UNIVERSITY OF OKLAHOMA

GRADUATE COLLEGE

THE BUSINESS OF ATOMIC WAR: THE MILITARY-INDUSTRIAL COMPLEX AND THE AMERICAN WEST

A DISSERTATION

SUBMITTED TO THE GRADUATE FACULTY

in partial fulfillment of the requirements for the

Degree of

DOCTOR OF PHILOSOPHY

By

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Norman, Oklahoma
2020

THE BUSINESS OF ATOMIC WAR: THE MILITARY-INDUSTRIAL COMPLEX AND THE AMERICAN WEST

A DISSERTATION APPROVED FOR THE
DEPARTMENT OF HISTORY

BY THE COMMITTEE CONSISTING OF

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Abstract

This dissertation examines nuclear weapons manufacturing in the American West from 1942 through the early 1990s. Specifically, it examines Hanford Engineer Works in Washington, Pantex in the Texas Panhandle, Rocky Flats Plant in Colorado, uranium mines and mills across the American West, and Los Angeles's ICBM industry. Using the tools of environmental, business, and nuclear history, this manuscript asserts several related propositions. First, the military-industrial complex was not a top-down organization directed by a scientific-technological elite, but a diffuse system supported by, and comprised of, working Americans who found lucrative paychecks and a distinctive social status by taking jobs in the weapons industry. Second, private firms as much as the federal state, and at times even more so, shepherded the U.S. effort to procure nuclear weapons and delivery systems. Third, the state's demand for nuclear weapons pushed private firms to manufacture nuclear materiel as quickly as possible and overlook the environmental and human health consequences of rapid nuclear procurement. Fourth, this dedication to procurement over human and environmental health galvanized thousands of westerners to form anti-nuclear movements and seek justice for decades of radioactive contamination. Recognizing that the success of America's nuclear weapons program, and indeed the success of the military-industrial complex, itself, was contingent on the participation of millions of Americans and dozens of private corporations, this manuscript offers a bottom-up interpretation of the military-industrial complex.

This dissertation intervenes in a historiography that privileges the role of the American state in manufacturing nuclear weapons at the expense of private industry, regards the military-industrial complex as a monolithic entity, and has failed to examine how nuclear weapons work

produced both economic benefits and physical pains for working Americans. It recognizes that private firms held and exercised agency in producing nuclear weapons. Nuclear weapons work provided westerners with a new source of economic wealth while poisoning western bodies and western landscapes. By showing how nuclear weapons work enriched some westerners and harmed others, this manuscript explains why some Americans continue to fight against the military-industrial complex and why others continue to support it.

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Acknowledgments

I am particularly grateful to my dissertation committee. Kathleen Brosnan, the committee chair, has been an exemplary mentor. Her criticism, guidance, and support straightened my aim and pushed me forward. Anne Hyde went above and beyond the call of a mentor by providing me with both professional support and personal guidance. Time and time again Anne demonstrated that she cared not only about my academic success but my overall well-being. David Wrobel’s mastery of historiography helped me craft this dissertation and engage with a diverse literature. His knack for turning a phrase and his sensitivity has influenced my writing. Elyssa Faison and Alison Fields have helped me understand nuclear issues from different perspectives. Although this manuscript does not engage with Japanese nuclear history, Marshallese nuclear history, nor nuclear art history, studying these topics with Elyssa and Alison helped me understand that nuclear developments meant different things to different people. That notion is encapsulated, and better articulated, in the central thesis of this manuscript. I thank John McNeill for agreeing to serve on my committee. Unlike the other scholars on my committee, John is not affiliated with the University of Oklahoma. John’s work has influenced and shaped my thinking, perhaps more than any other historian’s. Following John’s lead, I have attempted to tackle a geographically and temporality large subject in this manuscript by blending disparate analytical approaches. Each member of my committee encouraged me to forego writing a narrow dissertation in favor of an expansive narrative. I thank them for this challenge. I hope my readers will enjoy its fruits.

