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There Must Be Something in the Water: Understanding PFAS Contamination of Groundwater as a National Security Issue

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There Must Be Something in the Water:
Understanding PFAS Contamination of Groundwater as a National Security Issue

Kylie N. Ford

*For my parents,
and their coworkers from 'The Base.'*

Abstract

This report addresses the widespread pollution of domestic groundwater resources with Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS) caused by firefighting activities performed at military installations across the United States. Two former military bases in Southeastern Pennsylvania are used as a single case study: the Naval Air Development Center (NADC) in Warminster and the Naval Air Station Joint Reserve Base (NASJRB) in Horsham. Chapter 1 gives a history of domestic military bases from the perspective of the infrastructure buildup and downsizing that occurred over the 20th Century, along with the environmental degradation revealed during brownfield redevelopment. The chapter then gives specifics about the base cleanup process under the Base Closure and Realignment Act of 1988 and the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA). Chapter 2 delves into the ongoing human and environmental health concerns caused by the pollution of NADC and NASJRB. Chapter 3 examines the state- and federal-level water quality and hazardous materials laws in place applicable to the pollution of groundwater with PFAS. Chapter 4 examines CERCLA and its role in the management of PFAS pollution caused by the DOD, then uses the nationwide public health crisis caused by PFAS to argue that comprehensive national security requires the defense of environmental health. Chapter 5 details the developments in public policy and PFAS regulation that have occurred over the past two years. Through a synthesis of the information gathered in the preceding chapters, Chapter 6 concludes the paper by urging for parties responsible to regulate PFAS and other hazardous chemicals responsibly, and by advocating for the DOD to recognize the critical role that environmental health plays in safeguarding national security.

Keywords: military, PFAS, Pennsylvania, public health, Superfund, national security

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Abbreviations

AG	Attorney General of Pennsylvania
ARARs	Applicable or Relevant and Appropriate Requirements, under CERCLA
ATSDR	Agency for Toxic Substances and Disease Registry
BRAC	Base Realignment and Closure
CDC	Centers for Disease Control and Prevention
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CSGWPP	Pennsylvania Comprehensive State Groundwater Protection Program
CWA	Federal Clean Water Act of 1972
DOD	Department of Defense
EA	Environmental Assessment
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
FWPCA	Federal Water Pollution Control Act of 1948
LRA	Local Redevelopment Authority
MCL	Maximum Contaminant Level
MEA	Millennium Ecosystem Assessment
NADC	Naval Air Defense Center
NASJRB	Naval Air Station Joint Reserve Base
NEPA	National Environmental Policy Act of 1970
NIEHS	National Institute of Environmental Sciences
NRDC	National Resources Defense Council
NPL	National Priorities List
NTP	National Toxicology Program
PA DOH	Pennsylvania Department of Health
PA DEP	Pennsylvania Department of Environmental Protection
PA SDWA	Pennsylvania Safe Drinking Water Act of 1984
PFAS	Perfluoroalkyl and Polyfluoroalkyl Substances
PFC	Formerly used abbreviation for PFAS
PFOS	Perfluorooctane Sulfonic Acid

PFOA	Perfluorooctanoic Acid
PPA	Pollution Prevention Act of 1990
PWS	Public Water System
RCRA	Resource Conservation and Recovery Act of 1976
ROD	Record of Decision
SARA	Superfund Amendments and Reauthorization Act of 1986
SDWA	Federal Safe Drinking Water Act of 1974
SNUR	Significant New Use Rule, under TSCA
TSCA	Toxic Substances Control Act of 1976
TT	Treatment Technique
UCMR	Unregulated Contaminant Monitoring Rule, under SDWA
UCMR 3	Third Unregulated Contaminant Monitoring Rule, under SDWA

Introduction. Military Bases: The Community Context

What effect does a military base have on its surrounding community? Ostensibly, the presence of a base produces largely positive effects, such as stable economic benefits to both service members and civilians. Behind well-guarded fences, however, the activities performed at a base can wreak long-term havoc on the environmental health of the oblivious community. Both on a base and beyond its fences, the land and groundwater are regularly so badly damaged that they become a public health concern. Oftentimes, it is only after a base is set for closure when the true extent of the damage is fully unearthed.

When a base is closed, most communities want to redevelop its land as quickly as possible. For the many community members left jobless in the wake of the closure, this redevelopment provides a critical opportunity to offset job loss through economic growth. Unfortunately, the environmental destruction wrought during the base's years of operation can postpone its redevelopment indefinitely. Without it, the massive tracts of land planned for redevelopment lay dilapidated. The community stagnates, struggling to rebuild itself economically while literally unable to rebuild on the land that previously housed one of its key sources of economic stability.

While these economic consequences of base closure can cripple a community, the health consequences of the on-base pollution can fundamentally undermine its residents' lives. Two bases located in Southeastern Pennsylvania have left such scars on their communities: the Naval Air Development Center (NADC) in Warminster, and the Naval Air Services Joint Reserve Base (NASJRB) in Horsham. The effects of the pollution of NADC on the groundwater in Warminster are still being remediated to this day, despite the originally-planned cleanup proceedings having been completed in 2000. The cleanup and redevelopment process at NASJRB in Horsham is still ongoing, due to its later closure date and extensive environmental remediation requirements. The

groundwater pollution resulting from the activities performed on these bases over the latter half of the 20th Century have spread beyond Warminster and Horsham, impacting the water resources and health of the residents of nearby Warrington Township as well. As direct result of actions performed at NADC and NASJRB, many residents have contracted long-term, life-threatening health conditions.

The effects of these bases on their community may seem exceptional, but are representative of a consistent pattern of environmental disregard on military lands. Historically, activities on military bases have consistently caused some of the worst environmental destruction recorded on domestic soil. The groundwater pollution resulting from the activities at NADC and NASJRB is a prime example of this trend. The chemicals used at these bases, Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS), have also been used commercially since the mid-1960s. Over the past few years, however, PFAS have received national attention due to the growing public health crisis caused by their prevalence in groundwater. While the Department of Defense (DOD) is only one of the many organizations responsible for this pollution, the substantial contributions of its bases to the nationwide PFAS problem are unsettling given its status as a government entity charged with defending the nation from threats to its security. The irresponsible use of PFAS and other hazardous materials on military bases has seriously threatened access to potable water in public water systems across the nation and irreparably damaged other critical environmental resources.

While the practices at bases such as NADC and NASJRB caused serious public health concerns during their years of operation, military bases do not inherently pose threats to groundwater with proper planning and risk management. The PFAS pollution problem was able to grow to its current scale due to failures: the mentality of the DOD concerning the environment

and the dearth of legal regulation of PFAS. While these two deficiencies have caused irreparable damage, the mindset of the DOD and the regulations on PFAS use can be amended to reduce the risk of future damage. Internally, DOD higher-ups can integrate human and environmental health considerations into their decision-making processes for their bases. Legally, if existing statutes are amended to adequately regulate the use of hazardous pollutants such as PFAS, public health will be protected from that pollutant whether the DOD implements such health-conscious practices or not. The correction of both of these shortcomings is the only sure way to prevent the pollution incurred on military bases from threatening the health of the nation.

To demonstrate the critical importance of these changes, the chapters that follow will use NADC and NASJRB as a case study, examining the damage inflicted by the bases on the environmental and human health of their communities and the legal contexts that permitted this damage. Chapter 1 will give a history of domestic military bases through the infrastructure buildup and downsizing that occurred over the 20th Century, the base cleanup process under BRAC and CERCLA, the lasting environmental damage uncovered at base closures, and a brief introduction to NADC and NASJRB. Chapter 2 will delve into the ongoing public health concerns caused by the groundwater pollution associated with PFAS use on these bases. Chapter 3 will examine the water quality and hazardous materials laws pertinent to PFAS at the state and federal level, ultimately demonstrating how the use of their use has been wholly unregulated for decades. Chapter 4 will detail the provisions of CERCLA and the nuances of PFAS management under the law by the DOD, then use the PFAS pollution problem to illustrate the relevance of environmental health to a contemporary understanding of national security. Chapter 5 will detail the developments in public policy and PFAS regulation that have occurred over the past two years. Chapter 6 will conclude the report by urging for parties responsible to regulate PFAS

chemicals and providing additional recommendations for policy reform.

The public health disaster which has occurred in Warminster, Horsham, and Warrington, and in countless communities across the nation was entirely preventable. If the DOD implements more environmentally responsible practices, the effect that military bases have on their communities in the future can be almost exclusively positive, both during and after their years of operation. If law and policy regulating the use of potentially hazardous chemicals are amended to prioritize public health, chemicals like PFAS will be prevented from threatening public access to critical environmental resources like potable water. If laws and practice continue as they currently are, the legacy that military bases leave on their communities will continue to risk causing the irreversible environmental destruction and public health disasters historically characteristic of base closures.

Chapter 1. The Lasting Environmental Legacy of Military Bases

20th Century Military Downsizing. During the end of the Cold War, the military was bloated following its buildup during the Reagan administration.¹ The DOD was losing financial resources, but continued to increase numbers of employed personnel throughout the first half of the 1980s.² Congress made various attempts to fix this financial problem through the imposition of mandatory personnel cuts for the DOD.³ Though these cuts aided in a small way, they were not nearly substantial enough to close the gap between dwindling resources and large expenditures. The increase in public demand for cuts in government spending and the post-Cold War decrease in manpower and infrastructure required by the DOD to ensure national security

¹ Bart Brasher, *Implosion: Downsizing of the U.S. Military, 1987-2015* (Westport, CT: Greenwood Press, 2000), 5.

² Brasher, *Implosion*, 6.

³ Brasher, *Implosion*, 9.

combined to make the massive military budget untenable.⁴ It became apparent to high-level officials in the DOD that the department “needed to be outlining its own force restructuring, or a body outside the military would do it for the department.”⁵ When the DOD proved unable to close its own bases when they became more of a drain on resources than their contributions to national security were worth, the latter situation came to pass.

Congress was initially called upon to perform this restructuring but proved equally incapable. Despite many bases being considered “surplus or nonessential,”⁶ Congresspeople from all areas of the country considered keeping bases open in their own districts a “high political priority.”⁷ This level of concern echoed that of their home districts—the closure of a base would remove many jobs from a community that had been previously seen as untouchable.⁸ Especially in communities with a large proportion of residents employed on-base, representatives and residents alike feared that the loss of a base would cripple their local economy and quality of life.⁹ In response to this fear, Congresspeople went to great lengths to prevent base closures from occurring: one senator went as far as to “personally circulate a list of at-risk bases on the Senate floor” to garner opposition.¹⁰ In short, though Congress was aware of the pressing need to cut spending incurred through nonessential bases, no Congressperson was willing to permit base loss in their own district.

Even with such opposition, the pressure to eliminate excess costs could not be avoided.

⁴ Brasher, *Implosion*, 5.

⁵ Brasher, *Implosion*, 16.

⁶ Congressional Research Service, *Military Base Closures Since 1988: Status and Employment Changes at the Community and State Level*, by George H. Siehl and Edward Knight, 2, June 17, 1996, accessed October 15, 2018, <http://www.dtic.mil/dtic/tr/fulltext/u2/a321657.pdf>.

⁷ Brasher, *Implosion*, 20.

⁸ Congressional Research Service, *Military Base Closures Since 1988*, 8.

⁹ Congressional Research Service, *Military Base Closures Since 1988*, 8.

¹⁰ Thomas G. McInerney and Erik R. Pages, “Bolstering Military Strength by Downsizing the Pentagon,” *Issues in Science and Technology* 14, no. 2 (1997): 82, accessed October 15, 2018, <http://www.jstor.org.avoserv2.library.fordham.edu/stable/43311761>.

The overall effectiveness of the DOD required the realignment or closure of some of its bases. This reality, combined with the inability of Congress and the Pentagon to close surplus military bases, prompted the Grace Commission¹¹ to call for the creation of an “independent, non-partisan commission” to remedy that inability in 1983.¹² After years of dispute concerning how this commission should be formed and the extent of its authority, the House Committee on Government Operations developed H.R. 4481. This bill was heard in committee in May 1998 and was signed into law six months later.

On October 24, 1988, the 100th Congress passed Public Law 100-526, the Defense Authorization Amendments and Base Closure and Realignment (BRAC) Act of 1988. This law established the ‘Defense Secretary’s Commission on Base Realignment and Closure,’ more commonly referred to as the BRAC Commission. The goal of this commission was to evaluate each base on the grounds of its importance in military matters, local economic value, and local environmental considerations,¹³ then force congress to make a “simple, yes-or-no vote” on base closure recommendations.¹⁴ The BRAC process outlined act functioned as follows:

[T]he commission [would] study aspects of excess infrastructure and make proposals to Congress, ...[then] present Congress, via the defense secretary, with a list of bases that should be closed or realigned. The DOD secretary could only accept or reject the entire list. He could not modify it. From the department, the list went to Congress. The body had 45 days to review the list and could only reject it by joint resolution. There could be no congressional amendments to the package.¹⁵

Due to the inability of both Congress and the DOD secretary to modify the list, the squabbling over base protection in individual Congressmembers’ districts was avoided. The BRAC

¹¹ The Grace Commission, officially titled the Private Sector Survey on Cost Control, was an investigative body established by President Ronald Reagan to investigate federal spending for areas of inefficiency.

¹² Brasher, *Implosion*, 20.

¹³ Brasher, *Implosion*, 20.

¹⁴ Brasher, *Implosion*, 20.

¹⁵ Brasher, *Implosion*, 20.

Commission reported its first set of findings to Defense Secretary Frank C. Carlucci on December 29, 1988.¹⁶ 45 days later, Congress officially approved the recommendations, and the post-Cold War downsizing of the military began in earnest.

This first round of the BRAC recommended the closure of 16 major¹⁷ bases across 12 states,¹⁸ and was estimated to lead to \$693.6 million saved annually, with 20-year savings netting \$5.6 billion.¹⁹ Following rounds called for the closure of 26 major bases in 1991, 28 in 1993, 28 in 1995, and 48 in 2005.²⁰ Recommended closures of both major and minor closures to date number approximately 1200, with the closures recommended in the 2005 round more than doubling the closures recommended by all previous rounds combined.²¹ These closures brought about marked personnel cuts—the active duty force across all branches dropped from \$2.0 million in 1990 to \$1.4 million in 2001, and continued to decline over the subsequent decade.²² The five rounds of BRAC cuts have accomplished their goal—though exact numbers vary, one estimate given by the DOD appraised a savings of \$12 billion annually.²³

Although the long-term drain on the financial resources of unnecessary bases on the federal budget is removed through BRAC closures and realignments, heavy upfront costs are required for the redevelopment of most bases. To ease the economic transition of and assist with

¹⁶ U.S. Department of Defense, *Base Realignments and Closures: Report of the Defense Secretary's Commission*, by Defense Secretary's Commission on Base Realignment and Closure, 1-2, December 29, 1988, accessed October 15, 2018, <https://www.acq.osd.mil/brac/Downloads/Prior%20BRAC%20Rounds/1988.pdf>.

¹⁷ A 'major' base closure is one that involves the loss of 300 or more civilian and/or military jobs. (Source: Congressional Research Service, *Military Base Closures Since 1988*, 28.)

¹⁸ Congressional Research Service, *Military Base Closures Since 1988*, 4.

¹⁹ U.S. Department of Defense, *Base Realignments and Closures*, 6.

²⁰ Congressional Research Service, *Military Base Closures Since 1988*, 4; Congressional Research Service, *Base Closure and Realignment (BRAC): Background and Issues for Congress*, by Christopher T. Mann, 13, April 25, 2019, accessed November 13, 2019, <https://fas.org/sgp/crs/natsec/R45705.pdf>.

²¹ Congressional Research Service, *Base Closure and Realignment (BRAC)*, 13.

²² Kim Parker, Anthony Cilluffo, and Renee Stepler, "6 Facts about the U.S. Military and Its Changing Demographics," Pew Research Center, April 13, 2017, accessed October 2, 2018, <http://www.pewresearch.org/fact-tank/2017/04/13/6-facts-about-the-u-s-military-and-its-changing-demographics/>.

²³ Congressional Research Service, *Base Closure and Realignment (BRAC)*, 7.

planning in communities whose bases have been realigned or closed, the federal government provides aid through the following channels: the Office of Economic Adjustment of the DOD, the Economic Development Administration, the Rural Development Administration, the Superfund program, the Federal Airport Improvement Program, and various community grants.²⁴ In addition to these organizations and programs geared towards community redevelopment, the DOD also provides severance packages to military personnel, including “early retirement incentives, temporary continuation of medical care benefits, pre-separation counseling for separating service members, employment counseling and placement assistance, relocation assistance, and special GI bill education benefits;”²⁵ severance packages offered to civilian personnel contain similar benefits. These assistance programs are heavily funded through Congress, with \$10 billion allocated over six years alone, from 1990-1995.²⁶

Beyond the cost of the transition of formerly employed persons, however, lies the substantial upfront costs of the redevelopment of the bases. After closure, former bases are referred to as ‘brownfields’ until their redevelopment plans have been completed. When a given base is closed, its surrounding community forms a Local Redevelopment Authority (LRA) whose role is to work closely with relevant military departments to achieve their vision for the brownfield’s redevelopment.²⁷ While redevelopment can be an arduous process for all parties involved, it presents the members of a community with an uncommon opportunity to define its goals for the future and reshape its infrastructure to serve those goals.²⁸ With the assistance of federally-

²⁴ Congressional Research Service, *Military Base Closures Since 1988*, 20.

²⁵ Congressional Research Service, *Military Base Closures Since 1988*, 20.

²⁶ Congressional Research Service, *Military Base Closures Since 1988*, 26.

²⁷ Office of the Under Secretary of Defense, *Base Redevelopment and Realignment Manual*, (Washington, D.C.: U.S. Department of Defense, 2018), 18, accessed November 5, 2019, <https://www.esd.whs.mil/Portals/54/Documents/DD/issuances/dodm/416566m.pdf?ver=2018-12-03-094242-090>.

²⁸ Association of Defense Communities, *Understanding Key Issues in DoD’s Base Redevelopment and Realignment Manual* (Washington, D.C.: Association of Defense Communities, 2006), 2, accessed November 10, 2019, https://www.defensecommunities.org/wp-content/uploads/2011/04/infobrief_BRRM.pdf.

funded redevelopment grants,²⁹ eager redevelopers have shaped many dilapidated brownfields into a thriving economic hubs that both facilitate job creation and meet the wants and needs of their communities.³⁰ When all goes according to plan, once the redevelopment process of a base has been completed, its substantial costs can be offset by the economic benefit brought about by the redevelopment.

Unfortunately for many communities impacted by base closures, the redevelopment of a military brownfield often does not go according to plan. Disagreements about the direction the redevelopment should take, whether among community members between the LRA and the military, can delay the process. Even with federally funded redevelopment grants, local funding for redevelopment can be scarce, slowing the redevelopment process. Many buildings on military bases were built decades ago, and do not meet building codes; these must be either substantially modified for reuse or condemned. Routine redevelopments usually take years, and common roadblocks such as these can delay a community's plans for their former base by further years.

