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Understanding the Chemical, Biological, Radiological, Nuclear and Explosive (CBRNE) Defense Policy Making Process Through Historical and Current Event Analysis

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By

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Abstract

Understanding Chemical, Biological, Radiological, Nuclear, and Explosives (CBRNE) defense policies is critical in promoting safety to civilian and military personnel in the United States and globally. This thesis first examines a few of the most significant CBRNE policies in history, their place in the world today, and how their creation has impacted society. Utilizing two canonical policy making models– the "linear model" and the "policy stream model"– a range of case studies are analyzed to examine how decision-making behind CBRNE policy compares with other comparable policy domains, particularly non-CBRNE biotechnology innovation. The likelihood of proactivity and the potential influence of foreign affairs across cases were assessed. The results of these studies suggest that, compared with non-CBRNE biotechnology policies, CBRNE policies in the United States are similarly likely to be driven by foreign events (approximately half the time in the cases examined), but they were slightly more likely to be reacting to external events rather than proactively addressing possible risks (43% of CBRNE cases examined were proactive, compared to 50% of biotechnology cases). These suggestive patterns merit further research to test whether they hold over a wider scope of cases.

Introduction

With constantly evolving innovation in science and technology, the threat of a CBRNE (Chemical, Biological, Radiological, Nuclear, and Explosives) event remains significant. Just in the twenty-first century alone, major CBRNE events such as the Anthrax Incident (2001), the Syrian Civil War (2013) and the COVID-19 Pandemic (2020) have taken the lives of people all over the globe. Biodefense policy examines actions designed to reduce risks, prepare for, respond to, recover from, and counter biological threats and bioincidents [1].

Despite the growing importance of CBRNE threats, comparatively little attention has been given to how policies are created to address these threats. Are CBRNE defense policies created similarly to other technological innovation policies that develop over time, or are they affected more by foreign events outside of the United States? This analysis will work to examine first, if CBRNE defense policies are created in a similar process to other biological/chemical technologies or not. The idea that CBRNE policies are affected by external events such as international policies, international procedures, or international pressures will also be explored, as well as proactiveness of policies and policy-making models.

Research for this thesis explored the relationship between CBRNE events, policies, and innovation of related biological technologies. The results of the case study analyses indicate that CBRNE policies are affected by foreign affairs–but no more so than other technological innovation policies. However, CBRNE policies are particularly likely to be reactive to events rather than proactive. These conclusions provide an important baseline of knowledge regarding CBRNE defense policy that should be considered for future research. These findings also

emphasize the need to consider a more proactive approach to trying to protect citizens from the growing threat of a CBRNE event that is faced daily by people globally.

Motivation

An analysis of CBRNE policies is important to risk management for the future. With data and knowledge more available than ever, the threat of a CBRNE attack remains at a significantly high level and the difficulty for attackers lessens with time.

Life in a modern society promotes itself to certain precautions and actions being taken by government and military to protect soldiers and civilians from CBRNE attacks. Understanding how policy fits into this is critical for understanding the past, present, and future of CBRNE. How can the United States' approaches change to be more effective?

The use of CBRNE weaponry is not a new concept. Toxic weapons were described as being used in the Trojan War by Homer in the *Iliad* around twelve hundred BCE. Beyond that, it's said that Mongols used to catapult dead bodies contaminated with a plague towards their enemies, forcing them to retreat in the mid fourteenth century [2]. It's no secret that CBRNE was a harsh reality of warfare during World War One. Tear gas, chlorine gas, chloropicrin shells, mustard gas, and anthrax spores were used by multiple nations against their enemies [2].

Though horrific, this major event led to the arguably most famous policy regarding CBRNE defense. The Geneva Protocol, more properly known as the Geneva Protocol for the Prohibition of the Use in War of Asphyxiating, Poisonous or Other Gases, and of Bacteriological Methods of Warfare, was signed on June seventeenth, nineteen hundred twenty five [2].

Why then, if the idea of CBRNE defense use has been around for centuries, does it still hold to be such an unknown area of research to the public eye? From an early age, humans are taught to fear the unknown, to avoid the things that could hurt us. CBRNE warfare is certainly that… unknown to the general public and certainly harmful. But CBRNE is different, because it is dealing with pathogens, with cells that are alive, that can infect humans without them even knowing.

Take the Anthrax Event of two thousand and one that sent the United States into mass hysteria. Five deaths and seventeen illnesses took place because letters laced with anthrax were being sent via the United States mail service. According to the Federal Bureau of Investigation, "the ensuing investigation by the FBI and its partners - code-named 'Amerithrax' - has been one of the largest and most complex in the history of law enforcement" [3].

But CBRNE cannot be unknown to everybody. Many people study the field and even further, governments and militaries conduct research regularly on CBRNE defense. Surely it cannot be unknown to them as well. Government policies and regulations can admittedly be difficult to find for somebody in the general public, which for security reasons, is probably a good thing. That being said, attitudes towards CBRNE can often be seen in the news following specific events. Unfortunately, there is not much scholarly literature regarding the attitudes of governments towards CBRNE defense. This thesis aims to make connections between CBRNE events, policies, and innovation of other biological technologies.

Literature Review

This research begins with an examination of the history of CBRNE defense and related guidelines. The parameters of proactiveness and foreign influence will be focused upon in

following sections to further develop the idea of their impact on how and why a policy is fabricated relating to CBRNE defense.

Security Council 1373

The International Legal Framework against Chemical, Biological, Radiological, and Nuclear Terrorism was created by the United Nations Office on Drugs and Crime. This is a publicly available document that includes numerous implementation procedures for CBRNE security. Security Council resolution 1373 (as part of this framework) was adopted after the terrorist attacks of September eleven, two thousand one [4], making this a non-proactive policy that came after the CBRNE event. "The resolution notes with concern the close connection between international terrorism and illegal movement of nuclear, chemical, biological and other potentially deadly materials and in this regard emphasizes the need to enhance coordination of efforts on national subregional, regional and international levels in order to strengthen a global response to this serious challenge and threat to international security" [4].

Security Council resolution 1373, as part of the International Legal Framework against Chemical, Biological, Radiological, and Nuclear Terrorism, highlights ways in which states can prevent and suppress the financing of terrorist acts, requirements aimed to prevent terrorist acts, ways to bring terrorists to justice and to deal with international cooperation measures [4]. It can be inferred that these regulations provided states with new ways in which to mitigate the risks associated with CBRNE terrorism and events.

Section 4.3 (Implementation of the International Legal Instruments Against CBRN Terrorism) highlights the importance of implementation of CBRNE policy instruments [4]. Though the United Nations has created these guidelines, if nationals do not implement and adopt

these guidelines, they become ineffective. This is an interesting point because the risk management does not lie in the hands of the policy makers, but in the hands of the people they affect. This is a crucial point to risk mitigation and protection of society from CBRNE events. Safety here goes beyond the policy maker.

Geneva Protocol

The Geneva Protocol was signed on seventeen June nineteen hundred twenty five by the League of Nations and it established a protocol for the prohibition of the use in war of asphyxiating, poisonous or other gasses, and of bacteriological methods of warfare. This is an early example of CBRNE defense policy. The protocol states that the use of chemical and biological warfare is prohibited for use by the civilized world [5]. Thirty eight states originally signed the Protocol, France being the first. As of April twenty twenty-one, one hundred forty six states have become an included party [6].

Biodefense Summit

In two thousand nineteen, the United States Department of Health and Human Services published a Biodefense Summit Transcript given by Robert Kadlec. At the time, Kadlec was the Assistant Secretary for Preparedness and Response [7]. The transcript highlights many CBRNE events in United States history, some of which are below.

In the Revolutionary War, George Washington ordered the variolation of the Continental Army to protect the American soldiers from a smallpox epidemic in New England [7]. In eighteen hundred sixty three, during the American Civil War, a confederate physician was incarcerated for importing clothing from smallpox and yellow fever patients and selling them to Union Soldiers [8]. Later in the future, President Dwight D. Eisenhower was forced to change his

CBRNE strategy from deterrence to prevention in nineteen fifty six due to an experiment at Dugway Proving Ground in which a group of soldiers were infected with brucella on a simulated battlefield. Following, also in nineteen fifty six, President Eisenhower advised a biodefense policy in order for the United States to be prepared to use bioweapons in a manner that would be advantageous [7]. Similarly, before President Richard Nixon left office, he issued Executive Order 11490. This tasked the Secretary of Health and Education Welfare with the responsibility of developing chemical and biological defenses for America [7].