This manuscript would not be possible without the diverse opportunities provided to me by the University of Oklahoma. I had to distinctive privilege of working with Anne Hyde at the

Western Historical Quarterly as an editorial fellow and book review editor from 2016 to 2018. This position allowed me to develop a firm understanding of the current trends and tendencies of western historiography and network with a variety of scholars. The University of Oklahoma Graduate College's Three Minute Thesis Competition challenged me to summarize my research and arguments into a brief speech. Participating in this competition helped me formula my ideas and the main takeaways of this manuscript. The University of Oklahoma's Osher Lifelong Learning Institute gave me a platform to test my ideas in a lecture setting. Chris Elliott and the lifelong learners, all experts in their respective fields, welcomed my new approach to nuclear history and encouraged my project. The University of Oklahoma also provided me with several fellowships, grants, and travel awards to facilitate my matriculation and research. The Nancy Mergler Dissertation Completion Fellowship funded the last year of my dissertation writing process. The Hudson Family Fellowship granted me the financial capital to pursue this research and craft this manuscript. The University of Oklahoma Department of History partnered with The Huntington Library to fund my summer research fellowship at The Huntington. There, I had the distinctive pleasure of with working Peter Blodgett and examining the library's extensive archival holdings. Peter also graciously allowed me to explore other archives in the Los Angeles area and obtain sources for this manuscript.

I relied on twenty-nine archives, museums, and repositories to craft this manuscript. I thank all of the archivists, librarians, and curators that have helped me locate pertinent documents and pieces of ephemera. A few archivists have gone above and beyond the call of duty to aid my research. Robert Franklin and Jillian Gardner-Andrews at the Hanford History Project in Richland, Washington, provided me with dozens of oral histories, many of which are still not available to the general public. In some cases, Robert provided me with oral history interviews he conducted mere days before. Fina Myers-Martinez at the NNSA/NSO Nuclear Testing Archive in Las Vegas, Nevada, located hundreds of declassified documents for me. I felt apprehensive asking Fina for more than 200 obscure government reports, letters, and scientific papers. She happily filled all of my requests and encouraged me to ask for more files. David M. Hays at the University of Colorado Boulder Libraries helped me locate documents on Rocky Flats Plant and Colorado's uranium industry. He also shared with me his family's military history and constantly kept me informed each time his repository received a new document or collection that might be pertinent to my research. Lucas Clawson at the Hagley Museum and Library in Wilmington, Delaware, facilitated my acquisition of Crawford Greenewalt's diary and helped me navigate the Hagley's rich DuPont holdings. Additional scores of archivists, librarians, and staff members aided my research and I am grateful for their invaluable support.

This manuscript also utilizes documents obtained via the Freedom of Information Act (FOIA). I thank the platoon of FOIA officers that responded, vetted, processed, and fulfilled my requests. The FOIA officers associated with the National Archives and Record Administration in College Park, Maryland, as well as the FOIA officers affiliated with the U.S. Department of Energy and the Federal Bureau of Investigation were particularly prompt and helpful. Eric Boyle and David Fort are exemplary FOIA officers. Eric and David both helped me track down and declassify documents lost when the U.S. Atomic Energy Commission gave way to the Department of Energy. Without these sources I could not tell this story.

My professional friendships have been invaluable. Leisl Carr Childers, Jason Herbert, Robynne Mellor, Madison Heslop, Jared Eberle, Will Cowan, David Bolingbroke, Mary Mendoza, Erin Mauldin, Raphie Folsom, and Josh McGuffie each provided me with encouragement, fellowship, and inspiration. Patricia Limerick consistently went out of her way to make me feel welcome at various scholarly gatherings. William Deverell encouraged me to examine Los Angeles and include its story in this manuscript. Members of my cohort at the University of Oklahoma helped me grow as a scholar as a human being. Courtney and John Buchkoski, Kevin Hooper, Abby Gibson, and Matt Corpolongo deserve special mention for their unwavering friendship and support. My fellow members of the American Historical Association Graduate and Early Career Committee have helped me navigate the perils of graduate work and grow as a scholar.