One of the most frustrating, time consuming, expensive, and common roadblocks to redevelopment is the base's environmental legacy. Prior to the redevelopment of a base, the military must conduct an environmental assessment per the National Environmental Policy Act (NEPA) to determine the environmental impacts of the redevelopment plan.³¹ This assessment usually unearths decades of pollution caused by military actions. Unfortunately for communities anxiously awaiting the job creation and revitalization promised by redevelopment, many military brownfields require extensive and expensive cleanup measures before redevelopment can

²⁹ Kenneth N. Hansen, *The Greening of Pentagon Brownfields: Using Environmental Discourse to Redevelop Former Military Bases* (Lanham, MD: Lexington Books, 2004), 127.

³⁰ Brasher, *Implosion*, 188.

³¹ Association of Defense Communities, *Understanding Key Issues in DoD's Base Redevelopment and Realignment Manual*, 10.

proceed.

Environmental Impact of Former Military Bases. The environmental impact of many former bases is staggering. The contamination of given base was deliberately ignored in the BRAC Commission's selection process, as all sites would eventually be legally required to be cleaned up anyway.³² The types of environmental degradation vary at each base, but could include many of the following pollutants: "spilled fuel, oil, lubricants, hydraulic fluids, industrial solvents, pesticides, paints and thinners, ...heavy metals and water, nuclear materials and other improperly stored hazardous waste and munitions,"³³ along with "low-level radioactive waste unexploded ordinance,...acids, nitrates, heavy metals fuels, and cleaning solvents."³⁴ Given the size of some military installations and the prevalence of such a wide variety of contaminants, the time required to assess, remediate, and document the damage at any given brownfield was substantial.

An effective framework for examining the damage done to a given brownfield site is provided by the Millennium Ecosystem Assessment (MEA), a report commissioned by the United Nations. The Assessment's framework details the various types of ecosystem services, the constituents of human wellbeing, and the interplay between those services and constituents.³⁵ The ecosystem services presented include the following: *supporting services*, such as nutrient cycling, soil formation, and primary production; *provisioning services*, such as food, fresh water, wood and fiber, and fuel; *regulating services*, such as climate regulation, flood regulation, disease regulation, and water purification; and *cultural services*, such as aesthetic, spiritual,

³² Hansen, *The Greening of the Pentagon Brownfields*, 88.

³³ Hansen, *The Greening of the Pentagon Brownfields*, 88.

³⁴ Robert F. Durant, *The Greening of the U.S. Military: Environmental Policy, National Security, and Organizational Change* (Washington, D.C.: Georgetown University Press, 2007), 77-78.

³⁵ Millennium Ecosystem Assessment, *Ecosystems and Human Well-being: Synthesis* (Washington, DC: Island Press, 2005), vi.

educational, and recreational benefits.³⁶ The constituents of human well being presented include the following: *security*, through personal safety, secure resource access, and security from disasters; *basic material for good life*, through adequate livelihoods, sufficient nutritious food, shelter, and access to goods; *health*, through strength, feeling well, and access to clean air and water; *good social relations*, including social cohesion, mutual respect, and ability to help others; and *freedom of choice and action*, through the opportunity to be able to achieve what an individual values doing and being.³⁷ The MEA framework will be used to categorize and assess the damage done to military brownfields throughout this report.

In general, groundwater and soil contamination are the most common long-term environmental health concerns at former military bases. As such, the primary ecosystem services affected by this damage on each site are soil formation, freshwater provisioning, and water purification. Other services, such as aesthetic and spiritual services, are often disrupted during the cleanup process as the people of a community become alienated from their environment. A more in-depth analysis of the ecosystem services disrupted by the environmental health hazards of military brownfields and their cleanups will be given in the following chapter.

Aside from the disruption of natural resources, economic resources are severely impacted by the costs of environmental remediation. Vast amounts of time, financial, and personnel resources are required for each cleanup. Just financially, the costs from the first round of the BRAC cleanups were projected to be \$42.4 billion by 1989.³⁸ These costs amounted to only a quarter of BRAC financial allocations with the first five years. While some federal funding is available for remediation, cleanup costs often delay brownfield redevelopment significantly.³⁹

³⁶ Millennium Ecosystem Assessment, *Ecosystems and Human Well-being: Synthesis*, vi.

³⁷ Millennium Ecosystem Assessment, *Ecosystems and Human Well-being: Synthesis*, vi.

³⁸ Durant, *The Greening of the U.S. Military*, 78.

³⁹ Congressional Research Service, *Military Base Closures Since 1988*, 29.

The communities surrounding these brownfields often become frustrated by the conflicting priorities at stake in the redevelopment of their former base. On one hand, on-base environmental damage is seen as a major roadblock to redevelopment to be dealt with as quickly as possible. On the other hand, the activities performed at each community's base deeply harmed the health and livability of their local environment, and the restoration of this health and livability is a major priority for most communities. They want the redevelopment to have a reasonably fast turnaround time to allow for job growth, but are forced to wait for years for its completion due to the persistent on-base safety concerns.

One of the primary delays in the cleanup process was the slow-moving processes of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), also known as the Superfund Act. The U.S. Environmental Protection Agency (EPA) has charged the Superfund program with managing the cleanup the most hazardous pollution sites in the country.⁴⁰ Due to their rampant contamination, many military brownfields became Superfund sites—in the early 1990s, 95 of the 116 federal sites on the program's National Priorities List (NPL) had been operated by the DOD. The details of CERCLA will be thoroughly addressed in Chapter 4, but it is worth noting here that the proportion of military brownfields that must undergo cleanup through the CERCLA process indicates that their pollution levels are exceptionally high.

This pollution was largely due to national security priorities in the Cold War. Environmental concerns were seen as an obstacle to national security.⁴¹ According to a prominent author on the subject, the Cold War fostered a “regulatory regime that allowed the

⁴⁰ Frank T. Manheim, *The Conflict Over Environmental Regulation in the United States: Origins, Outcomes, and Comparisons With the EU and Other Regions* (New York: Springer, 2009), 212-213.

⁴¹ Hansen, *The Greening of the Pentagon Brownfields*, 88.

military needs of the Cold War to take precedence over...protection ” of natural resources.⁴²

Much of the Cold War occurred prior to the slew of federal pollution management laws passed during the 1970s; nonetheless, if they had violated preexisting environmental protection laws, the DOD would have likely justified it in the name of national security.

The importance of integrating green practices into military action has been accepted for the most part since the end of the Cold War.⁴³ Regardless of this general acceptance, the importance of environmental concerns in national security cannot be overstated. The domestic environmental fallout from DOD actions on bases around the country during the Cold War lasts to this day. Moreover, many of the detrimental effects to human health caused by this rampant environmental degradation are only now being realized. Using the pollution of the nation’s groundwater resources with Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS) as a case study, this report will demonstrate that legitimate national security concerns can be caused by disregard for environmental health. This disregard is felt deeply in the aftermath of two bases in Southeastern Pennsylvania, closed in the final two rounds of the BRAC: The Naval Air Defense Center and the Naval Air Station Joint Reserve Base.

Groundwater Concerns in Southeastern Pennsylvania. The Naval Air Development Center,⁴⁴ located in Warminster, PA, began its life as a military base in 1944.⁴⁵ Prior to the acquisition of its 824 acres by the Navy, the land was an aircraft assembly facility owned by Brewster Aeronautical Corporation.⁴⁶ During the first five years of operation, NADC operated as

⁴² Durant, *The Greening of the U.S. Military*, 36.

⁴³ Durant, *The Greening of the U.S. Military*, 6-10.

⁴⁴ The name of this base has changed multiple times over the course of its history. Some documents refer to the base as the Naval Aircraft Modification Unit or the Naval Air Warfare Center.

⁴⁵ Doug Crompton, “NAWC/NADC Warminster Historical Information,” Friends of NavAirDevCen, last modified 2011, accessed September 28, 2018, <http://www.navairdevcen.org/>.

⁴⁶ U.S. Department of the Navy, *Preliminary Close Out Report: Naval Air Development Center*, by Abraham Ferdas, 1, September 28, 2000, <https://semspub.epa.gov/work/03/2054269.pdf>.

an aircraft assembly and adjustment facility. After this point, its primary purpose was the “research, development and testing of aircraft components, coatings, electronics and control devices.”⁴⁷ The base is well-known for its contributions to the Mercury missions through its development of a large human centrifuge used for astronaut training.⁴⁸ After half a century of operation, the base was commissioned to be closed in the fourth round of BRAC cuts, closing officially on September 30, 1996.⁴⁹

The land for the Naval Air Station Joint Reserve Base Willow Grove was bought by the Navy in 1942.⁵⁰ Its previous owner, Harold F. Pitcairn, had created an airfield on the land to use in his work as an aviator and aircraft developer.⁵¹ The ‘Naval Air Station Willow Grove’ became operational in January 1943, performing various services for the Navy throughout the latter half of the 20th Century.⁵² It reached its full acreage of 1,100 in 1957 through a purchase by the DOD, and eventually became a Joint Reserve Base of all four branches of the Armed Forces and the Pennsylvania Air National Guard in 1994.⁵³ The base was commissioned to be closed in the fifth round of BRAC cuts in 2005. Approximately 200-acres of the land was retained as a base for the Pennsylvania Air National Guard and the Army National Guard;⁵⁴ this parcel was renamed the ‘Horsham Air Guard Station,’ and is still operational to date.⁵⁵

The redevelopment of these bases has had mixed results. Following NADC’s closure per the 1995 round of BRAC cuts, the base’s land was redeveloped by the Bucks County Federal

⁴⁷ U.S. Department of the Navy, *Preliminary Close Out Report: Naval Air Development Center*, 1.

⁴⁸ Doug Crompton, “NAWC/NADC Warminster Historical Information.”

⁴⁹ U.S. Department of the Navy. *Preliminary Close Out Report: Naval Air Development Center*, 1.

⁵⁰ “NAS-JRB Willow Grove History,” Horsham Land Redevelopment Authority, accessed October 3, 2018, <https://www.hlra.org/nas-jrb-willow-grove/history.aspx>.

⁵¹ “NAS-JRB Willow Grove History,” Horsham Land Redevelopment Authority.

⁵² “NAS-JRB Willow Grove History,” Horsham Land Redevelopment Authority.

⁵³ “NAS-JRB Willow Grove History,” Horsham Land Redevelopment Authority.

⁵⁴ “BRAC Overview,” Horsham Land Redevelopment Authority.

⁵⁵ “NAS-JRB Willow Grove History,” Horsham Land Redevelopment Authority.

Lands Reuse Authority for a variety of nonmilitary uses: a 9/11 Emergency Response Center, a large-scale retirement home, a nonprofit agency, a county morgue, and a residential neighborhood.⁵⁶ Through the 2005 round of cuts, NASJRB was slated to be closed; however, through delays by Pennsylvania's former governor Ed Rendell, the base did not cease operations until September 2011.⁵⁷ The operations of the Navy and Marine Corps were transferred to other bases, but approximately a quarter of the land was retained for the use of the Pennsylvania Air National Guard and the Army National Guard. The remaining three quarters of the land is up for redevelopment, but exact plans have yet to be finalized. Unfortunately, the redevelopment of NASJRB has been delayed for years due to the results of the environmental assessment conducted at the site.

The actions of the military during the operational life of these bases have caused serious damage to the soil and groundwater quality, both on-base and in the surrounding area. NADC was home to eight separate hazardous waste areas containing a variety of substances, including oils, sludges from industrial wastewater treatment, solvents, and paints.⁵⁸ The effects of these chemicals were controlled in a plan terminating in 2000, but a new group of contaminants have emerged that are still being mitigated to this day: Perfluoroalkyl and Polyfluoroalkyl Substances.⁵⁹ PFAS were also the means of pollution at NASJRB, and the base's comprehensive

⁵⁶ James Boyle and Patch Staff, "A Look Behind the Scenes of the Naval Air Development Center's Closure," *Warminster Patch*, last modified April 11, 2011, accessed October 15, 2018, <https://patch.com/pennsylvania/warminster/a-look-behind-the-scenes-of-the-naval-air-development5fe2ef0b4e>.

⁵⁷ "BRAC Overview," Horsham Land Redevelopment Authority, accessed October 15, 2018, <https://www.hlra.org/nas-jrb-willow-grove/brac-nas-jrb.aspx>. ; "NAS-JRB Willow Grove History," Horsham Land Redevelopment Authority.

⁵⁸ U.S. Environmental Protection Agency, "Naval Air Development Center...: Cleanup Activities" last modified December 13, 2019, accessed December 13, 2019, <https://cumulis.epa.gov/supercpad/SiteProfiles/index.cfm?fuseaction=second.cleanup&id=0302466#bkground>.

⁵⁹ U.S. Environmental Protection Agency, "Naval Air Development Center (8 Waste Areas)," last modified December 13, 2019, accessed December 13, 2019, <https://cumulis.epa.gov/supercpad/SiteProfiles/index.cfm?fuseaction=second.cleanup&id=0302466>.

cleanup effort is still ongoing.⁶⁰ Due to the extent of the groundwater contamination, the effects on the environmental health of the bases and their surrounding areas are potentially irreversible.

The groundwater contamination in the communities of Warminster, Warrington, and Horsham has affected many areas of residents' lives, as evidenced by its consequences on local water resources. The ability of the local environment to provision fresh water and regulate water purification has been disrupted by the dumping of massive quantities of PFAS into the ground. These disruptions have impaired certain constituent parts of human health and wellbeing. The interruption in secure access to potable water resources led to grave health consequences for many residents; these consequences will be discussed in detail in the following chapter. Ever since the communities were made aware of the pollution of public water systems by the DOD, social cohesion has also been disrupted. These negative effects were directly caused by the changes in local land use occurring on-base, and indirectly caused by the lack of adequate regulation of the use of the pollutants.

While lengthy cleanup efforts continue to mitigate these effects, the surrounding community waits anxiously for its completion. The residents of Warminster, Warrington, and Horsham understand that the PFAS in their groundwater require time to be properly neutralized. Nevertheless, their patience has been slowly waning; years have passed since their base has closed, yet the technology to fully remediate their groundwater is still being developed. The redevelopment process of NASJRB's brownfields is stagnating in the wake of the immense cleanup required for the land to be considered safe for reuse, leaving the communities' opportunity for economic revitalization dangling just out of reach.

⁶⁰ U.S. Environmental Protection Agency, "Willow Grove Naval Air and Air Reserve Station, Horsham, PA," last modified October 23, 2018, accessed November 8, 2018, <https://cumulis.epa.gov/supercpad/cursites/csinfo.cfm?id=0303820>.

This lengthy process is an especially frustrating to residents due to the increased costs of living associated with the pollution. Residents who previously obtained water from their own private wells are now required to use bottled water, which is mostly unsubsidized. Many residents with access to the public water system (PWS) have paid mandatory surcharges for years to cover costs associated with the outsourcing of water resources. These costs of clean water pale in comparison to the increased healthcare costs and declining wellbeing of those residents who have become gravely ill after drinking contaminated water for decades. The following chapter will explore the history of PFAS and their environmental health effects, detail the grave health concerns faced by those chronically exposed to the chemicals, and present the ongoing research effort targeting the effects of PFAS on human health.

Chapter 2. Public Health Hazards of PFAS Pollution

The ongoing public health concern caused by these bases is one of groundwater pollution by Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS).⁶¹ While many PFAS were used on-base, two were used most extensively: Perfluorooctane sulfonic acid (PFOS) and Perfluorooctanoic acid (PFOA).⁶² This chapter will first explain the fundamentals of groundwater pollution and public health, and give a brief history of PFAS. Following this, it will explore the human and environmental health impacts caused by the groundwater contamination at NADC and NASJRB.

⁶¹ U.S. Environmental Protection Agency, *The Third Unregulated Contaminant Monitoring Rule (UCMR 3): Data Summary, January 2017*, 7, January 2017, accessed November 26, 2018, https://www.epa.gov/sites/production/files/2016-06/documents/drinkingwaterhealthadvisories_pfoa_pfos_updated_5.31.16.pdf.

⁶² Brian X. McCrone and Karen Araiza, "Brockovich Law Firm Files First Lawsuit Against Foam Manufacturers in Horsham Water Contamination," *NBC Philadelphia*, last modified September 17, 2016, <https://www.nbcphiladelphia.com/news/local/Brockovich-Law-Firm-Finally-First-Lawsuit-in-Horsham-Water-Contamination-393743131.html>.

Public Health and Groundwater Pollution. Public health is a broad field with many subdisciplines. In general, according to the American Public Health Association, public health “promotes and protects the health of people and the communities where they live, learn, work, and play” by proactively working “to assure the conditions in which people can be healthy.”⁶³ Environmental health, an important subdiscipline within public health, focuses on the critical role that the natural environment plays in human health. The National Institute of Environmental Sciences (NIEHS) defines environmental health as:

...both a scientific field of study that attempts to understand ‘the complex relationship between environmental risk factors and human biology within affected individuals’ and as an applied discipline that ‘uses this knowledge to prevent illness, reduce disease, and promote health.’⁶⁴

These environmental risk factors include biological factors, including organisms, species, communities, and ecosystems; chemical factors, including water, natural chemicals and compounds that impact health, and man-made chemicals and compounds that impact health; physical factors, including geology, heat, weather, and similar phenomena; social factors, including built infrastructure, warfare, poverty, racism, and other phenomena within human societies that affect health; and factors concerning the intersection of genetic predisposition with one or more of the factors above.⁶⁵

Another useful way of conceptualizing environmental health is through the perspective of ecosystem services, as established by the Millennium Ecosystem Assessment framework mentioned in the previous chapter. Through this lens, environmental health can be understood as the ability of an ecosystem to perform the ecosystem services on which its human and non-

⁶³ “What is Public Health?” American Public Health Association, last modified 2019, accessed December 19, 2019, <https://www.apha.org/what-is-public-health>.

⁶⁴ David B. Resnik, *Environmental Health Ethics* (New York: Cambridge University Press, 2012), 9, accessed October 31, 2019, EBSCOhost eBook Academic Collection.

⁶⁵ Resnik, *Environmental Health Ethics*, 9-10.

human inhabitants rely. For an environment to support public health, it must be able to provision food, fuel, and water, regulate common weather events such as floods; support its own continuity through nutrient cycling and soil formation; and support the aesthetic, spiritual, educational, and recreational events which its inhabitants require. The framework of ecosystem services provides a practical frame of reference for understanding the role of groundwater resources in an environment supportive of public health.

Groundwater is a crucial environmental resource on which billions of people across the globe rely for drinking water. Groundwater flows slowly through underground caverns known as aquifers.⁶⁶ Aquifers can be relatively open channels or networks of tiny, interconnected pores in bedrock. While most groundwater flows at a rate of less than one foot per day,⁶⁷ the flow rate of a given aquifer can be much slower than that, depending on the geological makeup of the aquifer. In the United States, groundwater is the primary source of drinking water for half of the population; in rural areas, it provides drinking water for nearly the entire population, as well as a significant portion of agricultural irrigation water needs.⁶⁸ Responsible use and protection of aquifers is critical for the long-term ability of environments to provision clean water resources for these necessary water uses.

