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EASTERN KENTUCKY UNIVERSITY

Legal and Community Input in the Record of Decision for the Bluegrass Army Depot

Honors Thesis

Submitted

in Partial Fulfillment

of the

Requirements of HON 420

Spring 2023

By

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Abstract: The Bluegrass Army Depot of Richmond, Kentucky is owned and operated by the United States Army to demilitarize the chemical weapons stockpile facility. The citizens of Richmond filed a civil suit against the Army for wanting to incinerate the stored chemical weapons. This research compiles an overview of the history of chemical weapons, current laws and legislation regarding the facility, political implications, public opinions surrounding the installation, facility stockpiles and ammunition, chemical weapons dissemination methods, and specific analysis and research dedicated to the Bluegrass Army Depot's project stages, destruction technologies, and public involvement. The central purpose is to compile a unique overview of all relevant information because the topic of chemical weapons stockpile and dissemination is seemingly taboo with little literature published on these installations. This research contains a literature review of Warren et al.'s document "Chemical Weapons Destruction: Advantages and Disadvantages of Alternatives to Incineration," provoking key questions about dissemination methodology and technology. The study not only details incineration and alternative chemical weapons disposal technologies, but specifically tailors these details to the nine United States chemical weapons storage facilities. The final results of this study outline the Bluegrass Army Depot's remaining ammunition, dissemination processes, and public outreach.

*Keywords and phrases:* honors thesis, undergraduate research, Bluegrass Army Depot, chemical warfare, public opinion and input, legal implications, storage facility, dissemination methods.

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## **Legal and Community Input in the Record of Decision for the Bluegrass Army Depot**

### **Introduction**

The Bluegrass Army Depot (BGAD) located in Richmond, Kentucky is one of only two chemical warfare storage facilities remaining in the United States of America. The other is located in Pueblo, Colorado called the Pueblo Chemical Depot. The United States Army acquired the land where the Bluegrass Army Depot resides in 1940. The chemical weapons demilitarization operation was established in 1941 and began activity only a short year later. Albert Benjamin “Happy” Chandler, Kentucky’s senator at the time, immediately made his way to the White House via train upon the Army’s announcement of the depot installation. His intention to combat the presence of the chemical warfare storage site due to unnecessarily taking up prime bluegrass land of the people, was immediately halted when the bombing of Pearl Harbor was announced. Governor Chandler knew all resources would be geared toward the bombing of Pearl Harbor with no hope in convincing the Army to relocate. Campbell and Vincent claim that “nearly all of the problems facing the army’s chemical weapons program can be traced directly or indirectly to the technology chosen by the army in the early 1980’s and, perhaps more important, to its refusal to back away from that choice” (1995).

In 1942, the depot was chartered as an ammunition and general supply storage facility. The BGAD merged with the Lexington Signal Depot in Avon, Kentucky to become the Lexington-Bluegrass Army Depot in 1964. This new facility was soon chosen for early closure under BRAC (Base Realignment and Closure) in 1999. Later that

year in September, the remaining facility - BGAD - received its current title as a chemical warfare storage facility.

The Army has many responsibilities in terms of legally and successfully running the facility, which includes: industrial services support; ammunition maintenance, renovation, disassembly, and demilitarization; thermal arc coating for Air Force Bombs; water washout facility services; Molte Salt Research and Development Facility services; ultrasonic testing for mortar ammunition; Chemical Material Surveillance Program; quality assurance and joint logistics support; ammunition life cycle management; and the facility also serves as a training ground for new service members.

The site is primarily composed of open fields and wooded areas that serve as munitions storage, space to repair general supplies and ammunitions, and disposing of said munitions. The installation stores conventional explosive munitions as well as assembled chemical weapons. The Army claims that the depot and the surrounding land is primarily involved in industrial services, and various activities associated with the storage and maintenance of conventional and chemical munitions.

The mission of the BGAD is “to provide America’s Joint Warfighters reliable, timely, and cost-effective munitions and chemical defense equipment in support of full spectrum Military Operations. Safeguard the remainder of the National Chemical Weapons Stockpile until demilitarization.” Similarly, the organization’s vision states: “Become the Department of Defense’s Center of Excellence for ammunition support to the Joint Warfighter” (U.S. Army, 2022).

Why is the process of disarmament untimely and strenuous? Has the BGAD followed all legal and public procedures? How has the facility affected the city of Richmond? Are there any legal implications that follow the installation of the BGAD?

The U.S. Army's initial choice to demilitarize these weapons by incineration was not met in a positive light by the public. Their attitude concerning incineration and the helplessness of the citizens of Richmond were shed in such negative, condescending light that the citizens of Richmond filed a civil suit against the government, begging for an alternative technological method of demilitarization. However, if the Army had a different attitude about the whole process, the people may have accepted and even supported their actions. As will be explored later in this research, when done correctly, incineration is actually a highly safe option for eliminating chemical weapons. Furthermore, the process is time efficient and the project would have been completed in a timely manner, most likely being concluded in the late 1990's or early 2000's.

The face of the BGAD facility got citizens of Richmond, Kentucky involved on a national level. Discussing this important issue allowed citizens to enter an unseen level of the Pentagon for the first time in order to express their views and concerns to government officials. Essentially, the civil suit filed by the citizens of Richmond in the early 1990's requesting that the chemical weapons stored in the BGAD not be incinerated, changed the face of public involvement and administration. One very important positive factor that came from this civil suit was the growth of public involvement and outreach regarding the processes of incineration, alternative disposal methods, and the depot in general.