Biological Warfare and Bioterrorism

Biological Warfare and Bioterrorism: a Historical Review by Stefan Riedel includes multiple different tables important to this analysis development. Table 1 gives examples of biological and chemical warfare use during the past two thousand years. Some highlights from this include the seventeen hundred sixty three use by British colonists to Native Americans, the American Civil War, World War One and World War Two [9]. Table 2 gives examples of biological warfare programs during World War Two, which included the use by the United States of chemical herbicides and Anthrax [9].

Table 1: Historical Examples of CBRNE Warfare, from Biological Warfare and Bioterrorism: a Historical Review by Stefan Riedel [9]

Time	Event
600 BC	Solon uses the purgative herb hellebore during the siege of Krissa
1155	Emperor Barbarossa poisons water wells with human bodies in Tortona, Italy
1346	Tartar forces catapult bodies of plague victims over the city walls of Caffa, Crimean Peninsula (now Feodosia, Ukraine)
1495	Spanish mix wine with blood of leprosy patients to sell to their French foes in Naples, Italy
1675	German and French forces agree to not use "poisones bullets"
1710	Russian troops catapult human bodies of plague victims into Swedish cities
1763	British distribute blankets from smallpox patients to Native Americans
1797	Napoleon floods the plains around Mantua, Italy, to enhance the spread of malaria
1863	Confederates sell clothing from yellow fever and smallpox patients to Union troops during the US Civil War
World War I	German and French agents use glanders and anthrax
World War II	Japan uses plague, anthrax, and other diseases; several other countries experiment with and develop biological weapons programs
1980–1988	Iraq uses mustard gas, sarin, and tabun against Iran and ethnic groups inside Iraq during the Persian Gulf War
1995	Aum Shinrikyo uses sarin gas in the Tokyo subway system

Table 2: Examples of Biological Warfare During World War II, from Biological Warfare and Bioterrorism: a Historical Review by Stefan Riedel [9]

Nation	Numbers of workers (estimated)	Focus
Germany	100–200	Offense research forbidden
Canada	small	Animal and crop diseases, rinderpest, anthrax
United Kingdom	40–50	Animal and crop diseases, anthrax, foot and mouth disease
Japan	several thousand	Extensive; official information suppressed by a treaty with USA in which all charges for war crimes were dropped for exchange of information from experiments
Soviet Union	several thousand	Typhus, plague
USA	1500–3000	Chemical herbicides, anthrax (started too late to be important)

Literature Evaluation

Policies such as the Geneva Protocol, were put in place to prevent CBRNE events, but yet have been broken globally plenty of times, specifically in the cases of the Holocaust (1941) and Italy's invasion of Ethopia (mid-1930s) [10]. In these cases, the preventative policy may not have been effective in stopping the CBRNE event. Adversary leaders still launched CBRNE attacks, in violation of the Geneva Protocol.

Security Council Resolution 1373 was created in two thousand one following the terrorist attacks of September eleventh [4]. This is a non-proactive policy that resulted from a CBRNE terror event.

From the analysis, it is clear that proactive CBRNE policies have not been entirely successful at preventing CBRNE attacks. This is clear by the literature presented regarding the Geneva Protocol, instances of violating the Geneva Protocol, evolution of the biodefense policy, and the history of CBRNE agents. Oftentimes, CBRNE policies are non-proactive in nature,

happening after the event has taken place. This can be seen in the literature presented regarding the United Nations Legal Framework and the transcript from the United States Department of Health and Human Services.

The International Legal Framework against Chemical, Biological, Radiological and Nuclear Terrorism, as created by the United Nations Office on Drugs and Crime is an important document for CBRNE policy standardization and implementation. The Security Council resolution 1373 provided new ways for governments to mitigate CBRNE risks and Section 4.3 of the document gave guidelines for implementation which show that safety goes beyond the original policy maker [4].

This entire module is very detailed and deliberate in providing the legal/policy background in which the United Nations follows. This makes it an exceptionally useful document when studying standards. The document also makes it clear that the risk management for CBRNE does not lie in the hands of the policy makers, but in the hands of the people that the policies affect, for they are the ones who are implementing. This is a crucial point to risk mitigation and protection of society from CBRNE threats. As an important critique with this piece of literature; it is published by the United Nations (unodc.org), a credible government source, yet includes the statement, “This publication has not been formally edited” [4]. This leads one to further question the review process that these guidelines are going through before publication.

The Geneva Protocol of 1925 declares, “...this prohibition shall be universally accepted as a part of International Law, binding alike the conscience and practice of nations” [5]. This is a bold claim made in the document, but questions remain. How can this be true if many nations

across the globe aren't signatories and the protocol continues to be under the possibility of violation?

Though the Geneva Protocol was held as one of the first international CBRNE policies, it has been violated a number of times since nineteen hundred twenty five. Adolf Hitler violated the Geneva Protocol during World War Two when he used hydrogen cyanide (Zyklon B) in place of water in showers to kill prisoners in his concentration camps. In the mid-nineteen hundred thirties, Italian soldiers used mustard gas in aerial raids against adversaries, civilians, and medical personnel in their invasion of Ethiopia under the leadership of Benito Mussolini.

The presidential legislatures outlined in the Evolution of Biodefense Policy transcript are significant because they promote the collection of CBRNE weapons by the United States, which may be seen as contradictory to the Geneva Protocol and other related policies. As a critique of this reading, it is not a peer-reviewed journal article, but the author is a well-known expert on the topic and qualified to give information. The source also does not provide much purpose behind the transcript or why the summit was taking place.

Biological Warfare and Bioterrorism: a Historical Review by Stefan Riedel is overall a very resourceful piece of literature. It is a peer-reviewed journal article written by an assumed expert. The article gives a clear abstract, motivation, and recommendations for further presentation and research. The literature also recommends that the medical community and public further educate themselves on CBRNE threats [9].

Throughout history, the United States has used CBRNE as both an offensive and defensive strategy. This is best presented in the transcript provided by the United States Department of Health and Human Services. It's important to note that in an offensive frame,

CBRNE weapons can be very successful in accomplishing a goal. In a defensive frame, CBRNE agents can be nearly impossible to defend against. And in the frame of the victim, CBRNE attacks can be devastating.

Many CBRNE policies regarding warfare/terrorism are non-proactive, as is seen in the policies following September 11th, 2001. Proactive and preventative measures are usually created on a smaller scale, in examples such as in regard to workplace safety. The Geneva Protocol is an example of a preventative policy measure that is larger in scale, as it is recognized internationally.

More specifically, risk management in the United States in the area of CBRNE defense has changed over time, having used CBRNE both offensively and defensively. There have been events in which a window of opportunity presented itself to adversaries due to vulnerabilities in policy and readiness. Policies related to CBRNE and biological technology that were studied here are able to be traced into following certain policy models. Though created at different times in history, by different people, under different circumstances, they tend to follow specific patterns into fruition. Two of these models can be found in the *Theory* section, and how policies such as the Geneva Protocol and Security Council 1373 fit into them.

In general, CBRNE events and policies have contributed to the United States' risk and casualty mitigation strategies. Whether offensively or defensively, CBRNE mechanisms can be successful in achieving the goals of a nation. These goals could be to either protect its citizens by prevention or protect their citizens by reaction. As stated previously, many CBRNE policies regarding warfare/terrorism are the opposite of proactive in nature, meaning that the policy is created in response to an event taking place. Evaluating the literature above also alludes to the

idea that CBRNE defense policy in the United States historically tends to be influenced on some level by foreign affairs. This will be expanded upon in further detail later in this thesis.