My personal network, namely my friends and family, have contributed more than they know to my success. Ed Blaise, Rolf Fure, and Justin Fure taught me how to stand up straight with my shoulders back and helped me save my life. Josh Smith stood by me through thick and thin. Andy Bennett shaped my outlook on life and has treated me like a son. Steven Myers encouraged me to stand by my values and be true to my convictions. Nannette Myers has always supported my goals and serves as a bedrock of support for much of my life. Evan and Sabrina Myers have helped me strategically relax and enjoy the little moments. Emma Myers helped me edit this manuscript. More importantly, Emma has believed in my vision for this manuscript and my future. My father, Fred, shaped my convictions at a young age. My mother, Lori, and my siblings, Joe and Christina, have weathered the burdens of life with me. We have all come a long way from the shelter. We continue to fight through this life together—and we are winning the fight. All of these people, my dearest friends and family, have shaped my work and my being. Everything I love about myself, how I conduct myself, and my aim are products of our fellowship. When I think about all of you, I remember who I am.

Each historical work is, to some extent, a reflection of the author's perspective and gaze. I had the distinctive opportunity of growing up in various military bases and living just outside of the Fond du Lac Reservation. I learned at an early age about what defense spending meant for working Americans and how Native Americans have suffered from distinctive burdens. My upbringing has influenced my historical analysis.

I wrote this manuscript for myself, the academic community, my readers, and my loved ones. I also wrote it for those men, women, and children that experienced the pains and benefits of the nuclear weapons industry. I hope that one day those who have enjoyed the benefits and those who have suffered the pains can come together and recognize each other.

Introduction

This is a new story about the efforts of the United States to manufacture nuclear weapons during World War II and the Cold War. While it focuses on the uranium mines and mills, plutonium enrichment plants, weapons factories, and the firms in the American West that produced nuclear weapons components and delivery systems, this manuscript addresses questions which resonated throughout the nation's war industries and still have meaning today. This manuscript mobilizes ideas and methods found in new western history, environmental history, nuclear history, and business history to address how the nation went about manufacturing nuclear weapons and how the fabrication of these arms transformed the lives of westerners and western environments. It is the story about the ever-shifting balance between big government and big business, and about the power of both to transform the lives, politics and economies of individuals and the communities they call home. Moreover, it explains why many Americans, as individuals and as participants in corporate culture, willingly accepted what more contemporary observers evaluate as profound risks to human health and environmental sustainability. In the end, it is a narrative that explains the ongoing modernization of the West and of the nation during an era of long-standing, often escalating global tensions known as the Cold War.[1]

This manuscript examines the military-industrial complex from a new vantage point by focusing on how individual westerners shaped and interacted with the system. The following

[1] To be clear, this project focuses on nuclear weapons manufacturing. Therefore, it does not investigate the laboratories that experimented with nuclear technologies and devices (such as Los Alamos), nor the United States's nuclear test sites and missile bases. It is also worth noting here that this is not a study of nuclear energy, which, as a field, differs greatly from nuclear weapons.

pages assert several related propositions. First, the military-industrial complex was not a top-down organization directed by a "scientific-technological elite," to use the phrase of Dwight D. Eisenhower, but a diffuse system supported by, and comprised of, working Americans who found lucrative paychecks and a distinctive social status by taking jobs in the weapons industry. Second, private firms as much as the federal state, and at times even more so, shepherded the U.S. effort to procure nuclear weapons and delivery systems. Third, the state's demand for nuclear weapons pushed private firms to manufacture nuclear materiel as quickly as possible and overlook the environmental and human health consequences of rapid nuclear procurement. Fourth, this dedication to procurement over human and environmental health galvanized thousands of westerners to form anti-nuclear movements and seek justice for decades of radioactive contamination. This last proposition pertains to the last few decades of the Cold War and remains an ongoing process. Recognizing that the success of America's nuclear weapons program, and indeed the success of the military-industrial complex, itself, was contingent on the participation of millions of Americans and dozens of private corporations, this manuscript offers a bottom-up interpretation of the military-industrial complex.