These questions are important, and lead this research process. Although the topic of chemical warfare is not a new concept, there is very little literature that has been

released regarding these chemical warfare storage facilities, and even less concerning the BGAD specifically. The legal and community input in the Record of Decision (ROD) for the Bluegrass Army Depot affected which demilitarization method was used to eliminate the chemical weapons stockpile through community outreach and public involvement. What were these public and legal actions resulting from the BGAD facility, and did these actions truly change the face of the installation and the choices of the Army?

### **Historicity and Timeline**

In his book titled “Biological and Chemical Warfare,” Hal Marcovitz chronicles a timeline regarding chemical warfare. Essentially, Marcovitz reminds us that chemical warfare is not a new phenomenon, and it is extremely important to understand legal and social history surrounding modern chemical weapons discourse. Humans have been using chemical warfare and similar strategies for centuries, and have been documented early and frequently throughout history. For example, beginning as early as the Peloponnesian War, circa 500 B.C., Spartans and their allies utilized chemical weaponry. Throwers to fling torches with burning sulfur and pitch were used to be thrown at their enemies. Modern uses for sophisticated chemical weaponry have increased with time, but have evident origins throughout history.

Americans began entering a new era in the 1770’s with the familiar spread of smallpox. Although this type of warfare is strictly biological, it led to most European countries signing the Hague Peace Convention. In the twentieth century, the Hague Peace Convention was the first organized event in history to develop writing against the use of chemical weapons in warfare.

In an effort to reinforce the first Hague Convention, the Second Hague Convention of 1907 strengthened the promises to ban chemical and biological warfare in combat military fighting. However, eight years later, the Germans used Chlorine gas against French and Canadian soldiers in Belgium. To remedy this situation, world powers reconvened again to write the Geneva Protocol of 1925 as an official document outlawing chemical and biological warfare once again. Unfortunately, countries broke the Geneva Protocol of 1925: Italian troops used chemical bombs against Ethiopia in the 1930's and during WWII, Nazi Germany used chemical agents to kill millions of Jews and other minority people groups in concentration camps.

In 1969 United States President Richard Nixon suspended chemical weapons programs in agreement with previous international world conferences. Starting a trend, the United States encouraged and inspired more than 100 other nations to sign the Biological and Toxic Weapons Convention in 1972. Despite other scandals of chemical weapon use occurring in the Middle East as well as Russia, the Chemical Weapons Convention met in a more serious manner. In 1997, the Chemical Weapons Convention outlawed the use of chemical weapons...again.

Going down through the early 2000's, more and more scandals presented themselves in regard to chemical weapon use in warfare. Chemical weapons have been banned and outlawed on multiple occasions. However, the need for legislation and enforcement obviously still exists today. Although chemical weapons are on the decline in the United States as a whole, the two chemical weapons disposal facilities - BGAD and Pueblo - are still a reality. Many of these ideas will be revisited later in this research, but it is important to lay a foundation of the use of chemical weaponry throughout human

history in order to understand the longstanding battle the government has fought to eradicate the use of these illegal weapons.

### **Current Laws and Legislation**

There were four main conferences regarding the discussion of permanently outlawing chemical weapons that really pushed the outcome of chemical weapons disposal facilities in the United States, and in turn affecting the BGAD. These conferences include the Versailles Treaty of 1919, Washington Disarmament Conference of 1922, 1925 Geneva Protocol, and the United Nations Conference on Disarmament. Out of these conferences, the Chemical Weapons Convention (CWC), the Organization for the Prohibition of Chemical Weapons (OPCW), Assembled Chemical Weapons Alternatives (ACWA), and Resource Conservation and Recovery Act (RCRA) were born.

***Treaty of Versailles 1919*** On June 28, 1919, Germany and their allied nations signed the Treaty of Versailles to formally end WWI. The treaty required several terms and actions to be met on behalf of Germany, including the calling and creation of the League of Nations, which was very strongly supported by United States President Woodrow Wilson. Germany was expected to “pay financial reparations, disarm, lose territory, and give up all of its overseas colonies” (Drexler, 2019).

***Washington Disarmament Conference of 1922*** Soon after in 1922, the largest naval powers of the world gathered in Washington for a conference to discuss naval disarmament in hopes of relieving growing tensions in East Asia. These world powers desperately wanted to prevent another World War after seeing the aftermath of WWI. Concerned policy makers tried to eliminate threats, such as Japan, who were on the rise for an arms race. Republican Senator from Idaho, William Borah, demanded that the

United States engage with its top two competitors in the naval arms race, Japan and Britain, in order to negotiate disarmament (The U.S. State Department, 2001). The final leg of the Washington Disarmament Conference of 1922 was to actualize the U.S. Open Door Policy in China. The United States had already worked closely with European Powers, and this conference seemed to be an effort to include Asian powers into the disarmament process and agreement. Although this conference had less to do with physical chemical disarmament, it allowed for an open line of communication between the European and Asian powers that so desperately needed to occur. In the end, this conference eventually led to the 1925 Geneva Protocol, United Nations Conference on Disarmament, and the Chemical Weapons Convention - which were all extremely important to the events at the BGAD.

***United Nations Conference on Disarmament*** The United Nations Conference on Disarmament (CD) was recognized by the General Assembly in 1978 as a peaceful negotiation forum for international community leaders, enhancing cooperation between groups. As previously mentioned, the CD superseded Geneva-based discussions, including a discussion specifically dedicated to creating the Conference of the Committee on Disarmament (United Nations Conference for Disarmament Affairs, 2019). The United Nations Conference for Disarmament Affairs Outlines the important agenda items that the CD is currently focusing on: “Cessation of the nuclear arms race and nuclear disarmament; Prevention of nuclear war, including all related matters; Prevention of an arms race in outer space; Effective international arrangements to assure non-nuclear-weapon States against the use or threat of use of nuclear weapons; New types of weapons

of mass destruction and new systems of such weapons; radiological weapons; Comprehensive programme of disarmament; and Transparency in armaments” (2019).