Groundwater pollution can occur either as salinization caused by unsustainable drainage of a coastal aquifer's water levels, or as the introduction of a chemical or biological polluting agent.⁶⁹ This report will focus on the chemical pollution of aquifers, which pollutants can be introduced into the environment either from a point source or a nonpoint source. A point source

⁶⁶ G. Tyler Miller and Scott E. Spoolman, *Living in the Environment*, 18th ed. (Stamford, CT: Cengage Learning, 2015), 320.

⁶⁷ Miller and Spoolman, *Living in the Environment*, 554.

⁶⁸ Miller and Spoolman, *Living in the Environment*, 554, 322.

⁶⁹ Miller and Spoolman, *Living in the Environment*, 328.

is a discrete outflow of effluent, such as a single pipe; a nonpoint source is an indiscrete source of effluent, such as runoff water from a field. Regardless of source type, an aquifer becomes polluted when a contaminant is absorbed by the soil, then percolates into an underwater aquifer. The pollutant then disperses in a slowly widening plume.⁷⁰ When the plume reaches a well, the water fetched from the well contains the contaminant.

Once an aquifer becomes contaminated, it takes a very long time to become decontaminated naturally due to the cold temperatures, low concentrations of dissolved oxygen, and extremely slow flows of groundwater.⁷¹ While natural decontamination of an aquifer can take anywhere from decades to millennia,⁷² human aquifer decontamination is difficult and expensive. Clean up costs can range from \$10 million to \$10 billion,⁷³ and requires the existence of technology capable of dispersing the specific pollutant present in the aquifer. The extreme costs associated with aquifer decontamination usually make investments in pollution prevention measures economically preferable to decontamination.

Beyond being economically preferable, pollution prevention is more desirable than cleanup from an environmental health perspective. Many people rely on groundwater resources to provide the clean water they drink and use to grow food. The pollution of groundwater indefinitely jeopardizes their otherwise-secure access to potable water. Additionally, while awareness of the pollution allows communities to take measures to protect their health from its effects, this awareness takes a toll on the cultural services provided by their land. The awareness of the pollution in the drinking water leads to feelings of disconnection and distrust of the resources of the environment, disrupting the spiritual connection to the land and potentially the

⁷⁰ Miller and Spoolman, *Living in the Environment*, 554.

⁷¹ Miller and Spoolman, *Living in the Environment*, 555.

⁷² Miller and Spoolman, *Living in the Environment*, 555.

⁷³ Miller and Spoolman, *Living in the Environment*, 555.

mental health of those impacted. If actions are taken to remediate the polluted aquifer, the machinery brought in to perform the cleanup and the scars it leaves on the local environment disrupt the aesthetic services provided by the environment. Pollution prevention is the only way to avoid this disruption in ecosystem services, protecting environmental health and integrity of communities reliant on groundwater resources.

While pollution prevention is the only way to protect the environmental health of a community, environmental health is often not a priority for the people making decisions. Pollution is often viewed as an externality, with little thought given to the environmental collateral resulting from these decisions. In the case of the DOD, environmental health has historically been both considered separate from and sacrificed in defense of national security.⁷⁴

This philosophical separation of environmental health from national security is deeply misguided given the dependence of the public on an environment healthy enough to provide the ecosystem services which enable their communities' survival. The large-scale disruption of ecosystem services, especially those concerning the provisioning and filtration of water resources, has had disastrous effects on the health and security of communities across the United States. The remainder of the chapter will examine the public health consequences faced by Warminster, Warrington, and Horsham as a direct result of PFAS pollution carried out by the DOD at NADC and NASJRB. To inform this evaluation, the following section will explore the history of domestic PFAS use.

History and Early Research. PFAS (originally abbreviated as PFCs) were first invented in the 1940s. They began to be produced for use in various stain- and water-resistant products

⁷⁴ Hansen, *The Greening of Pentagon Brownfields*, 88.

beginning in the mid-1950s, and for firefighting foam in the 1960s.⁷⁵ Throughout the latter half of the 20th Century, the chemicals were commonly used in the production of food packaging, carpets, furniture textiles, clothing, Scotchgard, and other products to cause them to be more water-, flame-, grease-, and stain-resistant.⁷⁶ Due to this widespread and wholly unregulated use, most people would test positive to having small quantities of PFAS in their blood.⁷⁷ Though all sources of exposure are not fully understood, the most common exposure route is through consumption of PFAS-laced food or water, or through use of PFAS-containing products.⁷⁸

In the early 2000s, public concern regarding the unknown public health and environmental health effects of the widespread use of PFAS in consumer products began to grow. The EPA, recognizing the chemicals’ “widespread exposure to humans[,] persistence in the environment[,] observed toxicity in animal models[, and the] insufficient information to properly assess human health risk,”⁷⁹ began taking steps to respond to this public concern. From the early 2000s through mid-2018, the EPA responded in three ways: first, through minimization of consumer exposure to two of the most widely used of these chemicals, PFOA and PFOS; second, through research into the public and environmental health effects of the chemicals; and third, through assessment the prevalence of certain PFAS in public water systems (PWS).

To minimize consumer exposure to PFAS, the EPA requested to the principle

⁷⁵ Robert Mueller and Virginia Yingling, “History and Use of Per- and Polyfluoroalkyl Substances (PFAS),” Interstate Technology Regulatory Council, November 2017, accessed November 27, 2018, https://pfas-1.itrcweb.org/wp-content/uploads/2017/11/pfas_fact_sheet_history_and_use__11_13_17.pdf, 2.

⁷⁶ Karen Araiza, “Sick Staff, Neighbors Get Few Answers About Montgomery County Navy Base Water Contamination,” *NBC Philadelphia*, May 26, 2016, <https://www.nbcphiladelphia.com/news/local/Water-Contamination-Willow-Grove-NAS-Public-Meeting-Horsham-Montgomery-County-380768661.html>. ; Joel Beauvais, “Science Guides Public Health Protection for Drinking Water,” The EPA Blog, May 19, 2016, accessed November 27, 2018, <https://blog.epa.gov/2016/05/19/protection-for-drinking-water/>.

⁷⁷ Araiza, “Sick Staff, Neighbors Get Few Answers...”

⁷⁸ “Perfluorinated Chemicals (PFCs),” National Institute of Environmental Health Sciences (NIEHS), modified November 13, 2018, accessed November 26, 2018, <https://www.niehs.nih.gov/health/topics/agents/pfc/index.cfm>.

⁷⁹ “Perfluorinated Chemicals (PFCs),” NIEHS, modified November 13, 2018.

manufacturers of PFOA and PFOS that production of the chemicals be discontinued. This request was accommodated for PFOS by 2002,⁸⁰ and for PFOA by 2015.⁸¹ Due to their removal from many products and industrial processes, data from blood testing over the past decade has demonstrated that exposures to PFOS and PFOA are decreasing nationwide.⁸² Despite this removal from consumer goods, however, PFAS are still used almost universally in the protective gear worn by firefighters and in the firefighting foam used for civilian and military purposes.⁸³

To conduct its research on PFAS, the EPA enlisted the aid of NIEHS and the National Toxicology Program (NTP). The early research conducted by NIEHS indicated that PFAS “break down very slowly in the environment,” and can have “persistent” negative consequences on animal and human life.⁸⁴ Studies conducted on animals by NIEHS linked PFAS exposure to the following effects: disruption of endocrine activity, reduction of immune system function, “adverse effects” on the liver and pancreas, delays in mammary gland development, and developmental problems linked to teratogenic exposure.⁸⁵ Other early studies recognized by NIEHS suggested a link between PFAS exposure and “reduced vaccine-induced immune protection in children”,⁸⁶ along with “cancers and reproductive problems.”⁸⁷ Research conducted separately by the Pennsylvania Department of Health later warned that PFAS exposure could impact “growth, learning and behavior” in children and infants, increase cholesterol levels, affect the immune system, disrupt hormones, interfere with women’s fertility, and increase risk of

⁸⁰ Beauvais, “Science Guides Public Health Protection for Drinking Water.”

⁸¹ Beauvais, “Science Guides Public Health Protection for Drinking Water.”

⁸² Beauvais, “Science Guides Public Health Protection for Drinking Water.”

⁸³ *Hearing Before the Subcommittee on Federal Spending Oversight and Emergency Management: The Federal Role in the Toxic PFAS Chemical Crisis*, S. Hrg. 115-461, 115th Cong., 2d sess., September 26, 2018, 26.

⁸⁴ “Perfluorinated Chemicals (PFCs),” NIEHS, modified November 13, 2018.

⁸⁵ “Perfluorinated Chemicals (PFCs),” NIEHS, modified November 13, 2018.

⁸⁶ “Perfluorinated Chemicals (PFCs),” NIEHS, modified November 13, 2018.

⁸⁷ Araiza, “Sick Staff, Neighbors Get Few Answers...”

certain types of cancers.⁸⁸ All entities conducting research on PFAS prior to mid-2018 indicated that further research was needed.

To assess the prevalence of the chemicals in PWS, the EPA began evaluating PFAS through the protocol of the Safe Drinking Water Act (SDWA) in 2012.⁸⁹ Eight PFAS, including PFOS and PFOA, were monitored under the third Unregulated Contaminant Monitoring Rule (UCMR 3) of the SDWA.⁹⁰ The data from this monitoring, released in 2017, showed that less than 1% of the nearly 5,000 PWS evaluated contained water with PFOS or PFOA levels above EPA guidelines.⁹¹ The SDWA and its applicability to PFAS will be discussed in greater detail in Chapter 3.

While the results of UCMR 3 could lead one to consider PFAS groundwater contamination to be an insignificant issue, that number does not adequately reflect the experience of the communities impacted by this pollution. Of the PWS tested, 95 were contaminated with PFOS levels above the EPA's 2016 health advisory levels, and 117 were contaminated with PFAS levels above those guidelines.⁹² To better understand the urgency of the public health concerns associated with this contamination, the next section will engage with the case study being addressed in this analysis: the Naval Air Station Joint Reserve Base and the Naval Air Defense Center.

⁸⁸ Justine McDaniel and Laura McCrystal, "Bucks and Montco towns with water contamination chosen for blood testing," *The Inquirer Daily News for Philly.com*, May 31, 2018, accessed November 27, 2018, <http://www.philly.com/philly/news/pennsylvania/bucks-montgomery-water-contamination-pfas-pfoa-navy-military-base-blood-test-20180531.html?arc404=true>.

⁸⁹ *Fact Sheet: PFOA & PFOS Drinking Water Health Advisories*, U.S. Environmental Protection Agency, 4, November 2016, accessed November 26, 2018, https://www.-06/documents/drinkingwaterhealthadvisories_pfoa_pfos_updated_5.31.16.pdf.

⁹⁰ U.S. Environmental Protection Agency, *The Third Unregulated Contaminant Monitoring Rule (UCMR 3): Data Summary, January 2017*. 4.

⁹¹ U.S. Environmental Protection Agency, *The Third Unregulated Contaminant Monitoring Rule (UCMR 3): Data Summary, January 2017*. 8.

⁹² U.S. Environmental Protection Agency, *The Third Unregulated Contaminant Monitoring Rule (UCMR 3): Data Summary, January 2017*. 11.

The Effects of PFAS Used On-Base. The bases serving as a case study in this report, NASJRB and NADC, are the source of PFAS contamination in their communities. These bases used large quantities of PFAS-containing firefighting foam for “routinely perform[ed] firefighting trainings,”⁹³ leading to the “direct release” of PFAS onto the ground at both bases.⁹⁴ Extensive use of this foam and other PFAS-containing materials at both bases over the latter half of the twentieth century led to high concentrations of certain PFAS in the groundwater of the bases’ surrounding the area. Unfortunately, both bases are situated near public water systems: NADC is a short distance away from four source wells used by the Warminster Municipal Authority, and NASJRB is located near both the Horsham Water and Sewer Authority and Warrington Township Water and Sewer Department.⁹⁵ This close proximity inevitably led to the contamination of these PWS. In 2014 and 2015, some of the water measured from these PWS had PFOA concentrations reaching 1,600 parts per trillion (PPT),⁹⁶ more than twenty times the “acceptable limit” of 70 PPT recommended by the EPA.⁹⁷ All contaminated wells were taken off of the public water systems by the end of 2016;⁹⁸ nonetheless, longtime residents of Warminster, Warrington, and Horsham were exposed to unsafe levels of PFAS in their groundwater for close to 50 years.⁹⁹

Decades of drinking PFAS-laced water have had grave effects on many residents and

⁹³ Pennsylvania Department of Health, Division of Environmental Health Epidemiology, *PFAS Exposure Assessment Technical Toolkit (PEATT) Pilot Project: Final Report*, 5, April 2019, accessed November 5, 2019, <https://www.health.pa.gov/topics/Documents/Environmental%20Health/PEATT%20Pilot%20Project%20Final%20Report%20April%2029%202019.pdf>.

⁹⁴ Pennsylvania Department of Health, Division of Environmental Health Epidemiology, *PFAS Exposure Assessment Technical Toolkit (PEATT) Pilot Project: Final Report*, 5.

⁹⁵ Pennsylvania Department of Health, Division of Environmental Health Epidemiology, *PFAS Exposure Assessment Technical Toolkit (PEATT) Pilot Project: Final Report*, 5.

⁹⁶ Araiza, “Sick Staff, Neighbors Get Few Answers...”

⁹⁷ U.S. Environmental Protection Agency, *Fact Sheet: PFOA & PFOS Drinking Water Health Advisories*, 2.

⁹⁸ Pennsylvania Department of Health, Division of Environmental Health Epidemiology, *PFAS Exposure Assessment Technical Toolkit (PEATT) Pilot Project: Final Report*, 5.

⁹⁹ Pennsylvania Department of Health, Division of Environmental Health Epidemiology, *PFAS Exposure Assessment Technical Toolkit (PEATT) Pilot Project: Final Report*, 5.

former base employees. One resident, Hope Grosse, was raised within short walking distance of NADC and worked on the base as a young adult.¹⁰⁰ She was diagnosed with an aggressive cancer in her mid-twenties, and her father died of cancer in his early fifties.¹⁰¹ Another resident, Joanne Stanton, grew up in Warminster; her son was diagnosed with a rare pediatric brain cancer at a young age.¹⁰² The stories of these two women are far from unique—many area residents and former base employees began to notice a “burgeoning number of life-threatening health problems” over the course of the last decade.¹⁰³

Despite the gravity and consistency of these concerns, little could be confirmed without further research. The EPA’s 2016 release of recommended Maximum Contaminant Levels (MCLs) for PFOS and PFOA was the catalyst of state-level research conducted by the Pennsylvania Department of Health (PA DOH) into the effects of PFAS on residents and former employees of the bases. A pilot program testing the blood of the residents of the area was conducted in 2018.¹⁰⁴ In April 2019, after years of anecdotal evidence, the resulting report published by the PA DOH confirmed these residents’ concerns.

This report, released by PA DOH’s Division of Environmental Health Epidemiology, analyzed the blood samples of 235 community members selected randomly for detection of 11 PFAS.¹⁰⁵ The results found that PFOS and PFOA, along with two other PFAS, were found in the participants in levels far exceeding national averages; moreover, concentration increased with

¹⁰⁰ “Our Team,” BuxMont Coalition for Safer Water, accessed November 5, 2019, <https://www.buxmontwater.org/partners>.

¹⁰¹ “Our Team,” BuxMont Coalition for Safer Water.

¹⁰² “Our Team,” BuxMont Coalition for Safer Water.

¹⁰³ Araiza, “Sick Staff, Neighbors Get Few Answers...”

¹⁰⁴ Pennsylvania Department of Health, Division of Environmental Health Epidemiology, *PFAS Exposure Assessment Technical Toolkit (PEATT) Pilot Project: Final Report*, 6.

¹⁰⁵ Pennsylvania Department of Health, Division of Environmental Health Epidemiology, *PFAS Exposure Assessment Technical Toolkit (PEATT) Pilot Project: Final Report*, 3.

age, length of residence in the area, and employment on-base.¹⁰⁶ Beyond confirmation of increased presence of certain PFAS in residents' blood, the report affirmed that exposure to these chemicals had had a negative effect on the “developmental, immune, metabolic and endocrine health of those exposed,” and had also caused elevated cholesterol levels and certain types of cancers.¹⁰⁷ This report validated what many Warminster, Warrington, and Horsham residents already knew—their water was slowly poisoning them.

As research has developed in recent years, the link between individual residents' life-threatening health conditions and the on-base PFAS pollution has become apparent. Once this link was discovered, many community members were reasonably outraged. Some residents, like Joanne Stanton and Hope Grosse, chose to organize their community. They founded the BuxMont Coalition for Safer Water to advocate for clean water, medical care, and drinking water regulations protective of public health.¹⁰⁸ Others chose to sue the Navy, the companies responsible for producing the firefighting foam, or both.¹⁰⁹ These developments will be discussed further in Chapter 5.

Unfortunately, the impacts of PFAS groundwater contamination are not limited to these communities in Southeastern Pennsylvania. Seventeen sites across the Commonwealth alone have been impacted by this contamination,¹¹⁰ from DOD bases and industrial sources alike.¹¹¹ Many communities across the nation—notably in New Hampshire, Alabama, Delaware, and

¹⁰⁶ Pennsylvania Department of Health, Division of Environmental Health Epidemiology, *PFAS Exposure Assessment Technical Toolkit (PEATT) Pilot Project: Final Report*, 3.

¹⁰⁷ Pennsylvania Department of Health, Division of Environmental Health Epidemiology, *PFAS Exposure Assessment Technical Toolkit (PEATT) Pilot Project: Final Report*, 3.

¹⁰⁸ “Our Team,” BuxMont Coalition for Safer Water.

¹⁰⁹ Araiza, “Sick Staff, Neighbors Get Few Answers...”

¹¹⁰ College of Public Health Staff, “College to Study Local PFAS Contamination, Cancer Data,” Temple University College of Public Health, October 8, 2019, accessed November 5, 2019, <https://cph.temple.edu/about/news-events/news/college-study-local-pfas-contamination-cancer-data>.

¹¹¹ *Hearing Before the Subcommittee on Federal Spending Oversight and Emergency Management: The Federal Role in the Toxic PFAS Chemical Crisis*, 14.

Michigan—have made a concerted effort to manage the contamination in their communities since its presence first became evident.¹¹² Due to the widespread, unchecked use of PFAS throughout the 20th Century, their presence in groundwater has become a problem for not just one isolated group of communities in Southeastern Pennsylvania, but for the nation as a whole.

The outrage of the members of polluted communities across the nation, combined with the advocacy of their representatives on their behalf, brought PFAS groundwater contamination into the national spotlight in late 2018. The resulting actions at the state and federal levels will be detailed in Chapter 5. The action most relevant to the present discussion of public health is the additional research being conducted to better understand the impacts of PFAS on human and environmental health, and to develop technologies to more efficiently remove these chemicals from the environment.

This research is being spearheaded by the NTP and the NIEHS. NTP is conducting a literature review of six PFAS, as well as animal studies on eight PFAS, to more precisely determine their impacts to human health.¹¹³ Special attention is being paid in these studies to the relationship between PFAS exposure and vaccine efficacy in children.¹¹⁴ NIEHS is providing grants to various organizations for the development of technologies to break down PFAS through its Superfund Research program.¹¹⁵ Projects being funded include efforts to develop “energy-efficient nanoreactors capable of breaking the carbon-fluorine bond that keeps PFAS from degrading”, “options to contain aqueous film-forming foams used for firefighting”, “databases that exploit land use data to identify cities and towns at high risk for PFAS exposure”, “new

¹¹² *Hearing Before the Subcommittee on Federal Spending Oversight and Emergency Management: The Federal Role in the Toxic PFAS Chemical Crisis*, 14, 19, 21.