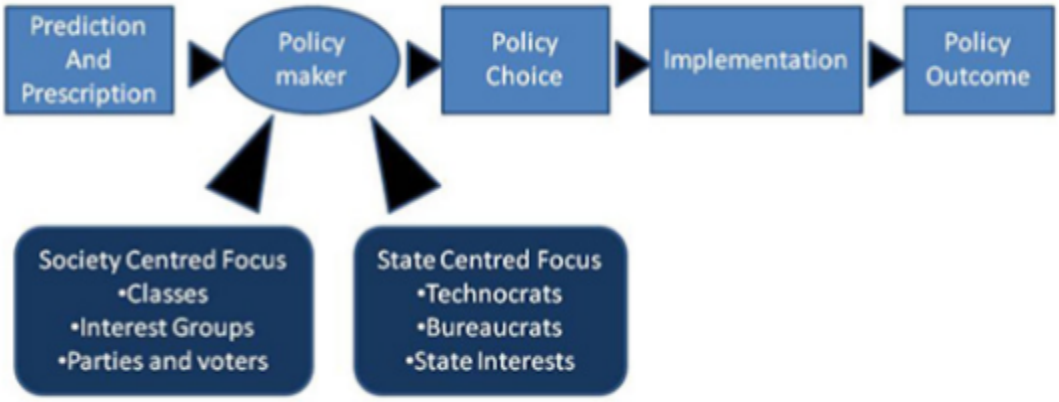
Theory

Policy Models

Policy models are important to understand when attempting to create a framework for policy implementation. They are included in this analysis to show that both CBRNE and non-CBRNE policies are created in similar ways, and their processes can be mapped out similarly using these models. For this analysis, four different examples of policies were analyzed and related back to the policy models. Their relation was conditional on a policy actually occurring, rather than a recommendation or action. These are outlined below and in the results section. Understanding these policy models and their effects on CBRNE defense is important to realizing how and why these policies are implemented.

The linear model of policymaking describes a process in which policy makers predict and prescribe an issue that they believe is to be addressed by a regulation, make a policy decision, and then the new policy is implemented with an outcome to be discovered in the future. It's understood that the policy makers would usually take either a society-centered focus or a state-centered focus. This linear model of policymaking was coined by Lasswell in 1951 and further developed by Meier in 1991 [11].

Figure 1: Linear Model of Policymaking from Policy Models (Lasswell, Meier) [11]



Based on case study analysis, it can be said that the Geneva Protocol is an example of the linear policy making model. Following World War I, many world leaders recognized the great danger that biological and chemical warfare would inflict on people all over the world. The international community was suddenly very aware of the "human-inflicted mass destruction [12]" that was possible. Therefore, at the Geneva Conference of nineteen hundred twenty five, the League of Nations developed what was to be known as the Geneva Protocol. A choice was made at the convention and the policy was implemented by its signatories [12]. This, therefore, is a clear representation of the linear model of policy making.

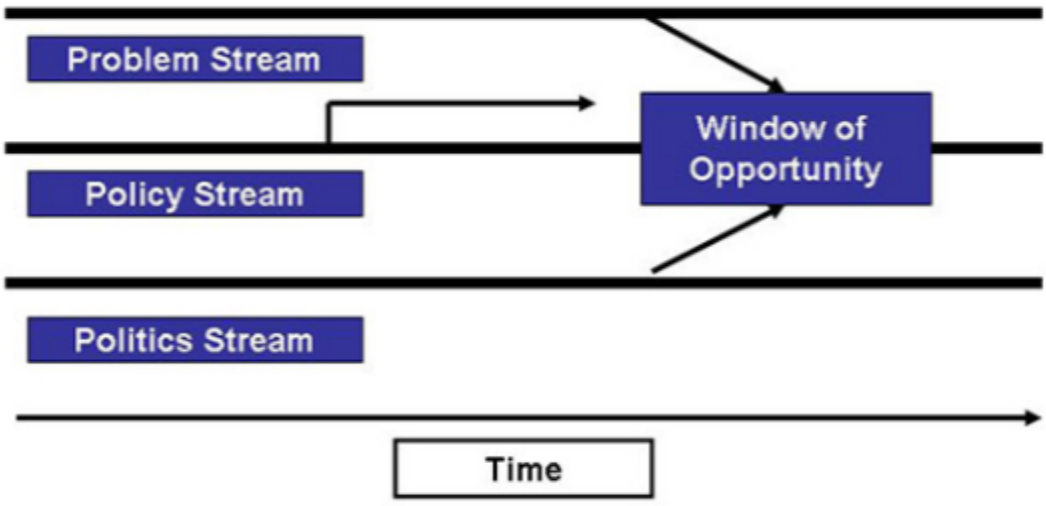
A similar policy development approach was also taken regarding the regulation of biotechnology for use in non-warfare contexts. In nineteen hundred eighty six, President Ronald Reagan approved the release of the Coordinated Framework for the Regulation of Biotechnology. This was expected to reduce public concerns as it was to "ensure a consistent Federal Government approach" to biotechnology [13]. According to the Ronald Reagan Presidential Library and Museum, this framework came about as a reformulated approach to the nineteen hundred eighty four framework due to public comments of concern [13]. The Office of

Science and Technology Policy highlights this in their twenty-six June nineteen hundred eighty six framework publication. “Of the comments FDA received on the policy statement, most favored the policy statement; some requested further clarification and guidance. The current action constitutes FDA’s final policy statement which has been revised in response to the comments” [14].

Reagan’s Framework for Biotechnology can also be said to have followed a linear model of policymaking as described by Lasswell and Meier [11]. The administration recognized the need for a more detailed policy following comments from the framework released in nineteen hundred eighty four. Considering both the interests of the state and the public, the Reagan Administration made a policy choice to republish a biotechnology framework and implement it into participating agencies, including Biotechnology Science Coordinating Committee, the Department of Agriculture, the Environmental Protection Agency, and the Food and Drug Administration, among others [14].

As stated above, Security Council Resolution 1373 put the responsibility of CBRNE safety in the hands of the user, rather than the policy maker. This is significant because it shows the government’s involvement and attitude towards CBRNE policy. Security Council Resolution 1373 can be said to have been formed out of a policy window, as coined by Kingdon’s Policy Streams Model [11]. The terrorist attacks on September 11, 2001 gave way to a “Problem Stream,” a desire for a more centralized military approach [15] gave way to a “Politics Stream,” and reliance on military efforts of enforcement [15] gave way to a “Policy Stream.”

Figure 2: Policy Streams Model from Policy Models (Kingdon) [11]



This section of the thesis aimed to explore CBRNE policies and how their implementation follows existing models in literature. Models such as these are used for analysis in a variety of industries because they explicitly and deliberately convey a process. In this journey of discovering how and why CBRNE policies are created, this model-based approach seems critical in acknowledging, as it provides a recognized, secondary parameter to examine in conjunction with the primary parameters of proactiveness and foreign influence.

Proposed Hypothesis

Are CBRNE defense policies created similarly to the technological innovation policies that develop over time, are they affected by external events outside of the United States, or are they affected by a combination of these? This analysis will work to examine first, if CBRNE defense policies are created in a similar fashion to other biological/chemical technologies or not. If the processes are different, the idea that CBRNE policies are affected by external events such as international policies, international procedures, or international pressures will be explored.

It is hypothesized that American CBRNE policies are non-proactive in nature upon initial implementation, as they are created as a response to a specific CBRNE event. This idea will be explored through case study analysis of CBRNE policies, the events surrounding them, and historical timelines. Policies were studied in both the CBRNE and technological innovation fields to determine if the majority of policies could be considered proactive or not.

It is hypothesized that American CBRNE policies are affected by international external factors. This is inferred based upon research of policies, military operations, policy models, overseas tactics, and other related concepts. Research for the literature review found a lot of cases of policies from the United Nations. With China and Russia being continuous threats to the United States and the free world, it is inferred that CBRNE policies in these countries would be most likely to influence American policies.

Methods

Many CBRNE policies regarding warfare/terrorism are the opposite of proactive, in that the event happens before a policy is created. Proactive and preventative measures are taken usually on a smaller scale, regarding the workplace, etc..