The CD now holds annual meetings with a two-fold intention: the weekly sessions are divided into periodical topics, then the Rules of Procedure and Agenda controlled by the General Assembly sends in recommendations for how to make the conference operate as smoothly as possible. Although established in 1978, the conference still holds meetings annually to discuss chemical weaponry, or more if necessary. The CD is extremely important to the BGAD because they guide the disarmament process for the chemical weapons disposal facilities in Kentucky and Colorado, and ensure the U.S. and other nations are being held to the same standards.

***The Chemical Weapons Convention (CWC)*** One of the most important conventions when it comes to dealing with the legality of chemical weapons is the Chemical Weapons Convention (CWC), finally hitting a breakthrough with uniting countries on the front of disarmament. “The Chemical Weapons Convention is a multilateral treaty that bans chemical weapons and requires their destruction within a specified period of time. The treaty is of unlimited duration and is far more comprehensive than the 1925 Geneva Protocol, which outlaws the use but not the possession of chemical weapons” (Kimball, 2020). Beginning negotiations in 1980, the CWC connects conversations from the United Nations Conference on Disarmament, commencing the convention on January 13, 1993, and ratified on April 29, 1997. Similarly to the previously discussed interlocking conferences, the CWC and OPCW are closely related. The OPCW is controlled by the CWC, which handles all chemical weapons-related activities, materials, and relevant industrial activities. The mission and responsibilities of the CWC are really important to



the work and regulations controlling the BGAD; The OPCW inspects and monitors facilities and activities that are relevant to the work of the convention to ensure their complicity.

The CWC has specific prohibitions, requirements, and systems of categories, schedules, and inspections in order to ensure their productivity and effectiveness as an organization as detailed by Kimball in “The Chemical Weapons Convention (CWC) at a Glance” (2020). The following information is a compilation of Kimball’s research into the CWC and its actions. The CWC prohibits any type of development, storage, or maintenance of chemical weapons. In this, the trading of chemical weapons is also outlawed, including military use and riot control agents. Encouraging or helping other nations to engage in prohibited CWC behaviors or actions is deemed unacceptable.

The CWC requires participating nation states to declare to the OPCW what chemical weapons they possess – if any – and any other related information regarding stockpiling within 30 days of entering as a member. The CWC also requires all chemical weapons facilities, abandoned, or old – all be destroyed if they fall under the jurisdiction or control of participating parties. All states must declare all of their stockpiles by category, chemicals are grouped into schedules based on the risk they pose, and have specific procedures for weapon destruction as outlined by the table below.

**Table 1: Categories and Schedules of Stockpile Classification**

Rank	Category based on chemical	Schedule based on level of risk	Category of destruction
1	Schedule 1 chemicals (example: VX and Sarin)	Pose a high risk, rarely used for peaceful purposes, may only be retained in small quantities for research/medical/pharmaceutical	Must destroy 1% within 3 years, 20% within 5 years, 45% within 7 years, and 100% within 10 years.

		/defensive use.	
2	Non-Schedule 1 chemicals (example: phosgene)	Toxic chemicals, pose significant risk, not produced in large quantities for commercial purposes.	Destruction must begin within one year after the nation enters the CWC.
3	Unfilled munitions, devices, and equipment designed to employ chemical weaponry.	Produced in large quantities for purposes permitted by the CWC but still pose risks.	Destruction must begin within one year after the nation enters the CWC.

In order to gain public acceptance, the CWC also established routine, challenge, and alleged inspections to generate confidence and compliance. Routine inspections within stockpile facilities verify what kind of chemical weapons are being stored, and confirm that inventory and activities are consistent with requirements of the CWC. Challenge inspections are like pop quizzes: they can be conducted at any moment to prevent noncompliance, which is balanced by the OPCW who can start and stop these random checks to prevent abuse of power or malintention. Lastly, alleged inspections take place when a facility is alleged of using chemical weapons illegally. In the rare event that members do not comply with the rules and regulations of the CWC, the OPCW could legally bring these issues forth before the United Nations Security Council and General Assembly, who have the power to theoretically restrict or suspend the rights and privileges of a nation member. The CWC is well informed of the chemical weapons stockpile facilities in the United States in Kentucky and Colorado, and are actively helping with demilitarization.

*Difficulties of the CWC* Although the Chemical Weapons Convention is a great addition to the conversation surrounding chemical weapons storage and disposal, many sources find that the CWC is still facing various challenges and difficulties. In his article, Robinson suggests two themes: there is always a possibility that chemical weapons can reemerge after dissemination in the absence of technological measures, and the growing tension between principle and political advantage (2008). However, it is safe to assume that anytime politics are involved with an issue, there is always the risk that the well-being of the actual issue at hand can be compromised.

Additionally, there are four non-members of the CWC that are inextricably tied to international chemical arms peace (Smithson, 2004). Israel has signed the CWC, but has not actually taken the legal steps to join. Egypt is thought to have their own chemical weapons production facilities for blister and nerve agents. Egypt is also believed to trade chemical ammunitions with Syria, who is accused of establishing a massive capacity of nerve agents and poisonous gasses. Lastly, North Korea is accused of having an unbroken allyship with early Soviet chemical weapons production. Until all nations join the CWC, there cannot be a concrete promise of international safety.