¹¹³ “Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS),” National Institute of Environmental Health Sciences (NIEHS), last modified September 30, 2019, accessed November 5, 2019, <https://www.niehs.nih.gov/health/topics/agents/pfc/index.cfm>.

¹¹⁴ “Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS),” NIEHS, last modified September 30, 2019.

¹¹⁵ “Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS),” NIEHS, last modified September 30, 2019.

ways to remove hazardous PFAS from water”, and “technology to speed up removal of PFAS at Superfund sites.”¹¹⁶ Once completed, these studies and literature reviews will paint a much clearer picture of the full effects of PFAS contamination on human health., and of how to best address them in affected communities.

The Centers for Disease Control and Prevention (CDC) and the Agency for Toxic Substances and Disease Registry (ATSDR) are also contributing to the research. These agencies are conducting a multi-site study through cooperation with seven grantee organizations to assess the human health effects of PFAS-contaminated drinking water on over 8,000 total individuals.¹¹⁷ According to the CDC, the study aims to “to select sites with residents who have a wide range of PFAS exposure levels...[to] identify health effects at different levels of exposure.”¹¹⁸ Temple University, located in Philadelphia, Pennsylvania, is the recipient of one of these grants. The \$5 million study funded by the grant will be conducted by the university’s College of Public Health over a five-year period, examining the water from 13 Pennsylvania counties. The Pennsylvania project ultimately aims to “estimate individual residents’ lifetime exposure to PFAS through drinking water,” and subsequently to “determine whether PFAS exposure is associated with increased thyroid and kidney cancer risk.”¹¹⁹ Through this partnership between Temple University and the CDC, this project will help meet national research objectives while providing with much-needed answers to Pennsylvania residents personally affected by PFAS exposure.¹²⁰

¹¹⁶ “Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS),” NIEHS, last modified September 30, 2019.

¹¹⁷ “CDC and ATSDR Announce Funding for Study of Health Effects of PFAS in Drinking Water,” Centers for Disease Control and Prevention (CDC), last modified April 1, 2019, accessed November 5, 2019, <https://www.cdc.gov/media/releases/2019/p0401-health-effects-pfas-drinking-water.html>. ; College of Public Health Staff, “College to Study Local PFAS Contamination, Cancer Data.”

¹¹⁸ “CDC and ATSDR Announce Funding for Study of Health Effects of PFAS in Drinking Water,” Centers for Disease Control and Prevention (CDC).

¹¹⁹ College of Public Health Staff, “College to Study Local PFAS Contamination, Cancer Data.”

¹²⁰ College of Public Health Staff, “College to Study Local PFAS Contamination, Cancer Data.”

In addition to the research being conducted by government agencies, nongovernmental organizations have also conducted research on the effects of PFAS exposure on human and environmental health. One such organization, the National Research Defense Council (NRDC), categorized PFAS as a “serious global health threat” in a report released in April 2019.¹²¹ The report argues that, based on their review of the scientific literature, the health advisory levels set by the EPA for PFOS and PFOA do not protect human health from potentially fatal health conditions due to the chemicals’ “extreme persistence, high mobility, and...associat[ion] with...different types of toxicity at very low levels of exposure.”¹²² Beyond this, the report emphasizes the increased risks to human health presented when certain ‘complex’ PFAS break down into ‘less complex’ PFAS such as PFOS and PFOA.¹²³ The report raises further concern about the public health risks associated with PFAS and the futility of current regulations surrounding their use.

Conclusion. PFAS have been shown to be extremely damaging to public health. Recent studies focusing on their human health impacts have shown clear links between exposure to these chemicals in drinking water and many life-threatening health conditions. The pollution at NADC and NASJRB has severely damaged the environmental health of Warminster, Warrington, and Horsham by disrupting critical ecosystem services. The effects of their disruption have been sorely felt by many former employees of the bases and residents. As a direct result of DOD use of PFAS-containing materials at NASJRB and NADC throughout the latter half of the 20th Century, many of their lives have been irrevocably damaged or prematurely ended.

¹²¹ Anna Reade, Tracy Quinn, and Judith S. Schreiber, *PFAS in Drinking Water 2019: Scientific and Policy Assessment for Addressing Per- and Polyfluoroalkyl Substances (PFAS) in Drinking Water* (New York: National Resources Defense Council, April 2019), 5, accessed November 6, 2019, https://www.nrdc.org/sites/default/files/media-uploads/nrdc_pfas_report.pdf.

¹²² Reade, Quinn, and Schreiber, *PFAS in Drinking Water 2019*, 6.

¹²³ Reade, Quinn, and Schreiber, *PFAS in Drinking Water 2019*, 6.

Understanding the grave and evident public health concerns associated with these chemicals, one might wonder how this level of harm was allowed to occur in a country with as high standards for public health as the United States. In such a country, one might expect that enforceable restrictions on the usage of and pollution with PFAS would be in place to prevent public health catastrophes like this. Yet, the groundwater contamination of Warminster, Warrington, and Horsham was entirely legal and is still legal to date. The following chapter will examine relevant pollution control laws at the state and federal level to better understand this legislative oversight.

Chapter 3. PFAS and Pollution Control Legislation

Given the grave public health concerns linked to PFAS-contaminated groundwater, it would seem reasonable to assume that their use is regulated; this is not the case. The regulatory structure permitted the DOD actions that resulted in the contamination of the groundwater by PFAS, both at NASJRB and NADC and across the nation, to happen completely legally. This chapter will demonstrate this by examining the state and federal legislation surrounding water quality and hazardous materials in place before and after the creation of the EPA. Regulatory developments which occurred after mid-2018 will be discussed in Chapter 5. While both state and federal laws will be examined, significant weight will be placed on the role of federal water quality and hazardous materials laws after 1970 in creating the regulatory context relevant to NADC and NASJRB. The laws in place allowed PFAS pollution to slip through regulatory cracks into the groundwater, jeopardizing the safety of hundreds of thousands of Americans.

Water Quality and Hazardous Materials Law before 1970. The federal water quality and pollution control laws on the books at the time of construction of NASJRB and NADC were much more limited in scope than those in place today. Prior to 1970, environmental regulation in

the United States was considered the domain of the states, except in cases of interstate concerns. Unfortunately, most states considered the costs of losing industry in their state due to comparatively strict regulations to be greater than the benefits of the public benefits protected by stricter environmental regulations.¹²⁴ This fear of outsourcing, combined with less developed public concern about environmental health, led to the development of water quality and hazardous materials laws only minimally protective of public health. This ultimately ineffective legislation developed in the early 20th century.

Pennsylvania's first major water quality law, the Purity Water Act, was enacted in 1905 in response to a typhoid fever outbreak.¹²⁵ This law sought to protect the quality of the state's waters for the sake of public health through restrictions on sewage discharge.¹²⁶ Despite numerous challenges in the state's court, the law's assertion of the necessity of water and sewage treatment plants for the protection of public health, with emphasis on the "degree of safety...[to be] obtained in treating sewage" and water, was upheld as "eminently fair and satisfactory."¹²⁷ While this law was instrumental in protecting human health through water quality in Pennsylvania, it only pertained to sewage discharge. Stronger water quality restrictions were needed due to the disastrous effects of coal mine discharges on the state's water quality.¹²⁸

These vital restrictions were developed through the Clean Streams Law of 1937, along with its many subsequent amendments. This law was an important step forward in the

¹²⁴ Peter Harnick, "Life Before the EPA: Calls to bring power back to the states ignore the struggles states had regulating the environment," *The Revelator*, June 22, 2017, accessed November 6, 2019, <https://therevelator.org/life-before-epa/>.

¹²⁵ Jan Jarrett and Matt Stepp, "Pennsylvania's History with Water Pollution Policy," *PennFuture Blog*, June 27, 2017, accessed November 6, 2019, <https://pennfuture.org/Blog-Item-Pennsylvanias-History-with-Water-Pollution-Policy>.

¹²⁶ Samuel G. Dixon, *Official Documents, Comprising the Department and Other Reports Made to the Governor, Senate and House of Representatives of Pennsylvania, Volume XI* (Harrisburg: Pennsylvania Department of Health through Harrisburg Publishing Co., 1908), 948, accessed November 5, 2019, Google Books eLibrary.

¹²⁷ Dixon, *Official Documents, Comprising the Department and Other Reports.... Volume XI*, 948.

¹²⁸ Jarrett and Stepp, "Pennsylvania's History with Water Pollution Policy."

management of Pennsylvania's water quality in many ways. First, it recognized the importance of water quality not only for the protection of human health, but also for the "protection of...animal and aquatic life, ...industrial consumption, and recreation."¹²⁹ Next, it had a much broader jurisdiction than the Purity Water Act—its 1945 amendment enabled the Pennsylvania Sanitary Water Board to regulate the discharge of industrial wastes, coal mine operations, and coal mines' impacts on "water quality, supply and quantity."¹³⁰ The 1945 amendment further required polluting parties to develop pollution control plans, to be submitted to the Sanitary Water Board.¹³¹ The Clean Streams Law remains a keystone of water pollution regulation in the Keystone State to this day.

At the federal level, the nation's first drinking water protection statute was signed into law in 1944, within a year of the construction of NASJRB and NADC.¹³² The Public Health Service Act of 1944, among other provisions not related to water quality, obliges the Surgeon General to direct research into "water purification, sewage treatment, and pollution of lakes and streams" to better understand the "causes, diagnosis, treatment, control, and prevention" of human illness caused by water pollution.¹³³ This law did not include any enforceable measures to manage the quality of drinking water, but the research conducted by it laid the groundwork for later statutes such as the Safe Drinking Water Act.

In 1948, the first enforceable federal water quality statute was passed: the Federal Water

¹²⁹ The Clean Streams Law, Pennsylvania Public Law 1987, No. 394, Cl. 32, (June 22, 1937), Introductory Clause, accessed November 5, 2019, <https://www.legis.state.pa.us/WU01/LI/LI/US/HTM/1937/0/0394..HTM>.

¹³⁰ The Clean Streams Law, Pennsylvania Public Law 1987, No. 394, Cl. 32, Introductory Clause. ; Jarrett and Stepp, "Pennsylvania's History with Water Pollution Policy."

¹³¹ Karl Boyd Brooks, *Before Earth Day: The Origins of American Environmental Law, 1945-1970* (Lawrence: University Press of Kansas, 2009), 56.

¹³² A. Dan Tarlock, "Safe Drinking Water: A Federalism Perspective," *William & Mary Environmental Law and Policy Review* 21, no. 1 (1997): 233, accessed November 5, 2019, <http://scholarship.law.wm.edu/wmelpr/vol21/iss1/5>.

¹³³ Public Health Service Act of 1944, Public Law 78-410, *US Statutes at Large* 58 (1944): 692, previously codified at *US Code* 42 (1944).

Pollution Control Act of 1948 (FWPCA). This act directed the Surgeon General and other relevant agencies to restrict the pollution and manage the water quality of interstate waters, tributaries, and ground waters through the development of comprehensive management programs.¹³⁴ It furthermore declared pollution of these waters to be a “public nuisance...subject to abatement,”¹³⁵ and established the Water Pollution Control Advisory Board to guide the regulation of pollutants.¹³⁶ This statute was amended in 1956, 1960, 1961, and 1965 to extend its authorization period, increase authorizations and appropriations, and extend special assistance to certain states.¹³⁷ A set of amendments called the Clean Water Restoration Act of 1966 were passed in that year to authorize a massive study, spearheaded by the Secretary of the Interior, on the effects of sedimentation and pollution on various human actions in U.S. estuaries.¹³⁸ The FWPCA was handicapped by its ability to only regulate interstate waters, but was an important first step in enforceable water pollution control.

While water pollution law began to develop during the first half the 20th Century, most federal and state hazardous substance laws were not created until after the EPA was established in 1970. The one notable exception, the Federal Hazardous Substances Labeling Act of 1960, sought to prevent consumer harm due to hazardous substance contact by requiring labels on products containing hazardous substances.¹³⁹ While important for consumer protection, this law

¹³⁴ “Federal Water Pollution Control Act (Clean Water Act),” Digest of Federal Resource Laws of Interest to the U.S. Fish and Wildlife Service, accessed November 5, 2019, <https://www.fws.gov/laws/lawsdigest/FWATRPO.HTML>.

¹³⁵ Water Pollution Control Act of 1948, Public Law 80-845, *US Statutes at Large* 62 (1948): 1156, codified at *US Code* 33 (1948), §1251 et seq.

¹³⁶ Water Pollution Control Act of 1948, *US Statutes at Large* 62 (1948): 1159.

¹³⁷ “Federal Water Pollution Control Act (Clean Water Act),” Digest of Federal Resource Laws of Interest to the U.S. Fish and Wildlife Service.

¹³⁸ “Federal Water Pollution Control Act (Clean Water Act),” Digest of Federal Resource Laws of Interest to the U.S. Fish and Wildlife Service.

¹³⁹ Federal Hazardous Substances Labeling Act of 1960, Public Law 86-613, *US Statutes at Large* 72 (1960): 372, codified at *US Code* 30 (1960), §§1261-1278.

only pertained to “hazardous substances intended or suitable for household use.”¹⁴⁰ Both because PFAS were not known to be hazardous substances and because the firefighting and aviation-related activities which caused the pollution are clearly not a ‘household use,’ the Federal Hazardous Substances Labeling Act did not apply to the pollution incurred at NASJRB and NADC.

The water quality and hazardous materials laws detailed above were those in place during the first few decades of operation of NASJRB and NADC. The developmental trajectory of water quality laws prior to the environmental decade demonstrates a desire to regulate water pollutants. The desire to regulate hazardous materials took longer to develop, potentially due to the lack of public awareness of hazardous materials prior to the 1960s. Water pollution caused by sewage or coal contamination is easy to understand conceptually, and its effects are often immediately noticeable to the untrained eye. On the other hand, hazardous materials pollution is less-easily understood, can have more subtle short-term effects, and often has long-term effects that could be ascribed to other causes. While the reasons for this lack of regulation can only be speculated, the effects of this neglect on Warminster, Warrington, and Horsham began in the early 1960s with the use of certain PFAS at NASJRB and NADC. PFAS was permitted to percolate into soil and the groundwater on these bases and many others across the country completely legally during the decade preceding the creation of the EPA.

Regulatory Shifts in the 1970s. In the decades leading up to the creation of the EPA, increasing public consciousness of environmental issues laid the foundation for future, large-scale environmental regulation. In the early 20th Century, many people did not believe that human actions had the ability to harm the environment. The first wake up call for many Americans was

¹⁴⁰ Federal Hazardous Substances Labeling Act of 1960, *US Statutes at Large* 72 (1960): 372.

the extinction of the passenger pigeon, a bird that had originally numbered in the billions, due to excessive hunting in 1914. The lack of pollution regulation allowed businesses to degrade the nation's environment virtually without consequence. Many considered this environmental damage to be necessary collateral to the culture of progress of the 20th Century United States, while others grew concerned over the ways that the side effects of this progress were impacting human and environmental health.

When Rachel Carson published *Silent Spring* in 1962, the dam broke on environmental consciousness. Carson's book sparked a national conversation about the connection between the use of pesticides and the degradation of ecosystems, and of the ability of human actions to cause serious environmental harm. This conversation deepened in 1970 with the first Earth Day. In 1969, Senator Gaylord Nelson of California conceived of the first Earth Day as a teach-in for the environment, after witnessing a major oil spill in Santa Barbara.¹⁴¹ On April 1, 1970, 1 in 10 Americans participated in the teach-in, which combined bipartisan support over environmental concerns with the energy of the 1960s anti-war movement.¹⁴² This building momentum led President Richard Nixon to create the Environmental Protection Agency (EPA) on December 2, 1970,¹⁴³ permanently changing the landscape of environmental regulation in the United States.

A few months prior to the first Earth Day, Nixon also signed the National Environmental Policy Act (NEPA) on January 1, 1970. NEPA mandates federal agencies to evaluate the potential environmental effect of all projects through either a comprehensive Environmental Impact Statement (EIS) for projects of known impact or large size, or a less-comprehensive

¹⁴¹ "The History of Earth Day," EarthDay.org, last modified 2019, accessed December 19, 2019, <https://www.earthday.org/history/>

¹⁴² "The History of Earth Day," EarthDay.org.

¹⁴³ Craig Collins, *Toxic Loopholes: Failures and Future Prospects for Environmental Law* (New York: Cambridge University Press, 2010), 7.

Environmental Assessment (EA) for projects of uncertain potential impact. Depending on EA findings, the EA can lead to a ‘Finding of No Significant Impact’ Report and the continuation of the project, or to the development of a full EIS to better assess any discovered environmental concerns.¹⁴⁴ Though simple and straightforward, NEPA was a considerable step in the right direction for US environmental legislation—systemically forcing federal agencies to ‘stop and think’ about the potential environmental collateral of their projects was previously unheard of.¹⁴⁵ NEPA’s broad scope paved the way for further legislation, allowing subsequent laws to focus on specific concerns.

The creation of the EPA and the passage of NEPA in 1970 laid the building blocks for the explosion of federal environmental laws enacted by Congress over the following decade. Increasing public concern over environmental issues led to the passage of the more than 70 environmental laws to be administered by the EPA over the next decade.¹⁴⁶ This flood of environmental laws would later earn this period the title of ‘environmental decade.’ Importantly, the pollution control laws enacted by Congress gave the EPA the crucial authority to regulate intrastate pollution along with interstate pollution. The statutes enacted largely followed the ‘command and control’ approach, first setting an upper limit for the presence or emission of a given pollutant in a given medium, then penalizing organizations found to be noncompliant.¹⁴⁷ The establishment of such strong federal statutes shifted the primary regulatory authority from state environmental agencies to the EPA, with state standards mandated to meet or exceed federal standards. The massive shifts produced by these laws and their subsequent amendments

¹⁴⁴ Steven Ferrey, *Environmental Law: Examples and Explanations*, 2nd ed. (New York: Aspen Law & Business, 2001), 73.

¹⁴⁵ Steven Ferrey, *Environmental Law*, 67.

¹⁴⁶ Manheim, *The Conflict Over Environmental Regulation in the United States*, 82.

¹⁴⁷ Dawn Anderson, “Regulatory Policy vs Economic Incentives,” The Environmental Literacy Council Blog, accessed November 6, 2019, <https://enviroliteracy.org/environment-society/economics/regulatory-policy-vs-economic-incentives/>.

utterly transformed environmental regulation in the United States.

While significant progress was made in pollution control legislation during the environmental decade, some forms of pollutants managed to slip through the cracks. The following sections will examine the developments in water quality and hazardous substances law relevant to PFAS which occurred after the creation of the EPA. While the laws that developed provide a framework that adequately regulates many pollutants, they do not adequately regulate PFAS. The weak spots in contemporary pollution control regulation have allowed for the rampant pollution of the nation's groundwater with PFAS, causing the grievous public health concerns now faced by the residents of Warminster, Horsham, and Warrington.