Case Studies

Through case study analysis, relationships were determined between CBRNE defense strategies, public attitudes, and the policies made regarding them. The first of which was to determine how specific CBRNE policies were established using various models of policy making. From there, a case study was done regarding Dugway Proving Ground and its operations, including Bellwether, Big Itch, and accidental anthrax shipments. Also included is an analysis of the attitudes taken by the United States Federal Government with regards to the use

of CBRNE defense tactics overseas. Specifically studied here are the two thousand thirteen use of chemical weapons in Syria and President Obama's response, as well as the two thousand twenty two threat of chemical weapons in Ukraine and President Biden's response. Operation Warp Speed and the FDA's 510(k) and Emergency Use Authorization implementation during the COVID-19 Pandemic was also studied.

Research was conducted first by branching off of the above literature review. The general internet was searched as well as the Rochester Institute of Technology Wallace Library Database, and Google Scholar. A large portion of the start of the results section can be attributed to coursework practiced with Dr. Nathan Claes, in the Rochester Institute of Technology course entitled *Readings in Public Policy.* It was then that policy models were discussed and learned, and this was used as the basis for the methodologies sections of the results.

Also used heavily in case study research were federal government websites such as those attributed to the White House, past presidential administrations, military bases, and government libraries. Additionally many news articles were examined to determine specific events and feelings regarding certain events to aid in case study analysis.

An in-depth study was conducted on Presidential speeches and interviews as well. Many hours were spent watching and rewatching videos after a search of "Obama on chemical weapons," "Obama on bio innovation." The same tactics and methodologies were conducted in regards to President Biden. Many videos were also viewed regarding CBRNE accidents on American military bases, which came about from a brief search of the United States' use of CBRNE.

Analysis and Parameters

Overall, thirteen different policies and reactions were studied regarding CBRNE and technological innovations. The results of the study were then summarized in tables and graphs. These figures show the differences in policies and how they contribute to the overall consensus of the paper.

In all of the research done, the thirteen different policies studied were chosen based on three parameters. These parameters helped to establish dependent variables among cases and create a limited scope. The cases to be chosen first had to be policies or actions created by the United States government. The cases also had to be either related to CBRNE or to biological or chemical innovations. Lastly, the cases had to be policies or actions that occurred within the last two centuries. Though not intentional, none of the policies/actions studied are more than one hundred years old.

Table 3: Case Studies by Type

Type of Cases	**Number of Cases Studied**
CBRNE Only Type	7
CBRNE and Technological Innovation	2
Technological Innovation Only	4
Total	**13**

Results

Incidents at Dugway Proving Ground

An incident in two thousand sixteen and the United States' government response demonstrates once again the attitude towards CBRNE safety. Let us go back a few years. As previously noted, CBRNE defense tactics were utilized greatly in World War One. So as World War Two approached, the United States was in search of a place in which they could easily test protective equipment and powerful weapons. And thus, in a remote area of the Utah desert, Dugway Proving Ground was established in nineteen forty two [16]. Many things took place over the years at Dugway and other related United States testing locations. Investigating these incidents helps to provide contextual evidence for United States attitudes towards CBRNE defense tactics used domestically.

Operation Bellwether included multiple tests and experiments regarding the use of mosquitos as weapons in the nineteen fifties. Similarly, Operation Big Itch tested if fleas could be a viable use of entomological warfare against the Japanese [15]. Presently, Dugway seems to boast an interesting mix of being both very hidden from, and very visible to the public eye. It is situated on about eight hundred acres of remote desert, yet hosts events for the local Utah community as well. On March first, twenty twenty two, Dugway celebrated its eightieth anniversary of operation [17].

But Dugway didn't always follow the most regimented procedures to ensure policy standards were met. On January fifteenth, two thousand sixteen, The New York Times reported that Brigadier General William E. King IV, who commanded Dugway for two years beginning in two thousand nine, had allowed almost two hundred other laboratories to receive shipments of

live anthrax from the Proving Ground. An initial review by the Pentagon concluded that the problems were mostly procedural and showed that insufficient testing was done to conclude that the anthrax samples were no longer alive and harmful [18].

It is from these examples that an attitude towards CBRNE testing can be determined. Dugway was established as a way for the United States to safely and securely test CBRNE defense tactics. Although the centralized government was involved, the safety remained largely in the hands of the people that were on the ground. In most cases, that is/was enough for the nation. But on rare occasions, safety was compromised, as such with the anthrax shipment issue by Brigadier General King IV.

There was no new policy emergence from the events that occurred at Dugway. In looking at Kingdon's Policy Streams Model, it can be said that the live anthrax incident was a Problem Stream, but neither a Policy Stream nor a Politics Stream occurred here, so a Policy Window was not opened. It's interesting to see that the United States has been quite adamant in implementing policies in regards to others' use of CBRNE, but made little policy efforts when one of their own released dangerous anthrax.

Operation Warp Speed

In this analysis, it's also important to look at how CBRNE defense policies are created in the United States. In the example of Operation Warp Speed, Kingdon's Policy Streams Model can be applied here. The COVID-19 Pandemic began in February 2020 when the SARS-CoV-2 virus infected and spread throughout the globe [19]. Operation Warp Speed was developed during the Trump Administration and it aimed "to deliver 300 million doses of a safe, effective vaccine for COVID-19 by January 2021, as part of a broader strategy to accelerate the

development, manufacturing, and distribution of COVID-19 vaccines, therapeutics, and diagnostics" [20].

Operation Warp Speed is an example of Kingdon's Policy Stream model because it resulted due to a Problem Stream, Policy Stream, and Politics Stream. After the COVID-19 Pandemic had begun, many lives were being lost, the economy was suffering, and infections were rising tremendously [19]. The COVID-19 Pandemic is the "Problem Stream." Vaccines would typically have to go through a long and detailed process of testing in order to gain FDA approval to be used by the public. In this case, so many people were dying that the policies needed to be changed for the emergency situation. This issue would be the "Policy Stream." For Operation Warp Speed to work, it also took cooperation and teamwork between different government agencies and private companies (that were manufacturing the vaccine). The Department of Health and Human Services and the Department of Defense rolled out Operation Warp Speed together [20]. This teamwork and coordination would be the "Politics Stream."

Security Council Resolution 1373 and Operation Warp Speed would both be considered CBRNE policies in the United States that came about in a way that mirrors Kingdon's Policy Window Model. The Live Anthrax incident at Dugway Proving Ground would be an example of an event that created a "Problem Stream," but due to a lack of a "Policy Stream" and "Politics Stream," a Policy Window was never opened.

Attitudes Towards Foreign Use of CBRNE

Shifting gears now to international affairs and America's attitude towards them, the thesis will examine first the Obama Administration's, followed by the Biden Administration's responses to the use of CBRNE globally. According to the United States Department of State, "...

on the early morning of August 21, 2013, the Assad regime released the nerve agent sarin on its own people in the Ghouta district of Damascus, killing more than 1,400 Syrians, many of them children" [21]. In the age of technology and social media, photos and videos of these victims traveled around the world. It was a horrific sight to be seen and many were saddened.

On September tenth, two thousand and thirteen, President Barack Obama addressed Americans regarding the conflict in Syria. Regarding the August twenty first incident, he said, "On that terrible night, the world saw in gruesome detail the terrible nature of chemical weapons, and why the overwhelming majority of humanity has declared them off-limits – a crime against humanity, and a violation of the laws of war" [22]. Obama references the 1997 agreement approved by the United States Senate that prohibits the use of chemical weapons for "98 percent of humanity" [22]. The speech continues to explain that these rules were indisputably broken and Assad's behavior was unacceptable.

According to National Public Radio (npr), President Obama said previously in 2012 that the use of chemical weapons in Syria would not be tolerated, and famously uttered that the then theoretical event would be "a red line for us" [23]. But, in the September speech described above, after the attack had occurred, Obama urged that Congress should authorize any military action taken. There seemed to be little support in Congress for military intervention, and the United States never took direct action in Syria under Obama's leadership [23].