Unfortunately, if anything were to change with the international status of chemical weapons usage or if a threat were to materialize, the United States is bound to the CWC agreement until specified otherwise (Giovanello, 2012). This could cause the United States to act as open prey if the situation were to arise. Vogel contends upon this point by stating that the essential questions of the CWC are the nature of the convention itself and is the agreement truly verifiable and enforceable (1997). While some critics argue the CWC cannot elicit enough control, supporters counterclaim that complete

verification is impossible, and the CWC's rigorous process is protection enough. The challenges facing the CWC are paradoxical and ultimately depend on perspective.

***The Organization for the Prohibition of Chemical Weapons (OPCW)*** The essential mission of the OPCW is to create a world where we can live free of chemical weapons, which contributes to international security, disarmament, and economic development. They serve as the implementing body for the CWC, and carry out the actions required by them. Their purpose is to eliminate chemical weapons by the rules, regulations, and requirements put in place by the CWC. The OPCW mission is to “implement the provisions of the Chemical Weapons Convention to achieve our vision of a world free of chemical weapons and the threat of their use, and in which chemistry is used for peace, progress, and prosperity” (Organization for the Prohibition of Chemical Weapons, 2023).

The OPCW is highly concerned with public outreach and involvement, which strengthens the four pillars of their program: credible and transparent regime, protection and assistance, international cooperation, and universal membership (Organization for the Prohibition of Chemical Weapons, 2023). From these four pillars, the organization breaks down topically. Informing people about what chemical weapons are, eliminating chemical weapons, preventing the re-emergence of chemical weapons, supporting national implementation of the convention, promoting peaceful uses of chemistry through international cooperation, ensuring preparedness, responding to the use of chemical weapons, supporting victims of chemical weapons, and achieving universality of the convention are the main work areas of the OPCW, as outlined by the CWC.

The OPCW has served as a very valuable resource for the demilitarization of the BGAD because they are the point of contact on a national level. Their commitment to

educating and helping people who are working in these volatile environments has changed the face of public administration regarding chemical weaponry. The OPCW has successfully opened this informational line of communication with the public, building trust and openness with the people these decisions are made to protect.

*Assembled Chemical Weapons Alternatives (ACWA)* The Program Executive Office (PEO) for ACWA is “responsible for the safe and environmentally compliant destruction of the remaining U.S. chemical weapons stockpile stored at the U.S. Army Pueblo Chemical Depot in Colorado and the Blue Grass Army Depot in Kentucky” (Program Executive Office, 2023). PEO ACWA is a program specifically tailored to provide information regarding the Bluegrass and Pueblo Army freedom of information, privacy, and security details. The program enhances national security standards as well as enforces environmentally sound manners of destroying the remaining stockpiles at the Bluegrass and Pueblo Army Depots (Acquisition Support Center, 2022).

ACWA was officially established by congressional legislation in 1996, and reports directly to the Secretary of Defense. This organization is responsible for pilot testing safely selected alternative technologies, and fast tracking the destruction of the chemical weapons stockpiles at the Bluegrass and Pueblo Depots. They serve not only as a congressional point of contact for the Bluegrass and Pueblo Depots, but also the reverse: the CWC and ACWA are able to communicate and help the depots through this organization and implement their internationally agreed upon strategies. ACWA essentially manages construction, systemization, operation, closure, and any contracting relating to the remaining stockpile facilities (Acquisition Support Center, 2022). The United States Acquisition Support Center has highlighted the goals, program status, and

projected activities for the BGAD as follows (2022). All mustard and nerve agents in 155 mm projectiles, 8-inch projectiles, and M55 rockets are to be destroyed. They have successfully disseminated all 8-inch projectiles and are preparing the campaign to destroy VX projectiles. Per congressional mandate, both sites – Kentucky and Colorado – are required to complete destruction no later than December 31, 2023. ACWA enforces the goals of the CWC and OPCW, but, much like the OPCW, is very involved with local communities. Especially through the process of demilitarizing the Bluegrass stockpile, ACWA helped the citizens of Richmond file their civil suit, and have remained involved with the location still to this day. They are still present at quarterly meetings, and work to keep Richmond informed on local procedures.

***Resource Conservation and Recovery Act (RCRA)*** Moving onto government centered organizations involved with the demilitarization of the BGAD, RCRA is possibly the most important document when it comes to Environmental Health standards. Instead of being based around the public, RCRA is a law that gives the Environmental Protection Agency (EPA) authority to control hazardous wastes from the cradle to grave: generation, transportation, treatment, storage, and disposal of hazardous waste (Environmental Protection Agency, 2022). Public outreach was covered more comprehensively with the implementation of the CWC, OPCW, and ACWA – and the concern for the actual chemicals themselves took a rise. RCRA essentially deems any unethical, dis-environmentally sound techniques of hazardous waste disposal to be deemed illegal.

RCRA is a foundational law, but became extremely important in Richmond's fight to have the chemical weapons from the depot properly taken care of in the manner best for the people and environment. These foundational laws and texts that have been

reviewed so far are imperative to understanding the legal and community input in the record of decision for the Bluegrass Army Depot.

### **Political Implications and Public Opinion**

Most citizens of Richmond question exactly why this process of demilitarization has taken so long when other locations have successfully disseminated their weapons several years, in some cases decades, ago. There is an implication for health, safety, and community by continuing to stall this process, and allowing destructive chemical weapons to be left in underground bunkers within city limits. People question if a standardized procedure would help speed the process along, and doubt the reliability of this process.