Water Quality Law after 1970. The first major water quality law of the environmental decade was the Clean Water Act (CWA). The CWA, signed into law in 1972, substantially amended the FWPCA of 1948. These changes gave the EPA a considerable increase in authority over domestic water pollutant discharges by instituting a regulatory structure for such discharges and implementing industry wastewater standards.¹⁴⁸ Among other provisions, the CWA of 1972 made point source discharges of pollutants into 'navigable waters' illegal without a permit, and established a grant system for sewage treatment plant construction.¹⁴⁹ Later amendments to the Act, such as the 1987 addition of Section 319, have addressed the need to develop state-level programs to address nonpoint source pollution.¹⁵⁰

The development of state-level programs is a significant departure from the 'command-and-control' nature of most pollution control legislation since the founding of the EPA. This

¹⁴⁸ "History of the Clean Water Act," U.S. Environmental Protection Agency, last modified August 8, 2017, accessed November 6, 2019, <https://www.epa.gov/laws-regulations/history-clean-water-act>.

¹⁴⁹ "History of the Clean Water Act," U.S. Environmental Protection Agency.

¹⁵⁰ "Introduction to the Clean Water Act: Section 319: Nonpoint Source Program," U.S. Environmental Protection Agency, accessed November 6, 2019, https://cfpub.epa.gov/watertrain/moduleFrame.cfm?parent_object_id=2788.

difference is due to the recognition that “nationwide uniformity in controlling non-point source pollution [is] virtually impossible” considering the variety of techniques needed to manage nonpoint source pollution in each state, depending on its land usage patterns.¹⁵¹ Some contemporary legal scholarship contends that nonpoint source pollution was not intended to fit under the structure of the CWA, and cannot reasonably be regulated under its framework.¹⁵² Unfortunately, no other federal statutes *do* provide a framework for the regulation of nonpoint source pollution, and groundwater is one of the primary conduits for nonpoint source pollution. Pollution of runoff water, including that on military properties, is also considered nonpoint source pollution. Thus, the CWA’s regulatory framework leaves the PFAS pollution problem of Southeastern Pennsylvania to the jurisdiction of the state.

Pennsylvania’s groundwater protection program under the CWA works in conjunction with the amended Pennsylvania Clean Streams Law mentioned above.¹⁵³ This program, titled the Comprehensive State Groundwater Protection Program (CSGWPP), establishes six strategic activities to protect the state’s groundwater which establish the state’s goals, priorities, and efforts involving groundwater protection.¹⁵⁴ These activities seek to “preven[t] ground water contamination wherever possible,”¹⁵⁵ yet have been remiss in doing so in regards to the PFAS

¹⁵¹ Damien Schiff, “Keeping the Clean Water Act Cooperatively Federal - Or, Why the Clean Water Act Does Not Directly Regulate Groundwater Pollution,” *William & Mary Environmental Law and Policy Review* 42, no. 1 (2018): 449, accessed November 5, 2019, <https://scholarship.law.wm.edu/wmelpr/vol42/iss2/3>.

¹⁵² Schiff, “Keeping the Clean Water Act Cooperatively Federal,” 449.

¹⁵³ Pennsylvania Department of Environmental Protection (PA DEP), *Pennsylvania Comprehensive State Groundwater Protection Program (CSGWPP) and Self-Assessment* (Harrisburg: Pennsylvania Department of Environmental Protection, 1998), 1, accessed November 5, 2019, <http://www.depgreenport.state.pa.us/elibrary/PDFProvider.ashx?action=PDFStream&docID=7496&chksum=&revision=0&docName=383-2000-030.pdf&nativeExt=pdf&PromptToSave=False&Size=544169&ViewerMode=2&overlay=0>.

¹⁵⁴ PA DEP, *Pennsylvania Comprehensive State Groundwater Protection Program (CSGWPP) and Self-Assessment*, 88-101.

¹⁵⁵ Pennsylvania Bureau of Water Supply Management, *Principles for Ground Water Pollution Prevention and Remediation* (Harrisburg: Pennsylvania Department of Environmental Protection, 1996), 3, accessed November 5, 2019, <http://www.depgreenport.state.pa.us/elibrary/GetDocument?docId=7466&DocName=PRINCIPLES%20FOR%20G>

groundwater contamination problem caused by facilities such as NASJRB and NADC. As of mid-2018, the Pennsylvania Department of Environmental Protection (PA DEP) had not established any regulations through the CSGWPP to minimize or prevent PFAS pollution in groundwater despite its inherent preventability, its frequency of occurrence across the state, its and grave health consequences for residents in affected areas.

Though federal laws such as the CWA have been the main source of water pollution legislation since 1970, Harrisburg has also aimed to safeguard the state's water quality from pollution through its own legislation. In 1965, and multiple times since, the Clean Streams Law was amended to require the restoration of damaged waterways by their polluters, and to give the state greater authority to regulate industrial activities impacting water quality within its borders.¹⁵⁶ The Commonwealth's Land and Water Conservation and Reclamation Act of 1968 and Growing Greener programs of 1999 and 2005 invested significant funds into water pollution restoration projects.¹⁵⁷ The Pennsylvania Department of Environmental Resources was formed in 1970 to manage such projects;¹⁵⁸ this office was split in two in 1995: the Department of Environmental Protection and the Department of Conservation and Natural Resources.¹⁵⁹ The PA DEP, housed in an office building named after Rachel Carson,¹⁶⁰ seeks to uphold the state's responsibility as a "trustee" to the people of the Commonwealth's "right to clean air, pure water,

GROUNDWATER%20POLLUTION%20PREVENTION%20AND%20REMEDIATION.PDF%20%20%3Cspan%20style%3D%22color%3Agreen%3B%22%3E%3C%2Fspan%3E%20%3Cspan%20style%3D%22color%3Ablue%3B%22%3E%3C%2Fspan%3E.

¹⁵⁶ Jarrett and Stepp, "Pennsylvania's History with Water Pollution Policy."

¹⁵⁷ Jarrett and Stepp, "Pennsylvania's History with Water Pollution Policy." ; "What is Growing Greener?" Pennsylvania Department of Environmental Protection, accessed November 6, 2019, <https://www.dep.pa.gov/Citizens/GrantsLoansRebates/Growing-Greener/Pages/What-is-Growing-Greener.aspx>.

¹⁵⁸ Jarrett and Stepp, "Pennsylvania's History with Water Pollution Policy."

¹⁵⁹ Sharon Bogden, *The Pennsylvania Manual, Volume 121* (Harrisburg: Pennsylvania Department of General Services, 2013), 4—57, accessed November 8, 2019, https://www.ogc.pa.gov/About%20Us/Documents/vol_121___entire_manual.pdf.

¹⁶⁰ "Directions to DEP's Central Office," Pennsylvania Department of Environmental Protection, accessed November 6, 2019, <https://www.dep.pa.gov/About/Pages/DEP-Central-Office-Directions.aspx>.

and to the preservation of the natural, scenic, historic, and esthetic values of the environment,” in accordance with an amendment to the Pennsylvania Constitution ratified in 1971.¹⁶¹ These state-level measures, combined with the federal-level water quality laws put forth by the EPA, have vastly improved the Commonwealth’s water quality. Even these substantial improvements, however, have not protected Pennsylvanians’ constitutional right to pure water from the PFAS pollution slowly spreading through the state’s groundwater.

Due to the demonstrated lack of regulation of PFAS in general water quality laws, the potential pathways to regulation through drinking water quality legislation will now be examined. Federally, contemporary drinking water protections were primarily established in the Safe Drinking Water Act of 1974 (SDWA). The SDWA safeguards domestic drinking water quality by protecting waters which may be “actually or potentially” used as sources of drinking water, both above and below ground.¹⁶² This law and its subsequent amendments have authorized the EPA’s Office of Ground Water and Drinking Water to set standards for tap water protection by imposing an enforceable Maximum Contaminant Level (MCL) or Treatment Technique (TT) for over 90 contaminants, applicable across all of the nation’s public water systems. These contaminants and their MCLs and TTs are catalogued in the National Primary Drinking Water Regulations,¹⁶³ usually accompanied by a Public Health goal for each chemical lower than the enforceable limit set.¹⁶⁴ The SDWA does not apply to private drinking wells, and

¹⁶¹ Jarrett and Stepp, “Pennsylvania’s History with Water Pollution Policy.”

¹⁶² “Summary of the Safe Drinking Water Act,” U.S. Environmental Protection Agency, last modified August 15, 2019, accessed November 7, 2019, <https://www.epa.gov/laws-regulations/summary-safe-drinking-water-act>.

¹⁶³ “Surface Water Treatment Rules,” U.S. Environmental Protection Agency, last modified November 2, 2016, accessed November 7, 2019, <https://www.epa.gov/dwreginfo/surface-water-treatment-rules>.

¹⁶⁴ Office of Ground Water and Drinking Water, *National Primary Drinking Water Regulations* (Washington, D.C.: U.S. Environmental Protection Agency, 2009), 1-6, accessed November 7, 2019, https://www.epa.gov/sites/production/files/2016-06/documents/npwdr_complete_table.pdf.

certain exceptions to compliance are made for small public water systems.¹⁶⁵

In 1984, Pennsylvania enacted its own version of the Federal SDWA known as the Pennsylvania Safe Drinking Water Act (PA SDWA). This act returned the ‘primary enforcement responsibility’ for managing the state’s nearly 9,200 public water systems from the EPA to the PA DEP’s Bureau of Safe Drinking Water.¹⁶⁶ The PA SDWA follows the same framework as the Federal SDWA, requiring public water suppliers to protect the water sources under their control, provide treatment of the water adequate to protect public health, maintain their facilities, and make corrective actions as needed to ensure a continuous supply of potable water to users.¹⁶⁷ The PA DEP has never set its own MCLs under the PA SDWA due to resource limitations,¹⁶⁸ relying on the EPA to evaluate potentially harmful chemicals through the Federal SDWA process.

To monitor unregulated chemicals which may merit regulation under the Federal SDWA, a program known as the Unregulated Contaminant Monitoring Rule (UCMR) was instituted through the 1996 amendment to the SDWA. The UCMR program monitors up to 30 contaminants every five years for their frequency of occurrence in public water systems across the country.¹⁶⁹ The combination of this assessment and other known information on the chemicals tested in each UCMR lead the EPA to publish the Contaminant Candidate List, the list

¹⁶⁵ “PFAS Laws and Regulations,” U.S. Environmental Protection Agency, last modified July 30, 2018, accessed November 7, 2019, <https://www.epa.gov/pfas/pfas-laws-and-regulations>.

¹⁶⁶ “Pennsylvania Safe Drinking Water Act,” Pennsylvania Public Law 1984, No. 43, Cl. 35, 1, accessed November 5, 2019, <https://www.legis.state.pa.us/WU01/LI/LI/US/PDF/1984/0/0043..PDF>. ; “Bureau of Safe Drinking Water,” Pennsylvania Department of Environmental Protection, accessed November 7, 2019, <https://www.dep.pa.gov/Business/Water/BureauSafeDrinkingWater/Pages/default.aspx>.

¹⁶⁷ Chapter 109: Safe Drinking Water, *PA Code 25* (1984) §109.4.

¹⁶⁸ “State MCL Considerations,” Pennsylvania Department of Environmental Protection, accessed November 7, 2019, https://www.dep.pa.gov/Citizens/My-Water/drinking_water/Perfluorinated%20Chemicals%20E2%80%93PFOA%20and%20PFOS%20E2%80%9320in%20Pennsylvania/Pages/Establishing-a-State-MCL.aspx.

¹⁶⁹ “Learn About the Unregulated Contaminant Monitoring Rule,” U.S. Environmental Protection Agency, last modified January 24, 2018, accessed November 9, 2019, <https://www.epa.gov/dwucmr/learn-about-unregulated-contaminant-monitoring-rule>.

of unregulated contaminants which the EPA believes may call for SDWA regulation.¹⁷⁰ As mentioned in Chapter 2, six PFAS were monitored under the third UCMR (UCMR 3) including PFOA and PFOS.¹⁷¹ This assessment found PFAS to be present in public water systems across the country from 2013 to 2015.¹⁷² Specifically, PFOA was found in 117 public water systems in levels above the EPA health advisory guidelines from 2016, and PFOS was found in above those guidelines in 95 public water systems.¹⁷³ Developments in EPA strategy in addressing PFAS pollution through the SDWA have occurred since mid-2018, and will be discussed in Chapter 5. Nonetheless, to date no MCLs or TTs have been established for any PFAS under the SDWA, so the pollution which occurred in Warminster, Warrington, and Horsham did not violate the SDWA.¹⁷⁴

Through this examination of water quality and drinking water law, it has been shown that the groundwater contamination that occurred as a result of the use of certain PFAS on-base at NASJRB and NADC occurred completely legally. Though some action was pursued through the Federal SWDA to assess PFAS dispersal in the nation's groundwater, no enforceable statutory restrictions were put in place to prevent such pollution from occurring from the start of the use of PFAS on-base to the time of publication. In a state whose constitution specifically guarantees its residents a right to pure water, this is a shocking oversight with grave consequences for residents.

Hazardous Materials Law after 1970. Having examined water quality law, the hazardous

¹⁷⁰ U.S. Environmental Protection Agency (U.S. EPA), *EPA's Per- and Polyfluoroalkyl Substances (PFAS) Action Plan* (Washington, D.C.: U.S. Environmental Protection Agency, February 2019), 14, accessed November 8, 2019, https://www.epa.gov/sites/production/files/2019-02/documents/pfas_action_plan_021319_508compliant_1.pdf.

¹⁷¹ U.S. EPA, *EPA's Per- and Polyfluoroalkyl Substances (PFAS) Action Plan*, 14.

¹⁷² U.S. EPA, *EPA's Per- and Polyfluoroalkyl Substances (PFAS) Action Plan*, 14.

¹⁷³ U.S. Environmental Protection Agency, *The Third Unregulated Contaminant Monitoring Rule (UCMR 3): Data Summary, January 2017*. 11.

¹⁷⁴ "PFAS Laws and Regulations," U.S. Environmental Protection Agency.

materials laws enacted following the creation of the EPA will now be examined to determine the extent to which they regulate PFAS. The nation's primary law for managing both hazardous and non-hazardous solid wastes, the Resource Conservation and Recovery Act (RCRA), was enacted in 1976. This law, building off of the Solid Waste Disposal Act of 1965, established guidelines for the management of hazardous waste from "cradle-to-grave."¹⁷⁵ Among other provisions, these guidelines lay out a thorough tracking system for hazardous materials that ultimately requires the treatment or disposal of waste at certified facilities.¹⁷⁶ In theory, the RCRA provides a comprehensive management system for the nation's hazardous waste; in practice, the law has been less effective than anticipated. Even when the RCRA functions as intended, many hazardous materials disposal sites certified under the RCRA have become Superfund Sites due to the insufficient lifespan requirements of the containers at disposal facilities.¹⁷⁷ These shortsighted design requirements, combined with deliberate 'midnight' violations of the law, have lowered its efficacy in managing hazardous materials substantially.

The RCRA has historically managed PFAS as non-hazardous, so no special precautions were required concerning PFAS creation, distribution, and disposal. However, some case law indicates that this may change in the future—in 2017, a district court acknowledged that there is an ongoing dispute concerning whether PFAS-containing material should be considered hazardous.¹⁷⁸ Regardless of such debates, PFOA-containing firefighting foam is still widely used without the restrictions that apply to chemicals designated as hazardous under RCRA. As no

¹⁷⁵ "Resource Conservation and Recovery Act (RCRA) Overview," U.S. Environmental Protection Agency, last modified November 12, 2019, accessed November 3, 2019, <https://www.epa.gov/rcra/resource-conservation-and-recovery-act-rcra-overview>.

¹⁷⁶ Collins, *Toxic Loopholes*, 88.

¹⁷⁷ Collins, *Toxic Loopholes*, 103.

¹⁷⁸ Jeanine L.G. Grachuk, "Recent PFAS Case Law - RCRA, CERCLA and Toxic Tort Claims," *Beveridge & Diamond PC (Blog)*, March 28, 2017, accessed November 9, 2019, <https://www.lexology.com/library/detail.aspx?g=016813b7-6c55-4632-8439-308e986b9777>.

move has been made by the EPA to change that, on-base PFAS groundwater pollution at NASJRB and NADC occurred legally under the RCRA.

Another federal law that regulates hazardous materials, the Toxic Substances Control Act (TSCA) of 1976, authorizes the EPA to identify, monitor, and restrict or ban a given chemical using the “least burdensome option” capable of minimizing public health risks.¹⁷⁹ This law divided chemicals into two groups: those present in consumer products before December of 1979, ‘old’ chemicals; and those created after December of 1979, ‘new’ chemicals. When the law took effect, old chemicals were managed by an initial designation as either ‘high priority,’ which required safety testing, or non-high priority, which required no further action.¹⁸⁰ New chemicals must undergo a pre-market review to ensure that they do not pose an unreasonable risk to the public. This review involves a submission of known information on the chemical to the EPA 90 days prior to the chemicals release into the marketplace, during which time the EPA can choose to submit it to further review if they suspected “unreasonable risk of injury to health or the environment.”¹⁸¹ Based on their review of an old or a new chemical, the EPA can also institute a ‘Significant New Use Rule’ (SNUR) for a chemical.¹⁸² This SNUR requires that a chemical’s manufacturers submit a ‘significant new use notice’ for the chemical if the uses of the chemical change significantly, or if certain other criteria are met.¹⁸³ Through the passage of the TSCA, the EPA was given the authority to entirely prevent the use of a given chemical if that chemical can be shown to present such an ‘unreasonable risk,’ but the onus was on the EPA to

¹⁷⁹ Congressional Research Service, *The Toxic Substances Control Act (TSCA): A Summary of the Act and Its Major Requirements*, by Linda-Jo Schierow, Summary Page, April 1, 2013, accessed November 6, 2019, <https://fas.org/sgp/crs/misc/RL31905.pdf>.

¹⁸⁰ Collins, *Toxic Loopholes*, 117.

¹⁸¹ Collins, *Toxic Loopholes*, 119, 114.

¹⁸² “Actions under TSCA Section 5,” U.S. Environmental Protection Agency, last modified November 19, 2019, accessed December 14, 2019, <https://www.epa.gov/reviewing-new-chemicals-under-toxic-substances-control-act-tsca/actions-under-tsca-section-5#how>.

¹⁸³ “Actions under TSCA Section 5,” U.S. Environmental Protection Agency.

demonstrate that risk.¹⁸⁴

The administration of the TSCA unfortunately did not function as well as its writers had hoped. Though well-intentioned and strongly worded, the requirement that chemicals be regulated if they present an ‘unreasonable risk’ left the law open to exploitably-flexible interpretation.¹⁸⁵ Beyond this phrasing issue, the combination of the sheer volume of Pre-Manufacture Review forms received by the EPA and the less-than-ethical self-reporting tendencies of the chemical manufacturers have allowed many harmful chemicals to reach the market.¹⁸⁶ These shortcomings led to substantial amendments to the TSCA in 2016, known as the Frank R. Lautenberg Chemical Safety for the 21st Century Act. These amendments make critical changes to the law to allow it to function as intended by requiring the EPA to justify its determination of no unreasonable risk along with those of unreasonable risk, adding protections for vulnerable populations, mandating restrictions on chemicals found to present an unreasonable risk, imposing deadlines for many actions required by the law, and tightening assessment requirements for new chemicals.¹⁸⁷ These changes were made too recently to determine their long-term effectiveness, but appear to close many of the loopholes of the original TSCA.