To excavate the history of the military-industrial complex from below, "The Business of Atomic War" examines five emblematic cases: Hanford Engineer Works in Washington; Rocky Flats Plant in Colorado; Pantex in the Texas Panhandle; uranium mines and mills across the American West; and the firms that manufactured intercontinental ballistic missile (ICBM) components in Los Angeles. In each case, nuclear weapons work provided westerners with distinctive economic opportunities. In each case, corporations determined how to produce nuclear materiel. In some cases, corporations worked with the state to select factory locations. In other cases, firms structured their nuclear workforce to reflect their methods of management and culture. In other words, this manuscript recognizes that private firms held and exercised agency when it came to nuclear weapons work. Most of the studied facilities and sites disproportionally saddled rural western communities with hazardous waste and radioactivity, igniting grassroots contestations surrounding the nuclear weapons industry.

At first glance, some might question my contention that the state was not the most important actor in developing nuclear weapons. Yet, we must remember that as westerners mined and milled uranium, enriched plutonium, and fabricated nuclear bombs and delivery systems, they followed the orders and cues of the private firms that employed them. Although presidents, national security advisers, and state officials crafted national security policies regarding nuclear weapons, they left the fundamental aspects of weapons production to private corporations. Businesses decided what types of nuclear weapon components to produce, how these components would be fabricated, and when these materials would be delivered to the state. Indeed, while state actors articulated what types of weapons the government desired to purchase, private firms determined the rest. In this case, the state acted primarily as the consumer.

Millions of Americans participated in procuring nuclear weapons and their delivery systems, whether by working for nuclear firms or by launching their own uranium mining enterprises. While some of these Americans wielded tremendous economic, political, and military power, most were members of the middle and lower classes. This group of people, what I call the atomic workforce, included uranium prospectors, miners, construction workers, factory workers, middle managers, engineers, and physicists. These Americans aspired for more for their themselves and their families. As champions of the doctrine of nuclear deterrent, they understood that atomic work helped safeguard the nation. They also understood that nuclear weapons fabrication provided new economic opportunities for themselves and their communities. They took pride in working with this new and dangerous technology, often styling themselves as pioneers, innovators, and guardians of American liberty. These working, dreaming, and scheming blue- and white-collar Americans mobilized their labor, intelligence, and imagination to facilitate the doctrine of nuclear deterrence and the economic ascendance of their households and communities.

During the early years of the Cold War, many members of the atomic workforce did not know that the materials they worked with could have adverse effects on their health. Some understood that working with nuclear materials posed distinctive hazards and relied on their expertise and knowledge to mitigate risk. Still others believed that the risks associated with nuclear weapons work were worth the fiscal, social, and national security rewards. By the 1970s, some atomic workers had developed diseases stemming from their nuclear labor. Other Americans not associated with nuclear work also began to draw attention to how uranium mines and mills, plutonium enrichment plants, and nuclear factories contaminated nearby communities and environments with radioactive waste. Using the tools of environmental history, the latter chapters of this dissertation uncover how concerns about nuclear waste, and anti-militarization convictions, led some westerners to form activist movements to challenge the presence of nuclear weapons facilities in the West. Some of these westerners were poor and rural Native Americans. Others were middle-class, urban, and white. With the exception of the former uranium miners and a handful of whistleblowers, most of the protesters did not work for the nuclear weapons firms but nevertheless suffered from the pollutants stemming from uranium mining and milling, plutonium enrichment, and nuclear weapons fabrication. Consequently, the final chapters of this dissertation engage with environmental histories of activism and environmental injustice.[2]