To many people's surprise, there actually is a standardized procedure set in place for specific munitions. One of the reasons this process has taken so long in Kentucky is because the BGAD location had the most M55 rockets in place. These weapons are extremely fragile and volatile, which are not a pleasant combination when mixed with a rushed process. Although the BGAD had the lowest initial percentage of chemical warfare stockpile agents, M55 rockets are the most difficult to demilitarize, neutralize, and disassemble. Additionally, the war in Afghanistan beginning in the early 2000's required substantial congressional funding. This venture added a lot of time to the demilitarization process due to lack of funding and government support. The BGAD facility has also increased the economy of Richmond in several ways. Not only did the installation provide jobs, but brought people from all over the United States to work there. The BGAD is raising the economy and keeping it elevated by employees choosing to stay in Richmond.

In her article, Michelle Bentley discusses “The Problem with the Chemical Weapons Taboo” that combats negative feelings citizens often have when it comes to the use of chemical weapons. She [Bentley] defines the chemical weapons taboo as “the idea that chemical weapons are prohibitively abhorrent” (2015). In her article, she explains that this idea has taken a leading role in politics, and has effectively constructed a stigma against the possession and use of chemical arms. Subsequently, our policies in the United States reflect the expectation that the use of chemical weapons “represents a grievous and punishable transgression,” as it is evident in modern politics (Bentley, 2015). Bentley’s ideas are a great reflection of public opinion on an international level, but also in the community of Richmond. When the Army announced that their choice of demilitarization for the chemical weapons stockpile was incineration, the public was not happy. This can be attributed to the negative stereotypes and taboos surrounding chemical weapons and incineration.

When incineration is not performed safely and strictly adhering to the rules of RCRA, many health issues and complications can follow. The BGAD facility eventually decided to demilitarize by neutralization and Supercritical Water Oxidation, or SCWO. To better understand the BGAD facility, it is important to discuss the eight other chemical activity depots that once existed in the United States. Comparing and contrasting their original stockpile percentages and destruction dates is important to grasp the timeline of the BGAD. The academic discussion surrounding chemical weapons and these depots are slim. This research serves as an informative project to tie the loose ends of chemical weapons, legal and public implications surrounding it, and making readers/citizens in these locations aware of the reality they face. To echo Campbell and



Vincent’s claim that chemical weapons destruction can be a window of opportunity with public outreach, the basis of “disarmament [should be] accomplished in a manner consistent both with rights of affected communities and with the protections of public health and the environment” (1995).

A common concern among citizens is the worry that there can be no true verification that all chemicals have been destroyed. In their article, Meselson and Robinson offer a reliable approach to ensuring the destruction of declared chemical weapons (1980). They claim that the operation should be overseen by a chosen processor where the destruction would be carried out by international observation. This process would take several years, and would allow for an optimum amount of time to ensure all safety measures and protocols are being followed as expected. As on-site inspections are already legal, any absence or loss of chemical weapons stock is able to be addressed along with any other questionable activities (Meselson and Robinson, 2010).

### **United States Chemical Weapons Storage Facility Stockpiles and Ammunitions**

At one time, there were nine chemical warfare storage facilities in the United States. Each depot had multiple different chemical agents in storage, used a different disposal technology to disseminate, with different destruction timelines. Below is a chart detailing this information.

**Table 2: United States Chemical Weapons Stockpile Storage Facilities Chart**

<b>Chemical Activity/ Depot</b>	<b>Chemical Agents</b>	<b>Disposal Technology</b>	<b>Percentage of Original Stockpile</b>	<b>Destruction Start Date</b>	<b>Destruction End Date</b>
Edgewood Chemical Activity, Maryland	HD	Neutralization	5.2	April 23, 2003	February 2006

Anniston Chemical Activity, Alabama	HD, HT, GB, VX	Incineration	7.2	August 9, 2003	September 22, 2011
<b>Bluegrass Army Depot, Kentucky</b>	H, GB, VX	Neutralization / Supercritical Water Oxidation	1.7	June 7, 2019	September 30, 2023
Johnston Atoll	HD, GB, VX	Incineration	6.6	June 30, 1990	November 29, 2000
Newport Chemical Depot, Indiana	VX	Neutralization	4.0	May 5, 2005	August 8, 2008
Pine Bluff Chemical Activity, Arkansas	HD, HT, GB, VX	Incineration	12.2	March 28, 2005	November 12, 2010
Pueblo Chemical Depot, Colorado	HD, HT	Neutralization / Biotreatment	8.3	September 7, 2016	September 30, 2023
Deseret Chemical Depot, Utah	H, HD, HT, Lewisite, GA, GB, VX	Incineration	43.2	August 22, 1996	January 21, 2012
Umatilla Chemical Depot, Oregon	HD, GB, VX	Incineration	11.8	September 7, 2004	October 25, 2011

\*(Quinn, 2022)

Key for Chemical Agent abbreviations:

GA: nerve agent, also known as Tabun

GB: nerve agent, also known as Sarin

HD: blister agent, sulfur mustard (nearly pure)

H: blister agent, sulfur mustard (20-30% impurities)

HT: blister agent, sulfur mustard (60% HD and 40% agent T)

Lewisite: blister agent, the central atom is arsenic

VX: nerve agent

The chart above is important because it shows what percentage of the original chemical weapons stockpile each location contained, and how long each location took to demilitarize their weapons. However, another important piece of information to consider is what type of ammunition each location possessed. Various types of ammunition call for different demilitarization processes. Some weapons are quickly and easily neutralized, while others are more fragile and require a lengthy process in order to abide by safety standards. For example, the BGAD only had 523 tons in comparison to other depots that had thousands, but M55 rockets are the most difficult to neutralize. The chart below explains what types of ammunition each depot possessed and how many total tons.