"We'll restore science to its rightful place" President Obama spoke in his two thousand nine Inaugural Address. But what did this mean? What is science's "rightful place?" According to The Obama White House, it was "a strong commitment to basic and applied research, innovation, and education, … restoring integrity to science policy, … and making decisions on

the basis of evidence, rather than ideology" [24]. On June twenty first, two thousand sixteen, the Office of the Press Secretary released an Impact Report entitled *100 Examples of President Obama's Leadership in Science, Technology, and Innovation*. It detailed specific examples that the White House felt showed the president's attitude towards science and technology and their innovation. In this, "policy" is mentioned a few times, but with very few specific instances of policies actually controlling or changing scientific innovation. Many policies seem to be aimed towards education, minorities, immigration, and training, which is expected from Obama's Democratic White House. Twelve of these one hundred examples are classified as "engaging in the world and ensuring national security" [24], which would be the most relating to the context of this paper. These twelve deal with open government partnerships, strengthened international cooperation, deployment of scientists for diplomacy, and enhancing biosafety. In October two thousand and fifteen, the Obama Administration released recommendations for action aimed at ensuring adequate measures to prevent the misuse of biological material [24].

To summarize the ideas presented in the times of the Obama Administration, in two thousand thirteen, Obama recommended that the United States Senate act in regards to CBRNE use in Syria, and in two thousand fifteen, his Administration released recommendations to work towards better biosecurity in the United States. Both instances dealt with CBRNE safety. Both instances dealt with the safety of human lives. Both instances resulted in *recommendations* from the Obama White House.

According to CBS News, Russia launched its full invasion of Ukraine early in the morning on February twenty fourth, two thousand twenty two, when one hundred missiles were fired on Ukraine, as well as three main ground invasions [25]. As the War in Ukraine rages on, to this day, Russia has not employed chemical weapons, though many sources believe the country

will. The destruction of a Ukrainian farm was thought to have been a chemical weapon (only to be proved as the explosion of a facility housing ammonium nitrate) [26].

On March Eleventh, two thousand twenty two, CNN reported on the Biden Administration's attitude towards Russia's use of CBRNE defense in Ukraine. President Biden famously announced that "Russia [would] pay a severe price if they use chemicals" [27]. Additionally in the report, press secretary Jen Psaki declined to speculate if there was, at the time, a significant sign of the nearing possibility of the use of CBRNE in Ukraine, though she was quoted as saying, "they have a large biological and chemical weapons program. So it's a pattern, but they also have the capacity" [27].

As of March Sixteenth, two thousand twenty two, the Biden Administration had given a total of two billion dollars in assistance to Ukraine in their fight against Russia, including an eight hundred million dollar security assistance package. This package included thousands of weapons, defense systems, aircrafts, and protective equipment [28].

In two thousand twenty one, President Biden announced a three hundred twenty five billion dollar research and innovation plan as part of his over two trillion dollar infrastructure investment proposal. Biden specified that the plan was to "boost America's innovative edge in markets where global leadership is up for grabs – markets like battery technology, biotechnology, computer chips, clean energy, the competition with China in particular" [29].

The Biden Administration has given millions of dollars to support Ukraine. In regards to biotechnology innovation, President Biden proposed billions of dollars to be spent on research and development. In contrast to the Obama Administration's actions, described above, the Biden Administration threw a lot of money at CBRNE defense abroad, and also at biotech innovation.

Biotechnology Policies

As originally stated, the goal of this analysis is to determine if CBRNE policies are similar to other biological and chemical technology policies and how the innovation of both entities are similar or different. To explore this further, it's important to look at current biotechnology policies and procedures in the United States and compare them to what has already been noted about CBRNE above. The first important idea to note from research is that specific policies on biotechnology are difficult to come by, as the government seems to provide limited examples in which it has created a law regarding biotechnology innovation. Much of the policies here seem to be procedural based.

One such policy is the United States Food and Drug Administration's 510(k) procedures regarding medical devices. Medical devices can be classified here as biological innovations. The FDA requires that device manufacturers must send in their intent to market a device to the FDA at least ninety days prior, which is known as Premarket Notification, or 510(k) [30]. This policy is controversial in the biomedical community, as it allows for medical devices to forego a detailed FDA approval process. If the medical device is similar to an already existing device, the product can forego Premarket Approval from the FDA [31]. This has been beneficial to many medical devices such as joint replacements.

Whereas Operation Warp Speed looked to expedite the approval process for COVID-19 vaccines, the FDA's 510(k) process also looks to expedite the approval process for medical devices. Where this connection became pertinent is during the COVID-19 pandemic, where the FDA also used the 510(k) approval process with the Emergency Use Authorization (EUA) to make ventilators more readily available [32]. This is an example of a time when CBRNE policy and biotechnology policy not only allowed for similar outcomes, but were used in the same

manner. Both Operation Warp Speed and the FDA's 510(k) process provided similar outcomes and were used during the COVID-19 Pandemic.

National Strategy for CBRNE Standards

The Department of Homeland Security and Commerce, housed under the White House Office of Science and Technology Policy, currently operates by guidelines set in their National Strategy for CBRNE Standards. This National Strategy describes the federal goals and vision for prioritization, establishment, coordination and implementation of CBRNE equipment standards in order to protect workers from attack. The Strategy concludes that certain goals must be achieved in order to ensure proper safety standards for Americans that work with CBRNE equipment. In creating this strategy, the government recognized current gaps existing in standards and policies, and aimed to facilitate growth and change in the CBRNE community [33].

Released in two thousand eleven by the Subcommittee on Standards, the strategy set forth had a goal of achievement by twenty twenty. The six goals outlined in the thirty-two page document were as follows: 1) establish an interagency group for CBRNE standards to promote coordination across all levels of government, 2) facilitate development of CBRNE equipment performance standards and use of standards, 3) facilitate use of interoperability standards for CBRNE equipment, 4) promote long-term standardization procedures to improve response and readiness, 5) establish voluntary CBRNE training and certification standards that promote policies, 6) establish CBRNE equipment test and evaluation [34]. To summarize, the overall goal here was to mitigate risks related to workplace CBRNE and overall safety of the American public to which it affects.

In response to this strategy and to begin work to achieve these goals, the National Institute of Standards and Technology (NIST) and the Office of Law Enforcement Standards (OLES), housed under the U.S. Department of Commerce, hosted a convergence meeting at which a plan was set in place to meet the six goals outlined above, with special emphasis given to Goal Five: *CBRNE Training and Certification Standards.* At this meeting, it was determined that with this strategy plan in place, there were three projected outcomes: 1) greater confidence in user understanding and use, 2) increased capabilities in responding to CBRNE incidents, 3) established framework to be maintained and continued. It was also concluded that training standards were to include separate capability levels, preparedness procedures, and learning modules. An extensive list of sample response and recovery standards were published, and federal agencies were called upon to be held responsible for CBRNE operational leadership [35].

This policy was created by the mechanism of the Linear Model proposed by Meier in nineteen ninety-one. This model of policymaking suggests that the policy is made in four stages: policy actors make predictions about issues to be addressed, a policy choice is made, the policy is then implemented, and the outcome is observed [36]. This can be said regarding the National Strategy for CBRNE Standards, as the Subcommittee on Standards identified an issue of CBRNE workplace safety, developed a policy, implemented the policy, and therefore expected an outcome to ensue. The policy was implemented in a relatively straightforward way that would fit into this Linear Model of Policymaking.

Analytical Results

Results of the case studies are summarized in the tables below. These tables were then translated into graphs, which are used to show that, of the thirteen cases studied, the majority of the policies/reactions were affected by foreign affairs. To get to the root of the hypothesis and

questions proposed, an analysis was also done comparing the effects of foreign nations on CBRNE and technological innovation policies. It is seen here that, of the cases studied, both types of policies were affected by foreign affairs about 66.6% or ⅔ of the time.