Although nuclear weapons work took place in every American region during the Cold War, this manuscript reminds us that the American West contained the balance of the nation's nuclear weapons facilities. This was not product of happenstance. During the late 1940s and throughout the 1950s, Atomic Energy Commission bureaucrats partnered with private firms to read the West's natural, economic, and demographic landscapes to select what they believed were ideal environments for uranium mines and mills, plutonium enrichment plants, nuclear weapons factories, and ICBM development. Although I have been tempted to examine nuclear weapon production across the United States, the West's disproportionate collection of nuclear weapons facilities demands attention. Consequently, this manuscript seeks in part to explain how the West won the nuclear weapons industry and how nuclear weapons work transformed the region and its inhabitants. Some of the themes present in this dissertation will be familiar to students of new western history. This manuscript is a story about economic development, corporate operations, and environmental injustice. It draws on older works in the field of new western history, such as William Robbins's *Colony and Empire* and Gerald Nash's *The Federal Landscape*, which position the West as a region abused by private corporations and propped-up by federal spending. "The Business of Atomic War" also speaks to themes presented in the 1998

[2] Readers interested in the historiography of environmental activism and environmental injustice would do well to start with Char Miller and Jeff Crane, eds., *The Nature of Hope: Grassroots Organizing, Environmental Justice, and Political Change* (Louisville: University Press of Colorado and Utah State University Press, 2018). Alternatively, readers could find a good entry point to this literature by examining Rob Nixon, *Slow Violence and the Environmentalism of the Poor* (Cambridge: Harvard University Press, 2011).

edited volume *The Cold War American West*, namely how Cold War militarization moved the West "from the edge of things to the center of one of the great struggles of power."[3]

Overall, this manuscript draws inspiration from J.R. McNeill's *Something New Under the Sun*, a text which integrates social, political, economic, and intellectual history with environmental history to explain how human preferences and patterns wrought environmental changes across the globe during the twentieth-century.[4] Following McNeill's lead, "The Business of Atomic War" asks how human preferences—in this case, the state's preference to manufacture weapons using private firms, the corporate preference for production over safeguarding environmental and human health, and worker preferences for high wages and status—created a pattern of nuclear development in the West. Furthermore, it reveals how this pattern transformed environments and bodies. Borrowing once again from McNeill's holistic framework, this manuscript posits that the history of nuclear weapons manufacturing, the history of economic development in the West, and the history of nuclear pollutants and activism make full sense only if seen together.

On its face, this manuscript offers a new approach to nuclear history. To date, the field of nuclear history has offered stories of scientific achievement and environmental ruin. Some nuclear historians, such as Richard Rhodes, Kai Bird, Martin Sherwin, and Hill Williams, have written about the history of nuclear weapons manufacturing by focusing on the scientists that

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[3] William G. Robbins, *Colony and Empire: The Capitalist Transformation of the American West* (Lawrence: University Press of Kansas, 1994); Gerald D. Nash, *The Federal Landscape: An Economic History of the Twentieth-Century West* (Tucson: University of Arizona Press, 1999); Kevin J. Fernlund, "The Cold War West: A New Image?," in *The Cold War American West*, *1945-1989*, ed. Kevin J. Fernlund (Albuquerque: University of New Mexico Press, 1998), 211.

[4] J.R. McNeill, *Something New Under the Sun: An Environmental History of the Twentieth-Century World* (New York: W.W. Norton & Company, 2000).

built the first atomic bombs and the state officials whom guided the process.[5] Other historians, including Traci Voyles and Valerie Kuletz, emphasized how mining uranium and manufacturing nuclear weapons devastated human bodies and environments.[6] Still other scholars, namely Kate Brown, have articulated that thousands of Americans willingly traded their biological health in exchange for nuclear weapons jobs at Hanford.[7] Most nuclear historians mark the state as the most important actor in nuclear weapons production and regard the military-industrial complex as a system that proved unresponsive to blue- and white-collar desires.[8] "The Business of Atomic War" recognizes the contributions of nuclear history scholars while pushing the field to move toward an analytical framework that considers how working Americans shaped nuclear weapons procurement. In other words, this manuscript seeks to dispel the notion that the military-industrial complex was an undemocratic force championed only by a technocratic elite.