**Table 3: United States Chemical Weapons Stockpile Ammunitions Chart**

<b>Depot</b>	<b>Ammunitions</b>	<b>Tons</b>
Edgewood Chemical Activity, Maryland	Ton containers	1,622
Anniston Chemical Activity, Alabama	M23 landmine, mortar rounds, projectiles, rockets, ton containers	2,254
Bluegrass Army Depot, Kentucky	M55 rockets, 155mm projectiles, 8-inch projectiles	523
Johnston Atoll	Bombs, M23 landmine, projectiles, rockets	705
Newport Chemical Depot, Indiana	Ton containers	1,269

Pine Bluff Chemical Activity, Arkansas	M55 Rocket, M23 Landmine, Ton Container	3,650
Pueblo Chemical Depot, Colorado	105mm projectiles, 155mm projectiles, 4.2-inch mortar rounds	2,611
Deseret Chemical Depot, Utah	Bombs, cartridges, M23 landmine, projectiles, rockets, spray tanks, ton containers	13,361
Umatilla Chemical Depot, Oregon	Artillery shell, bombs, M23 Landmine, M55 Rocket, spray tank, ton container	3,720

\*(ACWA, 2023)

## Literature Review

### Chemical Weapons Dissemination Methods

These stockpile depots not only had varying chemical agents and munitions, but also disposal technologies. Incineration, neutralization, biotreatment, and supercritical water oxidation were the top choices for demilitarization by these facilities.

Understanding the processes of each method, the positives, and negatives were important factors in each community's decision on which dissemination operation to use. It was really important to each community to choose whichever process was best for their people. Unfortunately for the city of Richmond, the United States Army wanted to incinerate the chemical weapons. Due to the civil suit the citizens filed against the Army rebuking their decision, the Army turned to neutralization and supercritical water oxidation instead. On the contrary, the Anniston Chemical Activity Depot in Alabama chose incineration. Regrettably, the Anniston Depot was located in an African American, low-income neighborhood where the well-being of the public was not so readily considered. Although the chemical weapons dissemination process was completed too

recently to know how it has affected the citizens of Calhoun County, Alabama – this line of thought would be an interesting study to follow throughout the next several decades. Improperly incinerated chemicals can lead to numerous negative health effects and several types of cancers.

The process of incineration was the most popular choice for dissemination, followed by neutralization, biotreatment, and lastly, supercritical water oxidation. “Chemical Weapons Destruction: Advantages and Disadvantages of Alternatives to Incineration” by Warren et al. is the essential document to this specific discussion regarding the methods of disposal used for these chemical weapons (1994). This specific document was written directly to the United States General Accounting Office to review selected technological disposal processes as alternatives to incineration, while also explaining the process of incineration and other alternative technologies. The following criteria were used to judge the pros and cons of incineration, neutralization, biotreatment, and supercritical water oxidation: meeting the legal deadlines for destroying the chemical weapons stockpile, the cost of the technologies, and their performance characteristics compared to incineration (Warren et al., 1994). This document was specifically compiled in order to discuss these methods for chemical weapons disposal for the previously mentioned U.S. disposal facilities in the charts above.

***Incineration*** As previously mentioned, the process of incineration is the most common method of chemical weapon/agent destruction. In the early 1980’s, incineration was named the preferred method for chemical weapons disposal by the DOD (Department of Defense), and was endorsed as safe and timely by the NRC (National Research Council) in 1984 (U.S. Department of Health & Human Services, 2013). In their report on

chemical weapons destruction about advantages and disadvantages of alternatives to incineration, Warren et al. detailed the procedure of incineration, and how the system works as the following (1994). Essentially, incineration is an engineering process that employs thermal decomposition via thermal oxidation at a very high temperature to destroy the organic part of hazardous waste, and reduce volume. The chemical agents are drained of the toxic components, disassembled, and the remaining toxic parts are sent to four possible incinerators. Incinerator one pumps agent from holding tanks to a liquid incinerator. Casings are decontaminated in a metal parts furnace in incinerator two. The deactivation furnace, incinerator three, burns explosives and propellants. Packing materials are burned in incinerator four, which is the dunnage incinerator. Even though each of the four furnaces possesses its own polluted waste system, all of the ventilated air is released to a common exhaust stack (Warren et al., 1994). Incineration is the most widely used and understood method of chemical and hazardous waste disposal, so as a result, there is more information regarding the pros and cons of incineration.

**Pros.** Warren et al. acknowledges that incineration effectively destroys and decontaminates the entire munition. This means that no other technology is required because of the completeness offered with the incineration process. Additionally, the incineration process has been thoroughly tested with all chemical agents, while also not only complying with, but surpassing EPA requirements for environmental and public health protection. As an added benefit, after incineration, the remaining metal parts are decontaminated to the point that it can be recycled and resold to the public for scrap. In order to satisfy the terms of the CWC, the process of incineration is irreversible due to the finality of ventilating the remaining exhaust after the burning process.

**Cons.** Unfortunately, some of the health effects of incineration are still unknown. Research reliably acknowledges that certain cancers and autoimmune disorders can be triggered or induced by incorrect processes of incineration. Similarly, very complex and expensive abatement systems are necessary to remove all particulates and acidic gasses. If the process of combustion is incomplete or incorrect, issues of emissions could increase. Lastly, visible exhaust plumes from stack emissions are often misinterpreted by public and environmental groups as a hazardous pollutant and find the process to be falsely risky.