Table 4: Case Study Results Summary, by year of occurrence, for CBRNE Policies

Policy or Government Response	*Summary of Policy or Response*	*Year*	*Affected by Foreign Affairs*	*Paired Event or Reasoning*	*Government Agency*	*Proactive or Not Proactive Relative to Event*	*Policy Method, if any*
Change in Strategy from Deterrence to Prevention	An experiment at Dugway Proving Ground in which a simulation led to a brucella outbreak, led Eisenhower to change CBRNE strategy from deterrence to prevention to avoid another accidental infection	1956	No	Infection of soldiers at Dugway Proving Ground	Eisenhower Administration	Not Proactive	
Policy for US to be prepared to use bioweapons offensively	Biodefense policy for the United States to be prepared to use bioweapons in a manner that was advantageous	1956	Yes	Cold War Era	Eisenhower Administration	Proactive	
Executive Order 11490	Tasked the Secretary of Health and Education Welfare with the responsibility of developing chemical and biological defenses for the United States	1969	Yes	Cold War Era	Secretary of Health and Education Welfare	Proactive	

Review of Anthrax Leak at Dugway Proving Ground	Review conducted by the Pentagon, which concluded that the problems at Dugway were procedural and insufficient testing was done on anthrax samples	2010s	No	Release of Live Anthrax at Dugway Proving Ground	Pentagon	Not Proactive	
National Strategy for CBRNE Standards	Describes the federal goals and vision for prioritization, establishment, coordination and implementation of CBRNE equipment standards in order to prevent employees from attack	2011	No	Growth and Change in the United States, Protection of CBRNE Workers	Department of Homeland Security and Commerce, White House Office of Science and Technology Policy, Subcommittee on Standards	Proactive	Linear Model
Obama's Reaction to Syrian Chemical Weapon Use	Obama addressed the American people in a speech, said that the use of chemical weapons would not be tolerated; also urged Congress to take military action in Syria which, did not happen	2013	Yes	Chemical Weapon Use in Syria	Obama Administration	Not Proactive	
Biden's Reaction to Russia's Invasion of Ukraine	Biden addressed Americans in a speech in which he condemned Russia's potential chemical weapon use; gave two billion dollars in assistance to Ukraine	2022	Yes	Russian Invasion of Ukraine	Biden Administration	Not Proactive	

Table 5: Case Study Results Summary, by year of occurrence, for Technological Innovation Policies

Policy or Government Response	*Summary of Policy or Response*	*Year*	*Affected by Foreign Affairs*	*Paired Event or Reasoning*	*Government Agency*	*Proactive or Not Proactive in Relation to Event*	*Policy Method, if any*
Coordinated Framework for the Regulation of Biotechnology	Meant to ensure a consistent Federal Government approach to biotechnology and a reformulated approach to the 1984 framework	1986	No	In Response to Public Concern of FDA	Office of Science and Technology Policy, Reagan Administration	Not Proactive	Linear Model
510(k) Premarket Notification Device Approval Procedure	Premarket approval process that allows for medical devices to be classified as biological innovations; if the medical device is substantially similar to an already existing device, it can forego Premarket Approval from the FDA	1997	No	For Medical Device Approval in the United States	US Food and Drug Administration	Not Proactive	
100 Examples of President Obama's Leadership in Science, Technology, and Innovation	Impact Report that detailed specific examples that the White House felt showed the president's attitude towards science and technological innovations	2016	Yes and No	Technological Innovation Global Competition and Protection	Obama Administration	Proactive	

Biden's Research and Innovation Plan	A three hundred twenty five billion dollar research and innovation plan as part of a two trillion dollar infrastructure investment proposal to push America's innovation in competition with China	2021	Yes and No	Technological Innovation Global Competition and Protection	Biden Administration	Proactive	

Table 6: Case Study Results Summary, by year of occurrence, for Both CBRNE and Technological Innovation Policies

Policy or Government Response	*Summary of Policy or Response*	*Year*	*Affected by Foreign Affairs*	*Paired Event or Reasoning*	*Government Agency*	*Proactive or Not Proactive in Relation to Event*	*Policy Method, if any*
Operation Warp Speed	Aimed to deliver millions of doses of vaccine for COVID-19 to Americans while accelerating the development of other COVID-19 equipment	2020	Yes (global pandemic) and No (made by US for US)	COVID-19 Pandemic	Trump Administration, Department of Health and Human Services, Department of Defense	Not Proactive	Policy Stream
510(k) Approval Procedure for Use with Emergency Use Authorization during COVID-19 Pandemic	Allowed for FDA to make ventilators more readily available during COVID-19 Pandemic	2020, 2021	Yes (global pandemic) and No (made by US for US)	COVID-19 Pandemic	US Food and Drug Administration	Proactive	

Table 7: Foreign Affairs Influence by Case Type

Case Type	Percent of Cases
CBRNE Only Type	4 of 7 (57%)
CBRNE and Technological Innovation	2 of 2 (100%)
Technological Innovation	2 of 4 (50%)

Table 8: Proactivity by Case Type

Case Type	Percent of Cases
CBRNE Only	3 of 7 (43%)
CBRNE and Technological Innovation	1 of 2 (50%)
Technological Innovation Only	2 of 4 (50%)

Figure 3: Results of CBRNE versus Non-CBRNE Policies/Actions Influenced by Foreign Affairs