As chemicals in use in industry, all PFAS used domestically were required to be assessed under the TSCA when each was first used domestically. Though it is logistically very difficult to examine the approximately 2000 of the over 4000 PFAS that have been used domestically in recent years,¹⁸⁸ the EPA is taking measures to minimize or phase out the use of the chemicals whose detrimental effects on human or environmental health have become apparent. As

¹⁸⁴ Collins, *Toxic Loopholes*, 114.

¹⁸⁵ Collins, *Toxic Loopholes*, 114.

¹⁸⁶ Collins, *Toxic Loopholes*, 115.

¹⁸⁷ *Comparing the 1976 Toxic Substances Control Act to the Frank R. Lautenberg Chemical Safety for the 21st Century Act (H.R. 2576)* (New York: Environmental Defense Fund, 2016), 1-10, accessed November 9, 2019, <http://blogs.edf.org/health/files/2016/06/Side-by-side-oldTSCA-newTSCA-FINAL.pdf>.

¹⁸⁸ U.S. EPA, *EPA's Per- and Polyfluoroalkyl Substances (PFAS) Action Plan*, 11.

mentioned in Chapter 2, the EPA worked with the principle manufacturer of PFOS products in the early 2000s to phase out the chemical's use and production.¹⁸⁹ To begin phasing out the use of PFOA-related chemicals, the EPA met with the eight principle manufacturers in 2010 as part of the PFOA Stewardship Program to set reduction goals for 2015; each company met its goals.¹⁹⁰ The EPA has also issued SNURs to monitor and restrict the use of certain PFAS, including 88 PFOS-related chemicals in 2002, 183 PFAS no longer thought to be in use domestically in 2007, PFOA-related chemical use in carpets in 2013, and all PFOA- or PFOS-related chemicals in 2015.¹⁹¹ The agency is also using its authority under the TSCA to require the exploration of alternatives to PFOA-related chemicals prior to a product's commercial use of such chemicals.¹⁹² Despite these positive steps to address the public health concerns and avoid new uses of PFAS, PFOA-containing firefighting foam is still the standard for industry use.¹⁹³ This use furthers the legal contamination of the nation's groundwater, worsening this public health crisis with every use of the foam.

The nation's third major law charged with managing hazardous materials pollution is the Pollution Prevention Act (PPA). Enacted in 1990, the PPA recognizes source reduction of pollution as "fundamentally different and more desirable than waste management and pollution control," and accordingly seeks to minimize pollution by fostering source reduction practices.¹⁹⁴ Source reduction is defined in the PPA as any practice which reduces either "the amount of any

¹⁸⁹ U.S. EPA, *EPA's Per- and Polyfluoroalkyl Substances (PFAS) Action Plan*, 13.

¹⁹⁰ U.S. EPA, *EPA's Per- and Polyfluoroalkyl Substances (PFAS) Action Plan*, 13-14.

¹⁹¹ "Risk Management for Per- and Polyfluoroalkyl Substances (PFASs) under TSCA," U.S. Environmental Protection Agency, last modified July 20, 2018, accessed November 9, 2019, <https://www.epa.gov/assessing-and-managing-chemicals-under-tsca/risk-management-and-polyfluoroalkyl-substances-pfass#tab-3>.

¹⁹² "Risk Management for Per- and Polyfluoroalkyl Substances (PFASs) under TSCA," U.S. Environmental Protection Agency.

¹⁹³ *Hearing Before the Subcommittee on Federal Spending Oversight and Emergency Management: The Federal Role in the Toxic PFAS Chemical Crisis*, 26.

¹⁹⁴ "Pollution Prevention Act of 1990," U.S. Environmental Protection Agency, last modified March 30, 2017, accessed November 9, 2019, <https://www.epa.gov/p2/pollution-prevention-act-1990>.

hazardous substance, pollutant, or contaminant entering any waste stream or...the environment,” or “the hazards to public health and the environment associated with the release of such substances.”¹⁹⁵ This act was an important step forward for U.S. environmental regulation—along with a number of executive orders issued since the Clinton Administration, the PPA shifts the focus of pollution regulation from expensive and insufficient ‘end-of-pipe’ approaches to more comprehensive approaches ‘upstream.’¹⁹⁶

Chemicals regulated by this act are those monitored by the Emergency Planning and Community Right To-Know Act of 1986, along with any chemical whose “concentration levels beyond facility site boundaries as a result of...[on-site] releases” are determined to be meet certain criteria by the Administrator of the EPA.¹⁹⁷ To meet these criteria, a chemical must be “reasonably anticipated to cause significant adverse acute human health effects,” or chronic human health effects such as cancer, impairment of fetal development, neurological disorders, or certain other conditions.”¹⁹⁸ A chemical may also meet the criteria if it causes “significant adverse effect on the environment” due to its toxicity, persistence in the environment, or bioaccumulative tendency.¹⁹⁹

Based on the criteria laid out in the PPA and the human health effects of PFAS pollution due to on-site use of firefighting foam at bases such as NASJRB and NADC, it would seem plausible that any PFAS used on base would be included in the list of toxic chemicals regulated by the PPA. However, this is not the case. While some action has been taken to minimize human contact with some PFAS through the TSCA, to date no action has been taken under the PPA to

¹⁹⁵ “Pollution Prevention Act of 1990,” U.S. Environmental Protection Agency.

¹⁹⁶ Carol M. Browner, “Pollution Prevention Policy Statement,” U.S. Environmental Protection Agency, June 15, 1993, accessed November 14, 2019, <https://www.epa.gov/p2/pollution-prevention-policy-statement>.

¹⁹⁷ Pollution Prevention Act of 1990, *US Code* 42 (1990) §11023(d)(2)(A).

¹⁹⁸ Pollution Prevention Act of 1990, *US Code* 42 (1990) §11023(d)(2)(A-B).

¹⁹⁹ Pollution Prevention Act of 1990, *US Code* 42 (1990) §11023(d)(2)(C).

develop a plan for PFAS pollution reduction.²⁰⁰ This lack of action seems thoughtless considering that the EPA has been taking actions to reduce citizens' exposure to certain PFAS contaminants since the early 2000s. According to one firefighter active in Warrington prior to the 2016 release of the health advisories for PFOS and PFOA, the foam used in drills was unceremoniously washed away with water into either stormwater runoff drains, or onto nearby grass to seep into the soil.²⁰¹ Given the human and environmental health hazards of the foam, this method of disposal seems irresponsible; it also could have been prevented entirely if PFOA had been listed as a toxic chemical under the PPA. The extensive use of PFOA-containing firefighting foam across the nation and on-base, along with the EPA's demonstrated concern over certain PFAS 15 years ago, makes this omission somewhat conspicuous.

As noted earlier in this chapter, federal laws have assumed the bulk of the work of environmental regulation in the U.S. following the creation of the EPA. Despite this change, a few notable hazardous materials laws were enacted in Pennsylvania in the decades following the creation of the EPA. The Solid Waste Management Act of 1980 defined hazardous waste as certain materials which increase mortality or morbidity to humans, or pose a hazard to human health or the environment when mismanaged; it then established certain regulations for managing these materials.²⁰² The Worker and Community Right-To-Know Act of 1984 mandated that certain information be made available to employees and community members when they come into contact with hazardous substances.²⁰³ The Hazardous Sites Cleanup Act of 1988 declares that the "citizens of this Commonwealth have a right to clean water and a healthy

²⁰⁰ U.S. EPA, *EPA's Per- and Polyfluoroalkyl Substances (PFAS) Action Plan*, 13-14.

²⁰¹ B. Lang, Instagram Direct Message to author, November 10, 2019.

²⁰² "Solid Waste Management Act," Pennsylvania Public Law 1980, No. 97, Cl. 35, Introductory Clause, accessed November 5, 2019, <https://www.legis.state.pa.us/WU01/LI/LI/US/HTM/1980/0/0097..HTM>.

²⁰³ "Worker and Community Right-To-Know Act," Pennsylvania Public Law 1984, No. 159, Cl. 35, Introductory Clause, accessed November 5, 2019, <https://www.legis.state.pa.us/cfdocs/legis/li/uconsCheck.cfm?yr=1984&sessInd=0&act=159>.

environment.” This act accordingly outlines measures and provides funds for the cleanup of hazardous waste sites across the state.²⁰⁴ Nonetheless, despite the demonstrated increase in mortality and morbidity caused by PFOA-laced groundwater, PFAS are not regulated by these statutes.²⁰⁵

Through this examination, it has been demonstrated that the PFAS groundwater pollution which occurred at NASJRB and NADC occurred completely legally under state and federal hazardous materials laws, largely because it was not legally considered a hazardous material. Regardless of their legal status, the PFAS in use on-base have clearly demonstrated their hazardous nature. Though measures have been taken under the TSCA starting in the early 2000s to minimize consumer exposure to certain PFAS, it is deeply concerning that the chemicals were registered under the TSCA for decades before any action was taken to mitigate their hazard to the public. These chemicals have repeatedly been shown to be hazardous, yet to date have not been listed as hazardous chemicals under the TSCA or any other state or federal law. This neglectful oversight, combined with similar oversight of PFAS in water quality law, allowed thousands of servicemembers and community members to be slowly poisoned by their water for nearly half of a century.

Conclusion. This examination has demonstrated that PFAS were wholly unregulated for the vast majority of their history. The discontinuation of the commercial use of small subsets of PFAS was begun under the TSCA in the early 2000s, and SNUR requirements for new uses of PFAS were developed in the early 2010s. Even with these restrictions, however, no federal

²⁰⁴“Hazardous Sites Cleanup Act,” Pennsylvania Public Law 1988, No. 108, Cl. 27, Introductory Clause, accessed November 5, 2019, <https://www.legis.state.pa.us/WU01/LI/LI/US/HTM/1988/0/0108..HTM>.

²⁰⁵ *PFAS Sampling Plan* (Harrisburg: Pennsylvania Department of Environmental Protection, Bureau of Safe Drinking Water, April 2019), 3, accessed November 10, 2019, http://files.dep.state.pa.us/Water/DrinkingWater/Perfluorinated%20Chemicals/BSDW%20PFAS%20Sampling%20Plan_Phase%201_April%202019.pdf.

enforceable regulations have been put in place to date on the continued use of the vast majority of PFAS, including PFOA-containing firefighting foam. Due to this absence of regulations, PFAS-laced substances such as firefighting foam have been seeping into ground water resources across the nation for nearly fifty years.

As detailed in Chapter 2, substantial increases in morbidity and mortality have been shown in communities like Warminster, Warrington, and Horsham. These effects have developed into a public health crisis at the national scale. Though pollution regulations protective of public health are sometimes claimed to be too expensive to develop, the cost of *not* developing and implementing such regulations is difficult to quantify. The lives and qualities of life of the residents of Warminster, Warrington, and Horsham have been the cost of the unregulated use of certain PFAS on-base at NASJRB and NADC; similar costs have been incurred in communities across the country.

This reactive rather than proactive approach to pollution management has been the standard operating procedure of the DOD for the majority of its history. The cleanup of sites polluted by PFAS has been managed under the federal environmental law dedicated to cleaning up the nation's most polluted sites: CERCLA.

Chapter 4. Environmental Degradation, the DOD, and National Security

The pollution control laws evaluated in the previous chapter did not require the DOD to regulate its use of PFAS. As such, the standard procedure for PFAS use at military installations was to dump large quantities of firefighting chemicals onto the ground for nearly 50 years without concern for any potential environmental fallout. This pattern of under-consideration of environmental health on military bases has disrupted the provisioning of ecosystem services in countless communities across the nation, resulting in drastic public health and financial

consequences. Long before the health hazards of PFAS were known, the DOD relied heavily on CERCLA to clean up countless other contaminants saturating the soil and groundwater underneath its bases. This chapter will first detail CERCLA's framework and highlight how these apply to the DOD and PFAS through NADC and NASJRB. It will then demonstrate how the damage inflicted by the DOD on the environmental health of communities nationwide should be considered a national security issue.

History and Provisions of CERCLA. Absent regulations to prevent PFAS pollution from occurring, groundwater pollution with PFAS chemicals is managed largely through the Comprehensive Environmental Response, Compensation, and Liability Act of 1980. One of the nation's most important environmental laws, CERCLA was signed on December 11, 1980 in response to public health crises resulting from improper hazardous material management at sites across the country. The passage of CERCLA was ultimately brought about by the infamous Love Canal disaster of 1978. This community, located in Niagara Falls, New York, received national attention when toxic sludge seeped into residents' basements.²⁰⁶ Grave health consequences plagued residents as a result of the large amounts of hazardous materials dumped and buried under the town years prior.²⁰⁷ CERCLA was developed to manage the regulation, cleanup, and remediation of the release of toxins, usually retrospectively.²⁰⁸ Its cleanup processes are managed under the National Contingency Plan. Over the course of its existence thus far, CERCLA has managed nearly 40,000 sites,²⁰⁹ over 1300 of which merited placement on its National Priorities

²⁰⁶ Collins, *Toxic Loopholes*, 81.

²⁰⁷ Collins, *Toxic Loopholes*, 81.

²⁰⁸ Ferrey, *Environmental Law*, 333.

²⁰⁹ Ferrey, *Environmental Law*, 332.

List (NPL).²¹⁰ It is a “pillar of environmental law” in the United States.²¹¹ The statute has four main elements:

1. A system for information gathering and analysis,
2. Federal authority to respond to and clean up releases of hazardous substances,
3. A Hazardous Substance Response Trust Fund (the “Superfund”) to underwrite cleanup, and
4. A liability scheme for those responsible for releases of hazardous substances.²¹²

The third element is the most well-remembered, as CERCLA is commonly known as the “Superfund Act.”

The CERCLA process at a given site is as follows. First, the site is reported to the EPA, which conducts a preliminary assessment.²¹³ Up to \$2 million in initial cleanup and emergency waste removal are automatically authorized at all CERCLA sites, and the process begins quickly following the assessment.²¹⁴ The EPA then thoroughly investigates the site’s contamination and assigns it a Hazard Ranking System (HRS) score based on “toxicity, quantity, and concentration of wastes.”²¹⁵ The hazardous substances covered under CERCLA are those listed under Title 40, Section 302.4 under the Code of Federal Regulations; these include hazardous air pollutants covered under the Clean Air Act, toxic pollutants and hazardous substances covered under the Clean Water Act, hazardous wastes covered under RCRA, any “imminently hazardous” chemical substance addressed by the EPA through the TSCA, and any “element, compound, or mixture solution or substance” under CERCLA section 102 which presents “substantial danger to public

²¹⁰ Collins, *Toxic Loopholes*, 99.

²¹¹ Ferrey, *Environmental Law*, 332.

²¹² Ferrey, *Environmental Law*, 336.

²¹³ Ferrey, *Environmental Law*, 341.

²¹⁴ Ferrey, *Environmental Law*, 342.

²¹⁵ Ferrey, *Environmental Law*, 342.

health or welfare or to the environment.”²¹⁶ Sites are placed on the NPL if they score a 28.5 or higher (out of 100).²¹⁷

If a site is named to the NPL, the \$2 million limit originally allocated for emergency cleanup proceedings no longer applies.²¹⁸ For all CERCLA sites, the EPA conducts a Remedial Investigation to further understand and categorize site contaminants and a Feasibility Study to assess different possible methods of remediation.²¹⁹ These investigations lead to the official Record of Decision (ROD) on long-term actions to be taken.²²⁰ The cleanup process is initially funded by the Superfund, which is later reimbursed by the parties found liable for the contamination.²²¹ Parties can be found liable for the contamination on the grounds that they owned or operated the facility in question at the when the substance was released or disposed, arranged for disposal, transported the materials for disposal, or selected where the material would be disposed.²²² Once all remedial action called for in the ROD are completed, the EPA transfers full responsibility of the site and its upkeep to the state.²²³

Subsequent legislation has targeted CERCLA, either to tighten regulations or cut Superfund budget. In 1986, CERCLA was amended through the Superfund Amendments and Reauthorization Amendments (SARA). These changes included clean up compliance with Applicable or Relevant and Appropriate Requirements (ARARs), the levying of more environmental taxes on relevant corporations, standardization and incentive additions to

²¹⁶ “What Does CERCLA Identify as a Hazardous Substance?” Daniels Training Services Inc., last modified November 14, 2014, accessed December 20, 2019, <https://danielstraining.com/what-does-cercla-identify-as-a-hazardous-substance/>.

²¹⁷ Ferrey, *Environmental Law*, 342.

²¹⁸ Ferrey, *Environmental Law*, 342.

²¹⁹ Ferrey, *Environmental Law*, 342.

²²⁰ Ferrey, *Environmental Law*, 342.

²²¹ Ferrey, *Environmental Law*, 345.

²²² Ferrey, *Environmental Law*, 345.

²²³ Ferrey, *Environmental Law*, 342.

cleanups, increased involvement of state and public, increased involvement of public health authorities, and tightening of compliance requirements at federal facilities.²²⁴ Various executive orders have affected the implementation of CERCLA, including: EO 12580 (1987) directly involving Superfund Implementation, EO 13423 (2007) on Strengthening Federal Environmental, Energy, and Transportation Management, and EO 13514 (2009) on Federal Leadership in Environmental, Energy, and Economic Performance.²²⁵ Unfortunately, the ‘polluter pays’ fees funding the Superfund were not reauthorized in 1995, so the Superfund ran out of money in 2003.²²⁶ This lack of funding has significantly inhibited CERCLA from functioning as intended, forcing affected communities to foot the bill for the cleanup if liable parties cannot be found.

In the case of former military installations, the liable party under CERCLA is the DOD. Though CERCLA was intended only to clean up the ‘worst of the worst’ hazardous pollution sites, a substantial portion of the thousands of Superfund Sites across the country are former military bases. CERCLA is widely used to clean up military sites, despite its intended purpose of serving as a last resort to catch the slip ups from prevention-based pollution regulations. The DOD’s legacy of ecological destruction is quite grim, as unearthed by BRAC closures on bases like NADC and NASJRB.

PFAS Management under CERCLA. NADC and NADC were declared as Superfund sites before the health hazards of PFAS were known. NADC was first investigated in 1979, before

²²⁴ Ferrey, *Environmental Law*, 346.

²²⁵ “Select Executive Orders on Environmental Compliance Requirements for Federal Facilities,” U.S. Environmental Protection Agency, last modified January 29, 2018, accessed November 6, 2018, <https://www.epa.gov/enforcement/select-executive-orders-environmental-compliance-requirements-federal-facilities>.

²²⁶ Kaley Beins and Stephen Lester, *Superfund: Polluters Pay So Children Can Play* (Falls Church, VA: Center for Health, Environment and Justice, December 2015), 2, accessed April 2, 2019, <http://chej.org/wp-content/uploads/Superfund-35th-Anniversary-Report1.pdf>.