**Neutralization** As implied by the name, neutralization involves mixing chemical agents with other synthetic solutions in order to form a less toxic compound. These compounds are watered down to become less potent. An example of this process is hydrolysis. Water is bonded with these substances and causes them to break down. This process was used by the BGAD and several others.

**Pros.** One of the most appealing factors of neutralization is that the U.S. Army actually has prior successful experience with this process from other ventures. Knowing this process is reputable and has a track record of being favorable, is something to consider. Because the substances are essentially broken down by water, there are no gasses produced or exhaust being released. In turn, the equipment can be less expensive because there is no need for a complex abatement system like there is with incineration since there is little to no gaseous effluents. The low operating pressure conditions of the neutralization process reduces the risk of a dangerous explosion or leak. Also attributed to the low temperature and pressure, undesirable byproducts are avoided.

**Cons.** Unfortunately, the byproduct of this process is not suitable to be released into the environment because of the dangerous elements that can still be present. Instead, they are oxidized to stable materials that are suitable for release, which is expensive. These products can contain varying degrees of neutralization and are inconsistent. Therefore, problematic emissions and the slow process makes neutralization less ideal than incineration. Some agents such as mustard agent and VX are labor intensive to neutralize, so other technologies may be required in order to make them suitable for environmental release, increasing the cost of this process even more. Lastly, the generated amount of excess liquid is large, resulting in increased waste.

***Biotreatment*** The Pueblo Chemical Depot in Colorado is the only site that used biotreatment to neutralize chemical agents due to the remote desert location. In this process, hydrolysate is blended with chemicals and water, and is then put through a biotreatment process. Large tanks containing microbes digest and break down the solution. Water is secreted and released from the biotreatment process and then recycled. Salts, biosludge, and other compounds are left behind. This biosludge is composed of microbial waste products and other bacterial matters that are produced throughout the method. The remaining salts, biosludge, and other compounds are sifted and pressed to be separated from the water. The dried and packed compounds are then transferred to a RCRA permitted TSD (treatment, storage, and disposal) facility to be properly handled. Neutralization and biotreatment typically go hand-in-hand because neutralization was meant to be followed by biotreatment in ACWA standards.

**Pros.** Although not very popular, this treatment technology is traditional and well-understood. In terms of removing organic content, this process has enhanced



efficiency. This method is fairly cost effective and environmentally friendly (Abbassi, 2020).

**Cons.** The biotreatment process is extremely slow and requires a lot of free and empty land. Additionally, this process can get expensive if the chemicals are resistant to breaking down, and requires more money to continually be dumped in throughout the process. This method unfortunately produces unwanted microorganisms, bad gasses, bad odor, and water that cannot be recycled. The effluents containing the contaminated water can cause unwanted changes to the environment that decrease surrounding aquatic animal and plant populations (Shah, 2021).

***Supercritical Water Oxidation*** Supercritical Water Oxidation is somewhat similar to neutralization. The process involves mixing chemical substances with highly pressurized and heated water. Organic compounds become soluble under the pressure, the solution oxidizes at an elevated temperature, and produces agents like carbon dioxide, inorganic acids, and salts.

**Pros.** Complete oxidation with no byproducts is the main goal. Liquid effluent is collected and analyzed, and can actually be recycled if the substance does not reach a certain level of toxicity. The destruction and removal efficiency of chemicals is high with this method of neutralization.

**Cons.** The high pressure operations of this process can result in dangerous situations where leaks and other harmful incidents could occur. There are great amounts of liquid waste with this process as well, and needs a large containment structure to be stored in. These structures are expensive and greatly add to the cost of this process and construction time. Additionally, if there are any issues with corrosivity from added salt

formation, inside reactor chambers may experience adverse effects and delay facility operations.

**Results** The results of the study conducted by Warren et al. in 1994 states that alternative disposal technologies are most likely in initial stages of development and over a decade away from full-rate operations. We know now that these top four methods are the disposal methods that the chemical weapons storage and disposal facilities used to eliminate their weapons. They correctly predicted that these alternative technologies would probably not reach maturity in time to be used to destroy the U.S. stockpile by the initial deadline. However, these methods have been continually developed to increase the efficiency of technology should the need ever arise again.

The council and NRC recommended neutralization in combination with other alternative technologies, like biotreatment. They found this approach to be feasible in destroying bulk agents. Even though complex risks are involved with the process itself and untimely government procedure, there are no other current methods that sufficiently alternate from incineration technology. The EPA agreed with their decisions, and also included that any other alternative process besides incineration must go through the same rigorous testing process which can take up to nine years. As the EPA pointed out, this does not work with the analysis and evaluation timeline with the current need for urgent action and meeting deadlines.

### **Bluegrass Army Depot Analysis and Research**

ACWA's Program Executive Office maintains a website with up to date information regarding the Bluegrass Army Depot's project stages, destruction technologies, environmental activities, public involvement, and more – in order to keep

the public up to date with the current activities taking place. The following information is cited from their informational webpage, Program Executive Office (2023).

***Project Stages*** After the process of neutralization, the remaining nerve agent is reduced to hydrolysate – as discussed in the neutralization section. The hydrolysate is shipped to an off-site TSD facility for further processing. For M55 rockets, the Rocket Warhead Containerization System is used to assist with dissemination. Mustard agents and projectiles are neutralized by a technology called The Static Detonation Chamber (SDC). The magnitude of this technology is unsuitable for the technology of the main plant, and remains off-centered from the principle facility. This newest addition to the plant began operations on January 27, 2023. The newer and larger SDC is specifically designed to destroy various containerized warheads, overpacked M55 rockets, and other M55 rockets that may be unsuitable for other types of processing.