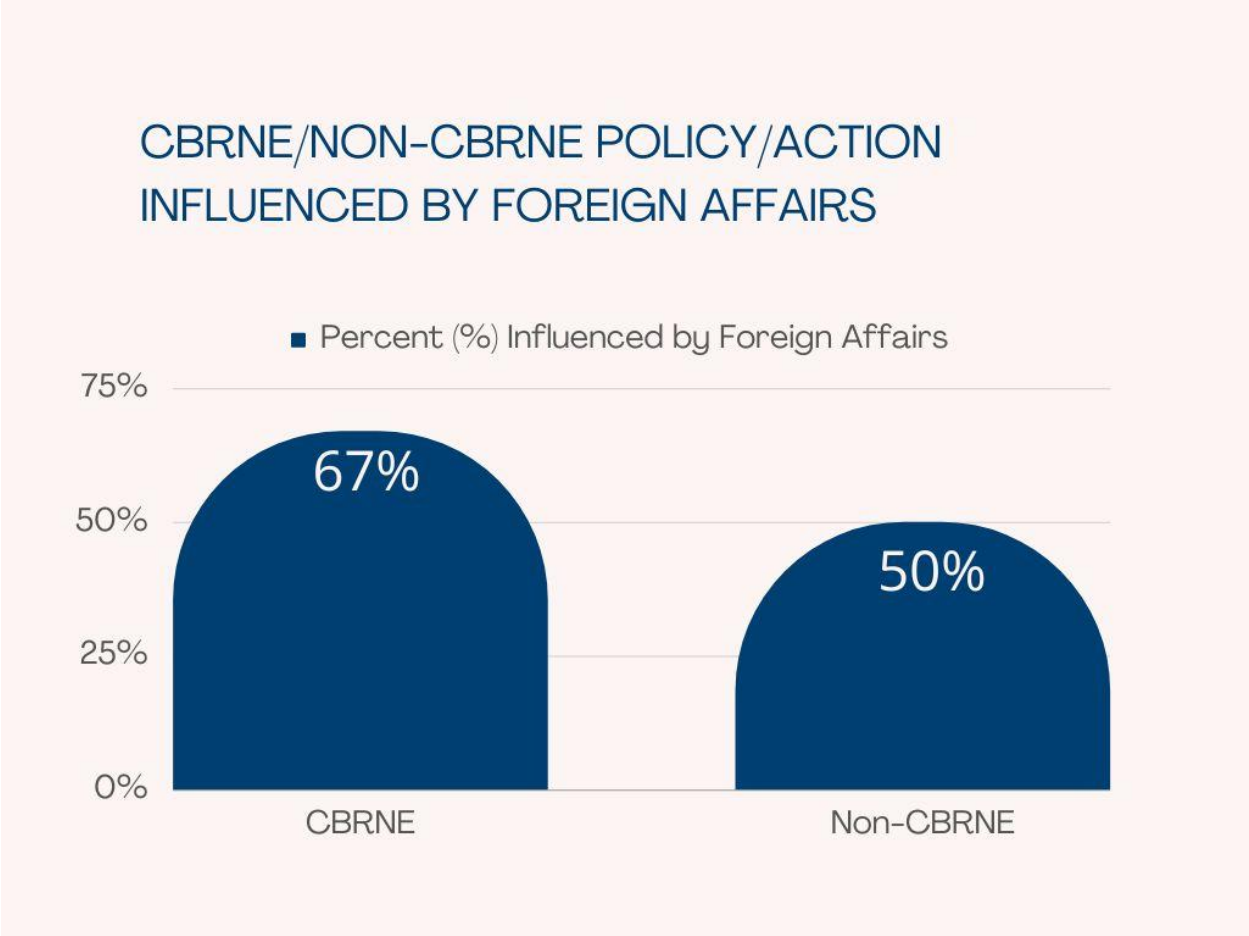


Figure 4: Results of CBRNE versus Non-CBRNE Policies/Actions Proactivity

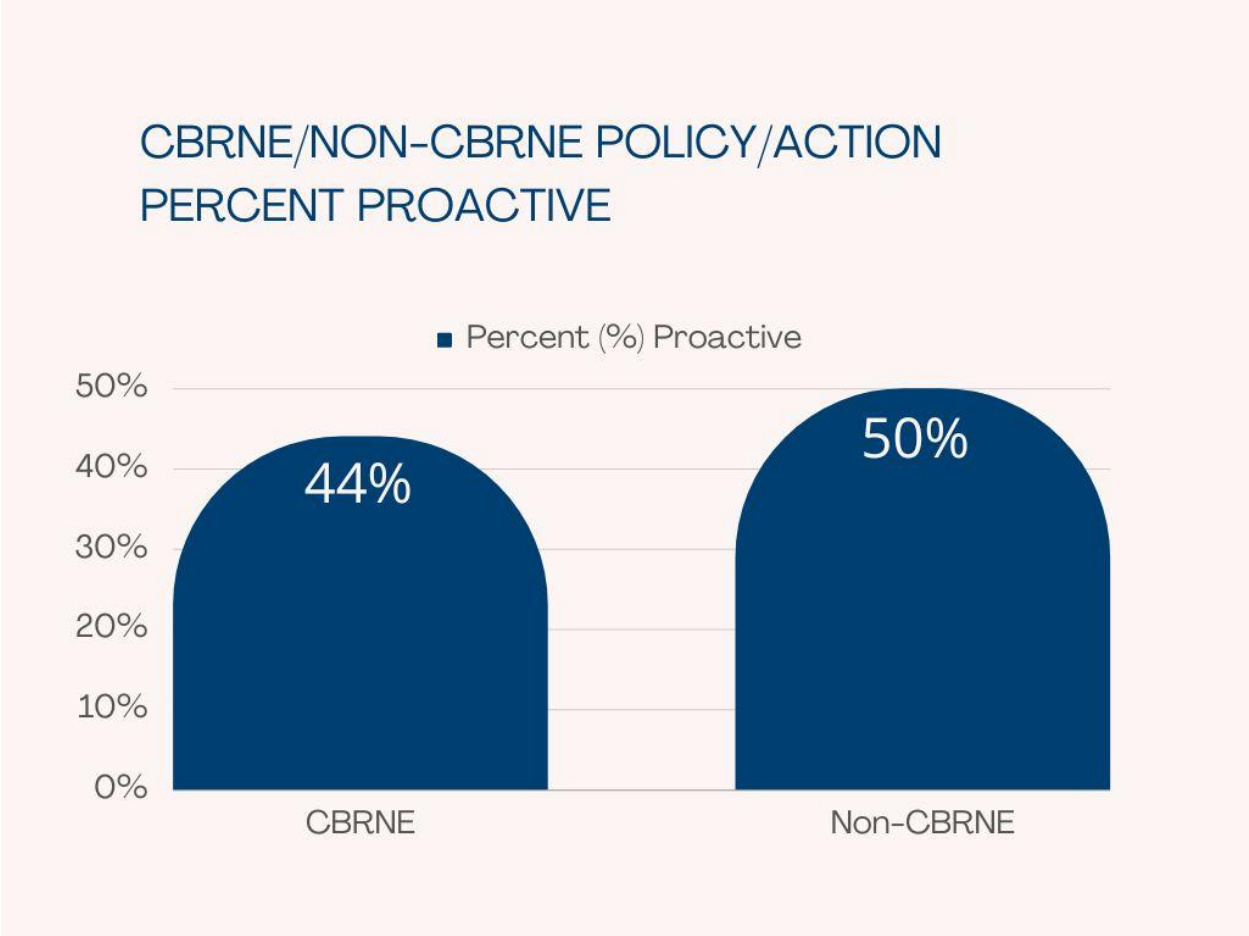
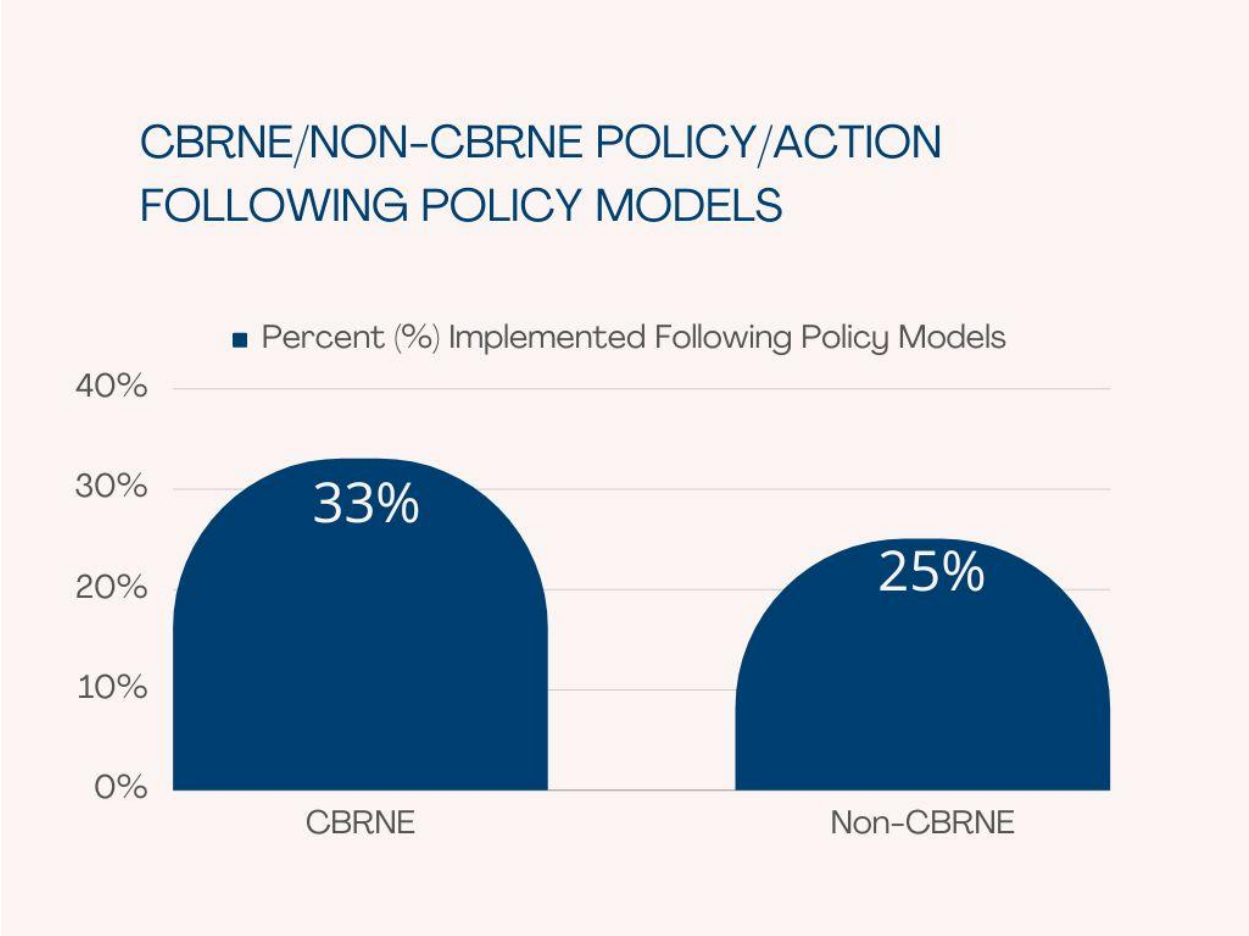


Figure 5: Results of CBRNE versus Non-CBRNE Policies/Actions following Policy Models



Discussion

Overall, this thesis aims to make connections between CBRNE events, policies, and innovation of other biological technologies. Understanding how policy fits into CBRNE use and safety is critical for understanding the past, present, and future of CBRNE and humanity. These ideas were first addressed with a literature review of existing CBRNE policies, including the Geneva Protocol. Next, Kingdon's policy models were examined and it was seen that in some examples, CBRNE defense and bioinnovation policies were created with similar processes. The study also revealed that in other examples, CBRNE defense and bioinnovation policies were not

created in similar ways, specifically with policy windows. A case study of Dugway Proving Ground was done to show attitudes towards CBRNE events within the United States, and comparisons were made between Obama's and Biden's responses to CBRNE threats abroad. Operation Warp Speed, the FDA's 510(k) program, the COVID-19 Pandemic response, and CBRNE protection strategies were also reviewed to show how CBRNE policies are made without regard to external factors or foreign nations. These findings were then summarized into tables and graphs to create a comparison analysis.