CERCLA was signed into law, due to the suspected presence of hazardous chemicals; NASJRB was investigated similarly and declared a Superfund site in 1995.²²⁷ The hazardous chemicals found on these sites include tetrachloroethylene, trichloroethylene, 1,2-dichloroethene, carbon tetrachloride, 1,4-dioxane, benzene, chloroform, lead, arsenic, and many others.²²⁸ At NADC, on-base activities that contributed to the presence of these chemicals included “aircraft maintenance and repair, pest control, firefighting training, machine and plating shop operations, spray painting, and various materials research and testing activities in laboratories;”²²⁹ at NASJRB, activities included aircraft maintenance, fuel operation, personnel training, civil engineering activities at NASJRB.²³⁰ While the remediation and cleanup of known hazards at NADC was completed in 2000, NASJRB was still in the midst of the process prior to the discovery of PFAS groundwater contamination at both sites.²³¹

Though PFAS are not designated as hazardous substances under CERCLA, the EPA began monitoring the chemicals at CERCLA sites in the late 2000s. In 2011, the Navy detected PFAS in the groundwater and soil underneath both sites.²³² In response, both sites were required to remediate this contamination. These cleanup activities have been lengthy and expensive—as

²²⁷ Hope Grosse and Joanne Stanton, “Warminster PA Community: Highly Fluorinated Compounds – Social and Scientific Discovery,” (presentation given at Northeastern University, Boston, MA, June 14, 2017), 3, accessed December 20, 2019, <https://pfasproject.com/wp-content/uploads/2017/06/community-organizing-military-grosse-stanton.pdf>. ; U.S. Environmental Protection Agency, “Willow Grove Naval Air and Air Reserve Station, Horsham, PA: Cleanup Activities,” accessed December 20, 2019,

<https://cumulis.epa.gov/supercpad/SiteProfiles/index.cfm?fuseaction=second.Cleanup&id=0303820#bkground>.

²²⁸ Grosse and Stanton, “Warminster PA Community,” presentation given at Northeastern University on June 14, 2017. ; U.S. Environmental Protection Agency, “Willow Grove Naval Air and Air Reserve Station, Horsham, PA: Contaminant List,” accessed December 20, 2019,

<https://cumulis.epa.gov/supercpad/SiteProfiles/index.cfm?fuseaction=second.contams&id=0303820>.

²²⁹ U.S. Environmental Protection Agency, “Willow Grove Naval Air and Air Reserve Station, Horsham, PA: Cleanup Activities.”

²³⁰ U.S. Environmental Protection Agency, “Willow Grove Naval Air and Air Reserve Station, Horsham, PA: Cleanup Activities.”

²³¹ U.S. Environmental Protection Agency, “Naval Air Development Center (8 Waste Areas).”

²³² Grosse and Stanton, “Warminster PA Community,” presentation given at Northeastern University on June 14, 2017.

of June 2017, \$27.3 million was spent on PFAS remediation and testing at both sites. Nationally, the PFAS pollution problem has increased exponentially over the past decade. The DOD spent \$2 billion on PFAS mitigation and research over the past decade, owing to the 401 known military installations across the country known to be contaminated with these chemicals.²³³

The problem of PFAS contamination affects so many bases because of how ubiquitously these chemicals were used for firefighting purposes at military installations. Following the release of the EPA's Health Advisory Levels for PFOS and PFOA in 2016, the PFAS-containing firefighting foam has been removed from land-based training activities at DOD bases, but is still used for firefighting purposes because there is no effective alternative.²³⁴ Though the discontinuation of PFAS from use in training activities is an important step in PFAS management, it was long overdue. According to the minutes from a National Fire Protection Association meeting held in 2001, one of the Under Secretaries of Defense was made aware of the 'bioaccumulative, persistent, and toxic' nature of PFAS in that year.²³⁵ While it is unclear how widely this knowledge was dispersed through the DOD prior to 2016, it is clear that leaders did not take action for 15 years in spite of their knowledge of the risks.

The widespread use of PFAS at military installations and in consumer products makes the lack of official knowledge of the health hazards surrounding PFAS prior to 2001 deeply concerning. Under the regulatory structure detailed in the previous chapter, the health hazards associated with these chemicals should have been detected by the TSCA in the late 1970s.

²³³ U.S. Department of Defense, "Transcript: DOD Media Roundtable on the PFAS Task Force," September 13, 2019, accessed December 20, 2019, <https://www.defense.gov/Newsroom/Transcripts/Transcript/Article/1960674/dod-media-roundtable-on-the-pfas-task-force/>.

²³⁴ U.S. Department of Defense, "Transcript: DOD Media Roundtable on the PFAS Task Force."

²³⁵ Representative Brian Fitzpatrick, Representative Patrick Meehan, and Representative Brendan Boyle to Secretary James Mattis, June 9, 2017, accessed November 14, 2019, <https://fitzpatrick.house.gov/sites/fitzpatrick.house.gov/files/DoD%20Letter%206.9.17.pdf>.

Beyond legal restrictions, it is concerning that the DOD did not conduct internal testing to determine if any health hazards were posed by a chemical used in such large quantities at its facilities for decades. This lack of testing and effective regulation of PFAS led to decades of indiscriminate environmental degradation.

The long-term damage wrought on environmental health by the DOD have been felt most deeply at the local level. In Warminster, Warrington, and Horsham, NADC and NASJRB played a largely positive role during their years of operation. These bases provided jobs for thousands, put on well-loved air shows on holidays, and were an integral part of the fabric of their communities. Following their closures, however, these bases' legacies have left a bad taste in the mouths of community residents and former base employees. Valuable ground water resources have been contaminated, many lives have been irrevocably damaged or prematurely ended, and millions of dollars and *many* hours have spent in cleanup, legal proceedings, and medical treatments. Many residents are unsure if they or their children will suffer serious medical problems later in life due to the duration of their exposure to PFAS and the ambiguity concerning the levels of PFAS remaining in their bodies. Due to the unregulated and irresponsible use of PFAS chemicals on-base, the legacy left by these bases will permanently be that of death, disease, and environmental degradation.

National Security and Environmental Health. The reactivity and delays which have characterized the federal government's response to the public health hazards of PFAS groundwater pollution are regrettably characteristic of the DOD's historic attitude towards environmental considerations. As discussed in previous chapters, the DOD has classically considered national security considerations to exist independently from environmental considerations. While the military's treatment of the environment has improved markedly in

recent decades, the process of integrating sustainable values into DOD practice is often done begrudgingly.

This conception of national security as separate from environmental concerns thoroughly misunderstands the fundamental role that the environment plays in the provisioning of national security. National security has conventionally been defined as “any trend or event that threatens the very survival of the nation and/or threatens to drastically reduce the welfare of the nation in a fashion that requires a centrally coordinated national mobilization of resources to mitigate or reverse.”²³⁶ By this definition, environmental concerns *are* national security concerns, as exemplified by the nationwide ‘trend’ of groundwater contamination with PFAS chemicals. Increased mortality and morbidity associated with PFAS exposure have occurred across the nation, ‘threatening’ to ‘drastically reduce the welfare of the nation.’ This threat has required a ‘centrally coordinated national mobilization of resources to mitigate’ the damage wrought by the pollution. Extensive human and environmental health hazards have been performed by the DOD in the name of national security, yet environmental security is a critical aspect of national security. In this case, the DOD’s disregard for the environmental health of the communities surrounding its bases is itself a national security concern.

The role of environmental concerns in national security is especially evident in light of anthropogenic climate change. This is illustrated with disquieting clarity in the Fourth National Climate Assessment, a report released in November 2018 by the U.S. Global Change Research Program. The report details the many ways in which climate change is already taking a toll on the economy, infrastructure, agriculture, health, and communities across the nation.²³⁷ The report

²³⁶ Jack Goldstone, “Environmental Scarcity and Violent Conflict: A Debate,” Environmental Change and Security Project Report, Issue 2 (Washington, DC: Woodrow Wilson Center. 1966), 66-71.

²³⁷ “Fourth National Climate Assessment: Summary Findings,” U.S. Global Change Research Program, accessed November 14, 2019, <https://nca2018.globalchange.gov/>.

also highlights the myriad of ways that domestic ecosystems and the critical services that they perform to enable the nation's prosperity will be affected by climate change.²³⁸ Given the scope of the problem, anthropogenic climate change certainly requires a centrally coordinated mobilization of national resources to mitigate. Thus, while defense against foreign powers is a key component of national security, it does not exist in a vacuum—environmental security plays a vital role as well.

The provisioning of national security is a difficult task which the U.S. Military executes with centuries of expertise. It is because of their dedicated work that citizens like the author are afforded the freedom to lead peaceful lives as civilians and write lengthy reports such as this one. Nevertheless, it is worth acknowledging that if a foreign power were to cause this level of damage to the water resources on which U.S. civilians rely, the DOD would likely be called to mobilize against its actions. The DOD's actions to protect civilians from harm from foreign powers should not themselves cause harm to civilians.

The role of environmental security in national security does not imply that it is the job of the DOD to solve climate change or lead domestic mitigation efforts in the name of national security. Specialized agencies exist within the federal government outside of the military which would be more reasonably tasked with finding solutions to the many environmental security problems facing the United States in the 21st century. However, the DOD's role as guardian of national security entails a responsibility to minimize its negative effects on the environmental health of the nation it protects wherever possible. The wellbeing of the public which the DOD is charged with protecting depends on its comprehensive consideration of the environmental harm which its actions cause.

²³⁸ "Fourth National Climate Assessment: Summary Findings," U.S. Global Change Research Program.

The interconnectedness of national security and environmental health is not a groundbreaking concept. A subset of individuals within the DOD realized the connection between national and environmental security as early as the first rounds of BRAC cuts, and have worked to integrate sustainable practices into DOD practice ever since.²³⁹ Even prior to the increased environmental awareness of the 1970s, the DOD acknowledged the importance of protecting the environment: in 1962, the Secretary of Defense Environmental Awards were established to honor “outstanding achievements and innovative environmental practices” within the DOD.²⁴⁰ Nonetheless, the Department’s long history of environmental disregard counteracts their expressed support of environmentally considerate practices.

Conclusion. Though military practices have become substantially greener in the decades following the Cold War, the lasting legacy of environmental destruction at former bases across the country is cause for serious alarm. According to current Assistant Secretary of Defense for Sustainment Robert H. McMahon, this harm stretches back as far as the Civil War, and the DOD spends \$1.3 billion annually on environmental remediation of its former bases.²⁴¹ Given such high costs, the preventable on-base environmental degradation that has continued into the 21st Century is an ill-considered and expensive mistake.

Communities affected by DOD-caused PFAS pollution have been outraged by the effects that these chemicals have had on their lives. While the DOD has spent billions on research and remediation of PFAS-contaminated groundwaters and soils, it cannot undo the damage that has been done. After years of advocacy, communities affected by this pollution have sparked a

²³⁹ Durant, *The Greening of the U.S. Military*, 38.

²⁴⁰ “Secretary of Defense Environmental Awards,” DENIX: DoD Environment, Safety and Occupational Health Network and Informational Exchange, last modified 2019, accessed December 20, 2019, <https://www.denix.osd.mil/awards/home/>.

²⁴¹ U.S. Department of Defense, “Transcript: DOD Media Roundtable on the PFAS Task Force.”

national conversation around PFAS and its regulation. Significant developments in PFAS policy have resulted from advocacy by both state and federal representatives over the past two years, foreshadowing further progress in the near future. The next chapter will detail these policy developments and the actions the DOD has taken to address PFAS pollution across the country.

Chapter 5. Recent Developments in PFAS Policy and Public Response

The past two years have seen a substantial policy development towards the regulation of PFAS, along with a real effort by the DOD to address its role in the public health damages caused by PFAS use on its bases. The following sections will detail the actions of various parties involved in these developments.

Public Awareness. Locally, continual journalism has provided extensive coverage of the PFAS contamination and response actions in Southeastern Pennsylvania. Local newspaper *The Intelligencer's Unwell Water* series, co-authored by journalists Kyle Bagenstose and Jenny Wagner, has won awards for this exceptional coverage.²⁴² State representatives such as Representative Todd Polinchock also keep their constituents updated with weekly email news blasts. The Buxmont Coalition for Safer Water also helps to keep the community members by posting notice of PFAS-related events to their website.²⁴³

Nationally, many environmental organizations and environmentally-focused departments of universities have publicized information on this topic that is easily accessible with a google search. Some organizations, such as the Northeastern University Social Science Environmental Health Research Institute, have created websites dedicated to pooling articles about PFAS from a

²⁴² “Unwell Water,” *The Intelligencer*, accessed November 9, 2019, <https://www.theintell.com/news/horsham-pfos>.

²⁴³ “Local, State, and Federal Events,” BuxMont Coalition for Safer Water, accessed November 10, 2019, <https://www.buxmontwater.org/upcoming-events>.

variety of other organizations.²⁴⁴ Other organizations, such as the Environmental Working Group, have used available data to create an interactive map demonstrating all known sites of PFAS contamination across the country.²⁴⁵

Citizen Lawsuits. Numerous lawsuits have been filed by civilians and veterans whose health has been affected by PFAS. In 2016, three separate cases were filed in Philadelphia’s U.S. District Court against the principal manufacturers of PFAS-containing firefighting foam; these cases were then combined into a class action suit.²⁴⁶ Four additional suits were filed in early 2017 by Warminster residents against the DOD and PFAS manufacturers, seeking compensation for past medical expenses and future medical monitoring.²⁴⁷ Attorneys such as Mark R. Cuker have been fighting for this compensation for the compensation of those affected for years,²⁴⁸ but due to restrictions written into CERCLA concerning suits filed against still-contaminated sites, there was concern that the suits would be dismissed on a technicality.²⁴⁹ In December 2019, however, federal Judge Jerry Pappert declined the Navy’s request to block this suit.²⁵⁰ This suit and others like it across the nation are still ongoing.

Pennsylvania Government. The government of the Commonwealth has taken an aggressive stance in managing the scourge of PFAS pollution across the state. In September

²⁴⁴ “Per- and Polyfluoroalkyl Substances: The Social Discovery of a Class of Emerging Contaminants,” *Northeastern University Social Science Environmental Health Research Institute*, accessed December 14, 2019, <https://pfasproject.com/>.

²⁴⁵ “Safe Drinking Water Information System (SDWIS) Federal Reporting Services,” U.S. Environmental Protection Agency, last modified June 27, 2017, accessed November 14, 2019, <https://www.epa.gov/ground-water-and-drinking-water/safe-drinking-water-information-system-sdwis-federal-reporting>.

²⁴⁶ Kyle Bagenstose, “Seventh PFC lawsuit filed by Warminster residents,” *The Intelligencer*, February 8, 2017, <http://www.theintell.com/2e3485ea-ee42-11e6-b033-fbf7a5736c72.html>.

²⁴⁷ Bagenstose, “Seventh PFC lawsuit filed by Warminster residents.”

²⁴⁸ Mark R. Cuker, “Third Circuit to decide right of exposed residents to receive medical monitoring for PFAS,” Cuker Law Firm, last modified 2019, accessed December 20, 2019, <https://www.cukerlaw.com/third-circuit-decide-right-exposed-residents-receive-medical-monitoring-pfas/>.

²⁴⁹ Bagenstose, “Seventh PFC lawsuit filed by Warminster residents.”

²⁵⁰ Pamela King, “Court allows Pa. Residents’ PFAS lawsuit against Navy,” *E&E News*, December 18, 2019, <https://www.eenews.net/greenwire/2019/12/18/stories/1061845119>.

2018, Governor Tom Wolf created a PFAS Action Team by executive order to address the PFAS pollution problem comprehensively at the state level.²⁵¹ This action team plans to use the ongoing research and statewide water sampling being conducted by the PA DOH and PA DEP to begin the process of establishing a state MCL for these contaminants. Though some argue that the state is not acting fast enough,²⁵² the PA DEP is in the process of hiring a toxicologist and is actively addressing the problem.²⁵³

Governor Wolf has also worked together with representatives such as Todd Polinchock of Warrington, Todd Stephens of North Wales, and Meghan Schroeder of Warminster to minimize the effects of PFAS pollution on the lives of their constituents as much as possible. These individuals have worked together to secure over \$20 million as of August 2019 to fund infrastructure projects and remove the surcharges that residents have been paying for their water.²⁵⁴ Representative Stephens sponsored PA House Bill 1420, a bill to provide additional funding for clean drinking water and PFAS remediation across the state through the establishment of a Military Installation Remediation Fund;²⁵⁵ This bill was signed into law by Governor Wolf in early December.²⁵⁶

²⁵¹ Governor Tom Wolf, PA Executive Order 2018-08, “Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS) Action Team,” September 21, 2018, accessed November 14, 2019, <https://www.governor.pa.gov/newsroom/executive-order-2018-08-perfluoroalkyl-and-polyfluoroalkyl-substances-pfas-action-team/>.

²⁵² Tracy Carluccio, “Pennsylvania must act faster on PFAS regulations,” *The Philadelphia Inquirer*, last modified August 21, 2019, accessed November 14, 2019, <https://www.inquirer.com/opinion/commentary/pfas-regulations-pennsylvania-dep-epa-sampling-20190821.html>.

²⁵³ Susan Phillips and Jon Hurdle, “Pa. to begin its own process of setting health limit for two PFAS chemicals,” *WHYY*, February 15, 2019, accessed November 14, 2019, <https://whyy.org/articles/pa-to-begin-its-own-process-of-setting-health-limit-for-two-pfas-chemicals/>.

²⁵⁴ Dana Bate, “Wolf allocates \$3.8M to BuxMont towns for PFAS treatment, eliminating surcharges on water bills,” *WHYY*, August 22, 2019, accessed November 14, 2019, <https://whyy.org/articles/wolf-allocates-3-8m-to-buxmont-towns-for-pfas-treatment-eliminating-surcharges-on-water-bills/>.

²⁵⁵ Representative Todd Polinchock, phone call with author, October 31, 2019. ; “House Bill No. 1410,” The General Assembly of Pennsylvania, Introductory Clause, accessed December 20, 2019, <https://www.legis.state.pa.us/CFDOCS/Legis/PN/Public/btCheck.cfm?txtType=PDF&sessYr=2019&sessInd=0&billBody=H&billTyp=B&billNbr=1410&pn=2161>.

²⁵⁶ “House Bill No. 1410,” The General Assembly of Pennsylvania.

Pennsylvania Attorney General (AG) Josh Shapiro has also been active in addressing the PFAS pollution problem. In August 2019, AG Shapiro wrote a letter to the majority and minority leaders of the federal Congress urging them to regulate PFAS and “redress the harms” they have caused.²⁵⁷ In October, AG Shapiro announced his office’s plan to pursue legal action against the manufacturers of the PFOA-containing firefighting foams. His office seems to be moving forward expeditiously with the suit, having already subpoenaed documents to prepare for their upcoming legal actions.²⁵⁸

Federal Legislative Branch. On the whole, the federal legislative branch has been slower to act than its counterpart in Pennsylvania. However, representatives of affected districts have been advocating for federal action to be taken concerning PFAS as early as 2016. In October of that year, Senators and Representatives from Pennsylvania wrote a letter to the Secretaries of the Navy and the Air Force urging the organizations to “clarify the health care resources” available and to conduct health screenings of former employees of NASJRB and NADC.²⁵⁹ More recently, in April of this year, Senator Tom Carper of Delaware met in Horsham with persons whose health has been gravely affected by PFAS pollution, including Hope Grosse.²⁶⁰

On the legislative side, the Senate has been developing legislation to regulate PFAS over the past two years. In September of last year, a hearing was held to better understand ‘the federal

²⁵⁷ Governor Wolf, PA E.O. 2018-08, “Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS) Action Team”

²⁵⁸ Kyle Bagenstose, “Shapiro: ‘Legal action’ coming for companies tied to PFAS drinking water contamination,” *The Intelligencer*, October 23, 2019, accessed November 14, 2019, <https://www.theintell.com/news/20191023/shapiro-legal-action-coming-for-companies-tied-to-pfas-drinking-water-contamination>.