By examining the military-industrial complex on the ground, this manuscript at once recognizes the pain and benefits it produced. Dozens of scholars, including Voyles, Kuletz, and Brown, have highlighted how nuclear weapons work produced pain in Indigenous and rural Anglo bodies via radioactive contamination and cancers. This dissertation does not refute the

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[5] Richard Rhodes, *The Making of the Atomic Bomb* (New York: Simon & Schuster, 1987); Kai Bird and Martin J. Sherwin, *American Prometheus: The Triumph and Tragedy of J. Robert Oppenheimer* (New York: Alfred A. Knopf, 2005); Hill Williams, *Made in Hanford: The Bomb that Changed the World* (Pullman: Washington State University Press, 2011).

[6] Traci Brynne Voyles, *Wastelanding: Legacies of Uranium Mining in Navajo Country* (Minneapolis: University of Minnesota Press, 2015); Valerie L. Kuletz, *The Tainted Desert: Environmental Ruin in the American West* (New York: Routledge, 1998). For other examples, see Peter H. Eichstaedt, *If You Poison Us: Uranium and Native Americans* (Santa Fe: Red Crane Books, 1994); Michele Stenehjem Gerber, *On the Home Front: The Cold War Legacy of the Hanford Nuclear Site* (Lincoln: University of Nebraska Press, 2007).

[7] Kate Brown, *Plutopia: Nuclear Families, Atomic Cities, and the Great Soviet and American Plutonium Disasters* (New York: Oxford University Press, 2013). John M. Findlay and Bruce Hevly make a similar argument in *Atomic Frontier Days: Hanford and the American West* (Seattle: Center for the Study of the Pacific Northwest in association with the University of Washington Press, 2011).

[8] Each of the works mentioned above privilege the state in their analysis and indicate that the system was unresponsive to local concerns.

existence of this pain. After all, pain is a biological reality that exists outside the realms of philosophy, phenomenology, and debate. However, this manuscript recognizes that historians have primarily focused on how the nuclear weapons industry produced pain and have done little to explain why thousands of Americans supported nuclear weapons work.[9] This manuscript seeks to take both the anti-nuclear and the pro-nuclear American experiences seriously. To do this, "The Business of Atomic War" attempts to craft a nuanced and sensitive story that explains how the military-industrial complex harmed some but benefitted others. To be clear, I do not mean to imply that the benefits of nuclear weapons work outweighed the pain it produced. Rather, by exploring both the benefits and the pains wrought by the industry, I hope to craft a more holistic history that identifies how the military-industrial complex benefitted some working Americans and harmed others.

My attempt to document the benefits of nuclear weapons work is inspired by Alan Brinkley's seminal article "The Problem of American Conservatism." In that piece, Brinkley attempted to understand why historians paid little attention to the American Right during the 1970s and the 1980s. For Brinkley, the "problem of American conservatism" was neither a problem facing conservatives nor a problem which conservatives may have created, but a problem of American historical scholarship. Historians had failed to plumb the Right's traditions

[9] Voyles, *Wastelanding*; Kuletz, *The Tainted Desert*; Brown, *Plutopia*. For other works that emphasize how the nuclear industry produced pain see, Sarah Alisabeth Fox, *Downwind: A People's History of the Nuclear West* (Lincoln: Bison Books, 2014); Judy Pasternak, *Yellow Dirt: An American Story of a Poisoned Land and a People Betrayed* (New York: Free Press, 2010); LeRoy Moore, *Plutonium and People Don't Mix: A Guide to Rocky Flats, Colorado's Defunct Nuclear Bomb Factory* (Boulder: Rocky Flats Nuclear Guardianship and Rocky Mountain Peace & Justice Center, 2017); Michael D'Antonio, *Atomic Harvest: Hanford and the Lethal Toll of America's Nuclear Arsenal* (New York: Crown, 1993).

and social and political movements.[10] In a similar way, this manuscript points out that historians have paid little attention to pro-nuclear working Americans and attempts to recover their history.