The BGAD has five project stages: design, construction, systemization, operations, and closure. Program Executive Operations of ACWA is responsible for overseeing and managing the contract that dictates the BGAD project stages. If the operations continue to remain in accordance with the laws, regulations, and requirements – the facility will remain open to continue the demilitarization process.

**Table 4: Project Stages and their Purpose**

<b>Project Stage</b>	<b>Purpose</b>	<b>Status</b>
1: Design	Facility is designed to safely and efficiently destroy chemical weapons.	Complete
2: Construction	Led by a team who successfully designed, built, and operated all of the facilities in the U.S..	Complete
3: Systemization	All machinery, equipment, and processes tested with water to ensure the efficiency and function of systems.	Complete

4: Operations	When systemization is complete, operations are gradually introduced into the munition systems.	Underway
5: Closure	Encompasses planning, preparation, disposal, decontamination, decommissioning, demolition of facilities, closing of property, closing of permits, and closing of contract.	Planning

These final project stages are finally underway, and are scheduled to be completed by December 1, 2023.

***Destruction Technologies: Neutralization*** Program Executive Operations ACWA is credited with safely destroying these chemical weapons and eliminating the lethal risk associated with continued storage. The staff of the BGAD is extensively trained to destroy the nerve agent stockpile with state of the art robotics systems. This technology helps ensure safety of the workers and facility. This robotic equipment disassembles munitions while nerve agents are drained and separated from explosive components.

The remaining metal parts are disposed of by excessive heat. Over 1000 degree fahrenheit temperatures are only needed for a minimum of fifteen minutes to complete the thermal decontamination process. The parts are then recycled and given back to the community. The M55 Rocket Handling System separates warheads from the motor, drains the chemical agent, and is placed in a safe location for transfer by the robotics system. Lastly, gas filtration is ventilated through High-Efficiency Particulate Air (HEPA) and carbon filters for ultimate cleansing before being released into the atmosphere.

***Public Involvement*** There are three main public involvement outreaches with the BGAD: Bluegrass Chemical Stockpile Outreach Office, Kentucky Chemical Demilitarization

Citizens' Advisory Committee (CAC – main committee), and the Chemical Destruction Community Advisory Board (CDCAB – subcommittee).

The Bluegrass Chemical Stockpile Outreach Office helps with people who want to learn more about chemical weapons and this destruction project specifically. They are able to supply information about neutralization, SDC units, and the Rocket Handling System. They outreach to the community by accepting and wanting feedback on the facility and their work. They accept visitors who have the option to see and handle miniature displays, watch project videos, and watch operations of miniature robots to examine models of chemical weapons. They are also involved and educated on the legal end of things, and can answer questions regarding ACWA, laws, and permit compliance.

The CAC and CDCAB both hold joint public meetings on a quarterly basis to provide updated information, if any. They discuss current operations and information from the Bluegrass Chemical Stockpile Outreach Office.

### **Challenges Faced with Implementation**

As Walker points out in his study, there were two main challenges for the implementation of chemical warfare storage facilities in the United States (2010). Originally, the Army planned to safely transport the stored chemical weapons. This plan was safe, secure, timely, and less financially extravagant than other dissemination methods. However, Congress “banned transportation of chemical munitions on safety and security grounds, necessitating the current plan for a destruction facility at each of the nine U.S. sites at which chemical weapons are stored” (Walker, 2010). The second major challenge the Army faced is controversy over incineration. Although incineration is the most widely tested form of demilitarization, safe, and fairly cost effective compared to

other methods – environmental and public health officials, regulators, and activists threatened to delay programs based on emissions, legal, and permitting issues (Walker, 2010). These two factors – transportation and public opinion – were the main challenges faced by the Army in establishing stockpile facilities in the United States.

Declining military utility, overconfidence in the arms control regime and process, the proliferation of chemical weapons, changing technology, and the increasing politicization of the issue are challenges posed to current policy (Roberts, 1986). While this issue begins to command more and more media attention, a creative and varied approach to current policy is necessary for chemical weapons laws to remain effective. Creating effective laws and legislation is a growing challenge the public health sector will continue to face.

## **Conclusion**

What are the legal and public implications in the record of decision for the Bluegrass Army Depot? A culmination of past historical events that lead to current laws and legislation laid the groundwork for public discourse regarding chemical weapons stockpile facilities in the United States. The CWC, ACWA, RCRA, and other organizations like it – fight to include political and community opinion in regard to demilitarization technologies. Although incineration was the most popular and well-researched choice for dissemination, alternative technologies were used abundantly. These technologies increased the need for additional time, money, and resources – but aimed to please the people in the towns by which they occurred. Although the Bluegrass Army Depot faced challenges with implementation, the overall result of the installation has been positive nonetheless. The legal and community input in the Record of Decision

(ROD) for the Bluegrass Army Depot affected which demilitarization method was used to eliminate the chemical weapons stockpile through community outreach and public involvement.

Richmond, Kentucky's citizens fought for neutralization followed by supercritical water oxidation in order to ensure safety for their homes and communities, instead of the possible threat from incineration. Their input ultimately impacted the Army's course of action by forcing them to consider the concern of the locals. In the end, there will always be discourse surrounding chemical weapons, their stockpile, and use in the United States and internationally due to the increasing attention surrounding the issue.

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