As seen in Figures 3, 4 and 5, of the cases studied, the CBRNE policies are affected by foreign affairs a majority of the time. The analysis also shows that, of the cases studied, the majority of CBRNE policies/actions are reactive in nature, as they are implemented after the related event takes place. A secondary finding of the analysis done for this thesis is that there is a difference between United States attitudes towards CBRNE events abroad and at home. This is seen in comparing the events at Dugway Proving Ground with the Presidential Administrations' responses in regards to Syria and Ukraine. The implications of these key findings are noteworthy, as they answer the questions of how and why CBRNE policies are created and implemented. With this knowledge, it is hoped that this industry may take a more proactive approach in trying to protect citizens with policy.

As with most research, limitations did become apparent here, with the first being subject matter experts. Though many databases and policy/history/data sourcing experts were consulted, it was difficult to find anybody that knew a lot about defense policy or CBRNE in general. Even consulting with active duty, retired, and civilian military working in biology, many people that were spoken with had little knowledge on the subject. Therefore, much of the research conducted was from databases, government documents, and historical artifacts. Another, perhaps obvious,

limitation, was the lack of ability to obtain government records and data. CBRNE can be seen as a dangerous and rather classified area of defense, and therefore not much information is available to the general public. A third, also obvious, limitation is the scope of the research done. Only thirteen cases were studied, and though this is significant, it does lead to decreased robustness of the conclusions and therefore, more research should be done using the analysis described above.

Only a few specific non-CBRNE policies were examined, and this could be an area of further recommended research. The research done here was restricted to modern administrations and policies in order to control scope. It is recognized that more research and connections need to be made here to fully interpret the events and further conclude the hypothesis made.

Conclusion

Topics relating to CBRNE policies and attitudes are typically not studied and generalities and conclusions are difficult to discover upon by research. This thesis aims to give results to case studies analyzing how the United States responds to the use of CBRNE at home and abroad. This was seen in research on United States military bases, as well as different federal administrations' responses to CBRNE use abroad. From this research, it can be learned that CBRNE policies in response to events are hard to come by, but the government is often seen with a perceived element of urgency towards the situation. As earlier proposed, there is clearly a stigma with using CBRNE innovation versus biological and chemical innovation for other areas.

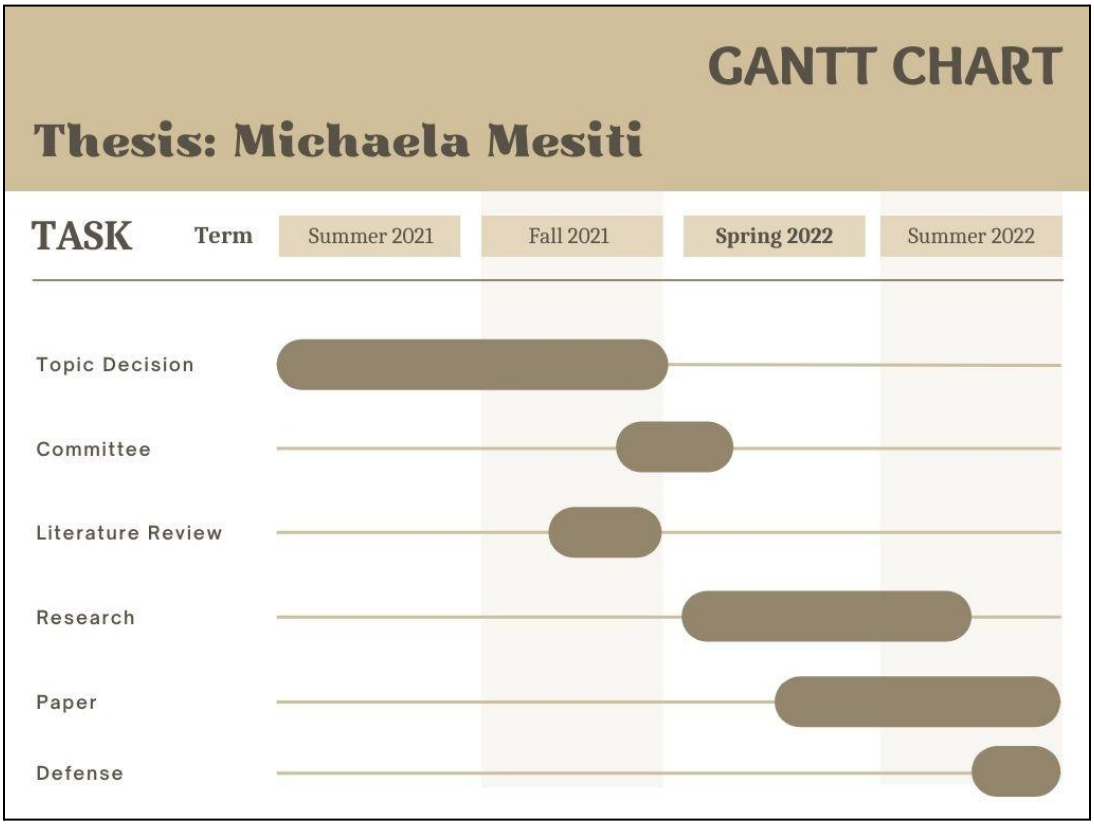
This work has significant value, as it can be applied to other levels of government, other nations, and other specific CBRNE events. While conducting research, it became quite apparent that there were not many who had explored specifically the area of CBRNE policies. Universities, professors, military personnel and various databases were consulted and very little about the relationship between CBRNE and policy was discovered. Therefore, the ideas

expressed in this thesis could be used for further research into if this argument can be rightfully applied to other areas of government in the United States (state, local, etc.), other nations, or other specific CBRNE events. It can also be used to predict how CBRNE defense policy may adapt or change in the future.

This research had policy relevance as it shows ways of policy making applied to CBRNE events throughout history and where these processes fall short. Whereas the Geneva Protocol gives a good example of where policy making has been specific in CBRNE, the incidents at Dugway Proving Ground give a good example of where they may lack in the United States. The examples of attitudes given in the Obama and Biden Administrations also show that there may not be clear policies set in place to defend against CBRNE threats abroad.

It is from the research conducted here that a relationship between CBRNE defense policy, attitudes regarding the topic home and abroad, non-proactiveness versus proactiveness, and policies relating to other biotech innovations can be made. As stated, there are limitations to the research, but as this study has not been thoroughly conducted before, that can be expected. In the future, this research can be used to study the future of CBRNE policy and CBRNE events in retrospect. This research can also be used to study CBRNE on different scopes, such as with an increased timeline or within other nations or entities.

Timeline


GANTT CHART
Thesis: Michaela Mesiti
TASK
Term
Summer 2021
Fall 2021
Spring 2022
Summer 2022
Topic Decision
Committee
Literature Review
Research
Paper
Defense

Committee Members

Reviewed by:

Nathan Lee/Assistant Professor	11/28/22
Committee Chair/Public Policy/RIT	Date
Ray Dongryul Kim/Associate Professor	9-13-2022
Committee Member/Political Science/RIT	Date
Cami Goldowitz/Liaison Librarian COLA	9-15-2022
Committee Member/Academic Affairs/RIT	Date
Eric Hittinger/Graduate Director	11-28-2022
Graduate Coordinator/Public Policy/RIT	Date

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