While "The Business of Atomic War" primarily investigates what nuclear weapons work meant for working Americans and the American West, it also recognizes how the atomic workforce contributed to international stability by drawing on the scholarship of John Lewis Gaddis. In *The Long Peace*, Gaddis makes the case that the Cold War was actually a time of great peace between the United States and the Soviet Union in terms of open warfare. According to Gaddis, the superpowers' aggressive procurement of nuclear weapons provided a stable international system by making the prospect of war so terrible it was not an option.[11] This dissertation shares Gaddis's appraisal of the Cold War. Moreover, it shows that many members of the atomic workforce articulated similar sentiments throughout the latter-half of the twentieth century. Indeed, most westerners that took nuclear weapons jobs believed that their labor was integral to keeping the superpowers from coming to blows. Put another way, members of the atomic workforce maintained that facilitating world peace was one crucial benefit of their labor.

Ever since Eisenhower popularized the phrase "military-industrial complex," scholars have attempted to uncover its meaning and indict the system. In the words of James Ledbetter, the concept of the military-industrial complex "has become a rhetorical Rorschach blot—the

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[10] Alan Brinkley, "The Problem of American Conservatism," *The American Historical Review* 99, no. 2 (April 1994): 410. In the aftermath of Brinkley's article historians began studying American conservatism. Readers interested in this new historiography should consult Kim Phillips-Fein, *Invisible Hands: The Making of the Conservative Movement from the New Deal to Reagan* (New York: W.W. Norton, 2010); Lisa McGirr, S*uburban Warriors: The Origins of the New American Right* (Princeton: Princeton University Press, 2001); Bethany Moreton, *To Serve God and Wal-Mart: The Making of Christian Free Enterprise* (Cambridge: Harvard University Press, 2009); Darren Dochuk, *From Bible Belt to Sunbelt: Plain Folk Religion, Grassroots Politics, and the Rise of Evangelical Conservatism* (New York: W.W. Norton, 2010).
[11] John Lewis Gaddis, *The Long Peace: Inquiries into the History of the Cold War* (New York: Oxford University Press, 1987).

meaning is in the eye of the beholder."[12] As Alex Roland put it, the military-industrial complex "was both a historical phenomenon and political trope."[13] For nearly sixty years, scholars and political commentators have used the phrase as a noun for the various networks of public and private forces that combine a profit motive with the planning and implementation of national security policy. Most use the phrase as a pejorative and indict the military-industrial complex with wasteful spending, distorting the American economy, accumulating government resources in the face of pressing social problems, suppressing American democracy, and provoking international conflicts for the sake of profit.[14] It should be noted, however, that these indictments were primarily based on personal politics, fears, and forecasts about the future. Few examined the nuclear weapons manufacturing contracts but nevertheless surmised that the agreements must have provided contractors with large profit margins. Indeed, while a few scholars attempted to locate the historical creation of the military-industrial complex, most wrote about how they *believed* the ongoing system posed a threat to their present and future.[15]

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[12] James Ledbetter, *Unwarranted Influence: Dwight D. Eisenhower and the Military-Industrial Complex* (New Haven: Yale University Press, 2011), 5.

[13] Alex Roland, "The Military-Industrial Complex: Lobby and Trope," in *The Long War: A New History of U.S. National Security Policy Since World War II*, ed. Andrew J. Bacevich (New York: Columbia University Press, 2007), 335-370.

[14] Ledbetter, *Unwarranted Influence*, 6-11.

[15] For texts that attempt to locate the genesis of the military-industrial complex, see Kurt Hackemer, *The U.S. Navy and the Origins of the Military-Industrial Complex* (Annapolis: Naval Institute Press, 2001); Michael Swanson, *The War State: The Cold War Origins of the Military-Industrial Complex and the Power Elite, 1945-1963* (Scotts Valley: Createspace Independent Publishing Platform, 2013); Stuart D. Brandes, *Warhogs: A History of War Profits in America* (Lexington: University Press of Kentucky, 1997). Far more scholars have written about the military-industrial complex of their day and their trepidations about the system. For examples, see C. Wright Mills, *The Power Elite* (New York: Oxford University Press, 1956); Sidney Lens, *The Military-Industrial Complex* (Philadelphia and Kansas City: Pilgrim Press & the National Catholic Reporter, 1970); Seymour Melman, *Pentagon Capitalism: The Political Economy of War* (New York: McGraw-Hill Book Company, 1970); Seymour Melman, *The Permanent War Economy: American Capitalism in Decline* (New York: Simon and Schuster, 1974).

