds can be oxidized slowly at temperatures that are low compared with normal combustion temperatures (e.g. 572 degrees Fahrenheit versus 3,632 degrees Fahrenheit). The oxidation is carried out at high pressure, e.g. 1,000 per square inch, in the presence of water.	-- Approximately 200 municipal and hazardous waste plants use this technology worldwide. -- An effective way of oxidizing organic matter in dilute aqueous solution. Thus it could be particularly useful for the case where agent is first chemically detoxified, resulting in an aqueous solution requiring further oxidation. -- It has been tested with a number of insecticides, and fungicides having chemical compositions that resemble those of chemical weapons.	-- High operating pressure could result in potentially dangerous chemical agent leaks. -- A major containment structure would be needed, adding greatly to capital costs and construction times. -- The liquid product will contain appreciable concentrations of organic compounds such as acetic acid; while they are non-toxic, they will require further treatment before release of the water to the environment. -- Gas emissions contain appreciable concentrations of volatile organic compounds and will require additional treatment before release to the atmosphere. -- Corrosion is a concern, possibly affecting structural integrity of the facility.

ATTACHMENT I

Description of technology	Advantages	Disadvantages
Supercritical water oxidation: Involves mixing chemical agents with water that has been pressurized and heated to a point at which organic compounds become soluble. (Above 705 degrees Fahrenheit, and a pressure above 221 atmospheres, or 3,205 pounds per square inch.) Solution is oxidized at an elevated temperature, producing carbon dioxide and inorganic acids and salts.	-- The aim of supercritical water oxidation is to have complete oxidation, with no products of incomplete combustion remain in solution. -- Liquid effluent may be collected and analyzed, then recycled if found harmful to the environment. -- A private company has experience testing the technology with dilute solutions of GB and VX nerve agents, and it achieved a very high destruction and removal efficiency using a laboratory-sized reactor. -- It would be particularly useful with a feed consisting of products from a previous detoxification step; the detoxified material would be in dilute aqueous solution, the form required for supercritical water oxidation.	-- High operating pressure could result in potentially dangerous leaks. -- Because feedstock may only contain a maximum of 20 percent agent, the amount of liquid wastes is greatly increased. -- A major containment structure would be needed, adding greatly to capital costs and construction times. -- Problems with corrosion of parts and salt formation inside reactor chamber may adversely affect facility operations.

Description of technology	Advantages	Disadvantages
Chemical neutralization: Involves mixing chemical agents with other substances to form less toxic compounds. An example of this process is hydrolysis--the breakdown of a chemical agent by water.	-- Army has experience in chemically neutralizing GB nerve agent. The Canadians have recent experience in neutralizing small amounts of nerve agents GA, GB, and VX, and the chemical agent lewisite. -- Because no appreciable exhaust gases are released, there is no need for a complex pollution abatement system. -- Would produce smaller amounts of gaseous effluents. -- Low operating pressure reduces risk of potentially dangerous leakage. -- Avoids formation of dioxins, furans, and other undesirable products from chlorinated compounds because of low operating temperature.	-- The products of the process are not suitable for release to the environment, they must be oxidized to final stable materials that are suitable for release. -- By-products of the process are extremely variable, which can cause problematic emissions. -- Process is slow compared to incineration. -- Mustard agent and VX are hard to neutralize; other technologies may be necessary for disposal. -- Because feedstock may only contain a maximum of 20 percent agent (for VX and mustard), the amount of liquid wastes is greatly increased. -- The time required to develop a neutralization-based process for use at any specific site may be three to five years longer than for baseline incineration.

ATTACHMENT I

Description of technology	Advantages	Disadvantages
Baseline incineration: An engineering process that employs thermal decomposition via thermal oxidation at high temperature to destroy the organic portion of the waste and reduce volume. Chemical weapons are drained of chemical agent and disassembled, then component parts are sent to one of four incinerators: (1) agent is pumped from holding tanks to a liquid incinerator, (2) casings are decontaminated in a metal parts furnace, (3) explosives and propellants are burned in a deactivation furnace, and (4) packing materials are burned in a dunnage incinerator. Each furnace possesses its own pollution abatement system, all of which lead to a common exhaust stack.	-- Can destroy or decontaminate the entire munition, so no other technologies are needed. -- Is the only fully developed process to dispose of chemical weapons. -- Substantial design and operational experience exists. -- Has been used by the United States, United Kingdom, Canada, and Russia as a means of disposing of chemical weapons. -- Has been thoroughly tested with all chemical agents. -- Thus far has fully complied with or surpassed EPA requirements for environmental and public health protection. -- Capable of a high degree of destruction-- has demonstrated destruction and removal efficiency of 99.9999997 percent with nerve agent. -- Can decontaminate metal parts to a level where they can be sold to the public as scrap. -- Process is irreversible, thus satisfying terms of the Chemical Weapons Convention.	--Many health effects are still unknown. Over 17,000 papers on dioxins have been published without settling controversies about human health effects. -- Complex pollution abatement systems needed to remove particulates and acid gases. -- Combustion problems could increase emission of products of incomplete combustion. -- Many citizens and environmental groups believe there are risks to the public and the environment. -- Visible exhaust plume from stack could be misinterpreted by public as hazardous pollutants.

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