²⁵⁹ Representative Brendan F. Boyle et al. to Secretary Ray Mabus and Secretary Deborah L. James, October 11, 2016, accessed November 14, 2019, <https://www.toomey.senate.gov/files/documents/NavyAirForce.pdf>.

²⁶⁰ Jim Melwert, “Sens. Casey, Carper hear ‘sobering’ testimony on polluted water near air base,” *KYW Newsradio*, April 8, 2019, accessed November 14, 2019, <https://kywnewsradio.radio.com/articles/news/sens-casey-carper-hear-sobering-testimony-polluted-water-near-air-base>.

role in the toxic PFAS chemical crisis.²⁶¹ This hearing led to the development of a bipartisan package which would set MCLs for certain PFAS.²⁶² This package passed out of committee in June of this year, and was attached to the Senate’s National Defense Authorization Act.²⁶³ Dozens of bills have been introduced in both houses of Congress over the course of 2019,²⁶⁴ indicating a serious will to pass legislation mandating the management of PFAS at the federal level. As of December 2019, however, these necessary legislative measures have been stalled indefinitely by partisan fighting.²⁶⁵

Environmental Protection Agency. The EPA has launched a nationwide campaign to address PFAS pollution. In May 2018, the EPA held a National Leadership Summit in Washington, D.C., bringing stakeholders together to share information on monitoring and treatment techniques, identify short-term actions needed at the local and state levels, and develop communication strategies to better inform the public in contaminated localities.²⁶⁶ In the months following this meeting, the EPA traveled to Pennsylvania, New Hampshire, Colorado, North Carolina, and Kansas to learn from those affected how the EPA could best assist affected communities.²⁶⁷ The information garnered from these events combined with other available information, such as the UCMR 3 data and the congressional hearing on PFAS pollution, enabled the EPA to create a PFAS National Action Plan. Released in February, this

²⁶¹ *Hearing Before the Subcommittee on Federal Spending Oversight and Emergency Management: The Federal Role in the Toxic PFAS Chemical Crisis.*

²⁶² “PFAS,” National Association of Clean Water Agencies, accessed November 14, 2019, <https://www.nacwa.org/advocacy-analysis/campaigns/pfas>.

²⁶³ “PFAS,” National Association of Clean Water Agencies.

²⁶⁴ “PFAS,” National Association of Clean Water Agencies.

²⁶⁵ Ariana Figueroa, “How PFAS negotiations fell apart,” *E&E News*, December 9, 2019, eenews.net/stories/1061761149.

²⁶⁶ “PFAS National Leadership Summit and Engagement,” U.S. Environmental Protection Agency, last modified October 2, 2018, accessed November 14, 2019, <https://www.epa.gov/pfas/pfas-national-leadership-summit-and-engagement>.

²⁶⁷ “PFAS Community Engagement,” U.S. Environmental Protection Agency, last modified September 17, 2019, accessed November 14, 2019, <https://www.epa.gov/pfas/pfas-community-engagement>.

report details the EPA's plans to address PFAS pollution. This plan includes the comprehensive research effort mentioned in Chapter 2, along with temporary remediation actions and avenues through which the EPA is looking to regulate PFAS.²⁶⁸ These avenues for regulation include development of MCLs for PFAS under the SDWA,²⁶⁹ further restricting the use of PFAS under the TSCA, and placing certain PFAS on the CERCLA hazardous materials list.²⁷⁰

Department of Defense. Over the course of 2019, the DOD has significantly escalated its actions addressing PFAS. In response to the leaked meeting notes demonstrating that certain DOD officials knew about the hazards of PFAS in 2001, the Pentagon's Inspector General has initiated an internal investigation.²⁷¹ This investigation seeks to determine both the extent of the DOD's knowledge of the harmful nature of these chemicals, and the extent of their use in spite of this knowledge.²⁷² Moreover, Defense Secretary Mark Esper established a PFAS task force on July 23 to centralize the DOD's efforts.²⁷³ This task force has identified approximately 40 actions needed to fully address nationwide PFAS pollution on military installations, and is currently taking steps to initiate many of those actions.²⁷⁴

The PFAS pollution problem has also sparked internal policy changes have also occurred within the DOD. Public communication has increased notably surrounding this class of contaminants, as evidenced by changes to the DOD's website and the press conference held in

²⁶⁸ U.S. EPA, *EPA's Per- and Polyfluoroalkyl Substances (PFAS) Action Plan*, 13-14.

²⁶⁹ Director Rosemary Kelley and Acting Director Karin Leff to Enforcement Directors and Regional Counsels of U.S. EPA Regions 1-10, "Updated Guidance on Emergency Authority under Section 1431 of the Safe Drinking Water Act," U.S. Environmental Protection Agency, May 30, 2018, accessed November 14, 2019, <https://www.epa.gov/sites/production/files/2018-09/documents/updatedguidanceonemergencyauthorityundersection1431sdwa.pdf>.

²⁷⁰ U.S. EPA, *EPA's Per- and Polyfluoroalkyl Substances (PFAS) Action Plan*, 13-14.

²⁷¹ Dino Grandoni, "Pentagon watchdog to examine military's PFAS use," *The Washington Post*, last modified October 16, 2019, accessed November 14, 2019, <https://www.theintell.com/news/20191016/pentagon-watchdog-to-examine-militarys-pfas-use>.

²⁷² Grandoni, "Pentagon watchdog to examine military's PFAS use."

²⁷³ U.S. Department of Defense, "Transcript: DOD Media Roundtable on the PFAS Task Force."

²⁷⁴ U.S. Department of Defense, "Transcript: DOD Media Roundtable on the PFAS Task Force."

September.²⁷⁵ Additionally, the DOD’s PFAS task force has prioritized communication with affected communities, informing its installation commanders “to have continuing dialogues with community leaders and organizations to discuss the scope of the PFAS issue in their area...and to discuss mitigation and remediation.”²⁷⁶ Another important policy change has occurred in base operations: the DOD has discontinued the use of PFAS-containing firefighting foam in land-based training exercises.²⁷⁷ The use of the foam for non-training purposes, however, cannot be discontinued until researchers discover an equally effective alternative to the foam.

Accordingly, research into such alternatives has been one of the DOD’s top priorities in addressing PFAS pollution. More than \$11 million has been spent over the past 3 years towards research in alternative firefighting technologies.²⁷⁸ Importantly, ecotoxicology tests are being performed on all possible alternatives to the foam to prevent the accidental introduction of further hazards into the environment.²⁷⁹ In addition to seeking alternatives to PFAS-containing firefighting foam, the DOD’s PFAS task force has identified other research goals to allow the Department to make “data rich” decisions.²⁸⁰ One such priority has been the understanding the DOD’s internal utilization and consumption of PFAS-containing materials over past decade.²⁸¹ Another priority has been the development of remediation technologies for contaminated soils and aquifers. These research efforts are still in their early stages, but some technologies appear

²⁷⁵ U.S. Department of Defense, “Transcript: DOD Media Roundtable on the PFAS Task Force.”

²⁷⁶ David Vergun, “Installation Commanders to Discuss Firefighting Foam Issues With Communities,” *DOD News*, U.S. Department of Defense, November 20, 2019, accessed December 20, 2019, <https://www.defense.gov/explore/story/Article/2034518/installation-commanders-to-discuss-firefighting-foam-issues-with-communities/>.

²⁷⁷ U.S. Department of Defense, “Transcript: DOD Media Roundtable on the PFAS Task Force.”

²⁷⁸ Miranda Paley, “5 Things to Know About DOD’s Research on ‘Fluorine-Free’ Firefighting Foam,” U.S. Department of Defense, September 6, 2019, accessed December 20, 2019, <https://www.defense.gov/explore/story/Article/1953510/5-things-to-know-about-dods-research-on-fluorine-free-firefighting-foam/>.

²⁷⁹ Paley, “5 Things to Know About DOD’s Research on ‘Fluorine-Free’ Firefighting Foam.”

²⁸⁰ U.S. Department of Defense, “Transcript: DOD Media Roundtable on the PFAS Task Force.”

²⁸¹ U.S. Department of Defense, “Transcript: DOD Media Roundtable on the PFAS Task Force.”

promising: recently, the U.S. Air Force has developed a technology which it claims is capable of destroying certain PFAS in underground aquifers using argon gas.²⁸² The DOD's actions throughout the latter half of 2019 are a welcome and conspicuous change from its previous approach PFAS management.

Conclusion. The policy developments regarding PFAS that have occurred over the past two years are critical and unprecedented. While the damage wrought to the nation's environmental health cannot be undone, the process of enacting regulations on PFAS protective of future public health is underway. The following chapter will offer recommendations for future actions, building on this recent progress.

Chapter 6. Recommendations for Regulatory Reform

These developments of the past two years, while promising for communities affected by PFAS pollution, did not occur because the laws and policies in place recognized the health hazards of PFAS through the channels designed to recognize and prevent such hazards. Instead, years of grassroots advocacy by groups such as the BuxMont Coalition for Safe Water in reaction to demonstrated increases in human mortality and morbidity was required for PFAS-related health hazards to be addressed.

In reviewing the events of the past half-century, the long-term inefficiency of the lack of adequate regulation is apparent. If the unchecked use of PFAS-containing firefighting foam on-base had been properly regulated, either in the 1960s or following the passage of the Toxic Substances Control Act in 1976, decades of human and environmental health damages would

²⁸² Oriana Pawlyk, "The Defense Department May Have Found a Fix for Contaminated Water on Bases," *Military.com*, November 7, 2019, accessed November 13, 2019, <https://www.military.com/daily-news/2019/11/07/defense-department-may-have-found-fix-contaminated-water-bases.html>.

have been avoided. Furthermore, the financial and logistical resources being spent to mitigate potentially irreparable damage to groundwater resources and to provide medical care for those affected by PFAS consumption could have been directed towards many other useful programs. Thus, in the long-term, the astronomical costs of absent regulations are an irresponsible use of taxpayer money. Above all, the damage to human life and colossal waste of resources resulting from the unregulated use of PFAS was absolutely avoidable, but the agencies responsible for doing the regulating took no preventative action until decades of irreversibly damage had already been done.

While the consequences of this lack of regulation cannot be undone, public health disasters like this can be avoided in the future by heeding the lessons learned from those consequences. The following sections detail my recommendations both for managing the current public health crisis created by PFAS contamination, and for minimizing the possibility of the occurrence of similar crises caused by irresponsible regulatory oversight.

Continued Use of PFOA-Containing Firefighting Foam. The use of PFOA-containing firefighting foam must be discontinued as quickly as practicable. In addition to pollution control, the continued use of this foam jeopardizes the safety of servicemembers and emergency responders who have already put themselves into harm's way for the sake of the public. Research efforts into new technologies should continue to prioritize developing adequate substitutes to prevent further harm to end this pollution at the source.

Pennsylvania Government. The Commonwealth's governing members have been addressing the PFAS contamination problem transparently at the state level while advocating for their constituents at the federal level. The work of Governor Tom Wolf to begin the process of establishing a state level MCL for certain PFAS under the PA SDWA despite resource

limitations demonstrates the state's genuine commitment to address this problem comprehensively. The research process necessary for the establishment of the MCL is lengthy; to address the issue more quickly during that process, he might consider establishing a temporary emergency MCL using available data from previous studies used by other states to establish their state-level MCLs for certain PFAS.

Environmental Protection Agency. The EPA should continue its plans as outlined in the PFAS National Action Plan. Moving beyond the current unenforceable Health Advisory Levels to enforceable regulation of the chemicals under the TSCA, CERCLA, and SDWA is the only way to adequately protect public health. Importantly, the designation of PFAS as hazardous under CERCLA will better facilitate the health care and personal injury claims of those seeking just compensation for the effect that PFAS exposure has had on their lives. In developing the MCLs for various PFAS under these statutes, the EPA should heed the warnings of groups such as the NRDC and set the MCLs lower than the current Health Advisory Levels. Research demonstrates that these Health Advisory Levels are not adequately protective of human health, especially for vulnerable populations. As considerations for such populations is a statutory requirement of the amended TSCA, lower MCLs must be set.

Debates are ongoing concerning whether MCLs should be set for the all PFAS, or only for the most well-known handful of chemicals. Due to the demonstrated human health dangers associated with this family of chemicals, it would be hugely irresponsible for the EPA to not regulate all chemicals in the family without sufficiently demonstrating the safety of individual chemicals in the family. Not only would a lack of such regulations potentially expose the public to further preventable harm, it would also be a huge source of legal liability if this harm were to occur.

In considering the uses of environmental remediation technologies, such as the recently developed method using argon gas, I would urge that extensive testing of such technologies be conducted prior to their implementation. As concerning a problem as PFAS contamination in groundwater presents, undertested remediation technologies offering a quick solution could prove more harmful to human and environmental health. Comprehensive testing is the only way to ensure that further unnecessary harm is not wreaked on the environmental health of communities and ecosystems that have already suffered enough.

Federal Legislative Branch. Congress should view this public health crisis as a direct result of inadequate regulation of pollutants that have been used commercially since before the establishment of the original TSCA, combined with the military's history disregard for environmental health. The amendments to the TSCA enacted through the Frank R. Lautenberg Chemical Safety for the 21st Century Act appear to strengthen this act to enable it to adequately protect public health, but continued monitoring of the act's efficacy through organizations such as the Congressional Research Service are necessary to ensure that this protection is achieved.

If the amended TSCA proves incapable of protecting public health, stronger standards should be adopted. One model for such stronger standards is provided by the European Union's Registration, Evaluation and Authorization of Chemicals law adopted in 2006; this law requires that a chemical's safety be demonstrated to a review board prior to its commercial use, and requires the producers of the chemical to conduct the required tests to demonstrate this safety.²⁸³

Congress should also evaluate current available routes of funding for the enhancement of filtration technologies of public water systems across the country. Following this evaluation, the developments of additional loans or grants programs should be considered to enable PWSs to

²⁸³ Manheim, *The Conflict over Environmental Regulation in the United States*, 144-145.

meet forthcoming standards for PFAS.

Department of Defense. The seriousness with which the DOD is now addressing the PFAS problem is promising. The DOD should continue to address its liability to communities affected by hazardous materials pollution responsibly, expediting base cleanups and redevelopments as much as thorough public health protections will permit. The internal policy changes and research effort spearheaded by the PFAS task force should continue to work in conjunction with new policies set and research conducted under the EPA's PFAS National Action Plan.

The DOD should also continue its internal investigation into extent of internal knowledge of the hazards of PFAS. When this investigation concludes, the causes determines for delayed action, parties responsible for those delays, and any further details uncovered should be published as transparently as national security permits. Though the DOD is taking many steps to redress its role in polluting the nation's groundwater, the American public will be footing the financial bill and bearing the negative health consequences of this pollution and its cleanup for the foreseeable future. The harms caused by extended DOD inaction in addressing the health hazards associated with PFAS are substantial; those liable for knowingly prolonging this inaction should be held publicly accountable.

Above all, the DOD should pursue a commitment to holistically sustainable practices in all areas practicable through a "beyond compliance" ethic.²⁸⁴ This ethic must include a definition of national security which recognizes the importance of environmental health in the long-term security of the nation. Globally, water security is a massive source of political unrest that is only worsening with the climate change. Domestically, the water insecurity issues of Flint, Michigan

²⁸⁴ Durant, *The Greening of the U.S. Military*, 151.

have led to the erosion of public trust of the government, chronic health problems for residents, and billions of dollars spent to mitigate damage that could have been avoided.²⁸⁵ The DOD's commitment to restoring the water resources it has damaged by PFAS is evidenced by its recent actions. Nonetheless, the Department must make a lasting commitment to pollution prevention rather than remediation to avoid inflicting future damage on the nation's environmental health.

Conclusion. The PFAS pollution problem caused by NASJRB and NADC in Warminster, Warrington, and Horsham is on its way to being resolved. Though harms to constituents and servicemembers caused by the groundwater cannot be undone, representatives at the state and federal level continue to work tirelessly to provide clean water, federal transparency, compensation for those most intimately affected, and regulations protective of public health to their constituents. Though their work is important and vital for the nation's environmental health, it should not be necessary in the first place.

Clean water is a constitutional right in Pennsylvania, and statutes purported to defend the public against water-related health concerns are in place at the state- and federal-level. While progress is being made to regulate certain PFAS under these water laws and hazardous materials laws, it is alarming and negligent that those laws did not protect against those hazards in the first place. This is especially concerning considering that these chemicals are used by armed forces and emergency response services *en masse*. Despite the grim history brought about by irresponsible use of PFAS, their regulatory future looks bright—the research to better understand them, technologies to remediate them, and federal legal will to regulate them grows by the day.

Nonetheless, if proper regulation of these chemicals had been in place proactively, many millions of dollars used in response and remediation actions could have been reappropriated to

²⁸⁵ “Flint Water Crisis Fast Facts,” CNN, last modified December 13, 2019, accessed December 20, 2019, <https://www.cnn.com/2016/03/04/us/flint-water-crisis-fast-facts/index.html>.

necessary government programs. Along with financial savings, proactive pollution prevention legislation saves lives, and could have saved communities awaiting base remediation from years of economic hardship. The residents of Warminster, Warrington, Horsham, and other affected communities across the country have paid the price of this lack of proactive regulation.

A national security considerate of environmental health demands that defense of necessary ecosystem services such as the provisioning of potable water be non-negotiable on domestic soil. The military must consider the long-term safety of its citizens living near bases to be sacrosanct, with potential exceptions considered only during dire wartime circumstances. Even internally, the branches of the military have a duty to their servicemembers to ensure that their drinking water is not contaminated by the requirements of their job. If the utmost care is not taken towards the protection of the nation's environmental health and its ability to perform necessary ecosystem services, comprehensive national security cannot be achieved, and the DOD will continue to endanger the public it has sworn to protect.

In short, the PFAS problem was the product of an outdated conception of national security combined with a nightmare of regulatory oversight. Though enforceable regulations for PFAS will likely be established in the near future, the implications of their previous neglect are cause for serious concern surrounding domestic hazardous materials monitoring. The lack of regulation of such widely used hazardous materials leads one to wonder what other unregulated hazardous materials might have leached into their drinking water. Measures have been taken to improve domestic environmental regulation and the military's conception of environmental health, but the results of these changes remain to be seen. If ineffective, we the people may be as doomed as the birds in Rachel Carson's *Silent Spring*. Until we responsibly regulate the many useful but lethal chemicals available to us, the very water that we drink may slowly poison us.

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