Following Eisenhower's instance that the military-industrial complex was directed by a "technological-elite," scholars interested in the system have centered their works on the relationship between the Pentagon and weapons manufacturers. Most draw on histories and muckraking books on militarization from the early 1900s. Texts such as George Seldes's *Iron, Blood and Profits*, H.C. Engelbrecht and F.C. Hanighen's *Merchants of Death*, and Otto Lehmann-Russbueldt's *War for Profits* provided them with polemical histories of weapons procurement from the Roman Empire to World War I. Each held that arms dealers cause, encourage, and perpetuate wars to maximize profits.[16] In search for the merchants of death, modern scholars have provided a top-down approach to the military-industrial complex and have done little to investigate the agency of weapons workers and weapons protesters. These scholars, few of which were historians, sought to uncover the military-industrial complex of their day and convince Americans to abandon the system. Most shared the political convictions that the military-industrial complex was enriching the "technological-elite," was unresponsive to local voices, and threatened the American economy and participatory government. In lieu of historical analysis, these scholars forecasted economic ruin and the rise of a new government where individual liberties were constricted and subservient to military imperatives.[17] By providing a historical examination of the nuclear military-industrial complex, this manuscript challenges

[16] George Seldes, *Iron, Blood and Profits* (New York: Harper and Brothers, 1934); H.C. Engelbrecht and F.C. Hanighen, *Merchants of Death: A Study of the International Armament Industry* (New York: Dodd, Mead & Company, 1934); Otto Lehmann-Russbueldt, *Die Blutige Internationale Der Rüstungsindustire* (Hamberg-Bergedorf: Fackelreiter Verlag, 1929).

[17] See, for example, Mills, *The Power Elite*; Lens, *The Military-Industrial Complex*; Paul A.C. Koistinen, *The Military-Industrial Complex: A Historical Perspective* (New York: Praeger Publishers, 1980); Aaron L. Friedberg, *In the Shadow of the Garrison State: America's Anti-Statism and Its Cold War Grand Strategy* (Princeton: Princeton University Press, 2000); Paul A.C. Koistinen, *State of War: The Political Economy of American Warfare, 1945-2011* (Lawrence: University Press of Kansas, 2012). John Stanley Baumgartner stands apart from these scholars in his defense of the military-industrial complex. See, John Stanley Baumgartner, *The Lonely Warriors: The Case for the Military-Industrial Complex* (Los Angeles: Nash Publishing, 1970).

several of these convictions. By interrogating weapons contracts, business reports, corporate newsletters, and oral histories, this manuscript strives to recognize the agency that individual westerners held and exercised as they manufactured nuclear weapons and encountered nuclear waste. Additionally, this method of analysis reveals that most weapons firms did not receive large profits for manufacturing nuclear materiel, however, their employees did receive comparatively high wages.[18] By highlighting this point, this manuscript illustrates that nuclear weapons work did little to benefit corporate profit margins but did provide average Americans with a new degree of wealth. This helps explain why so many Americans championed the system and participated in it. By revealing the power that average Americans held in the military-industrial complex, I show that the system was as much a creature of democratic forces as it was a tool of the "power elite."

This manuscript does not appraise the morality nor the ethics of the nuclear military-industrial complex. In an era dominated by post-modern analysis and relativism it is difficult for any author to appraise the morality and ethics of any given system without falling out the grace with any given reader. Thus, this manuscript plumbs the corporate and western histories of nuclear development and highlights stories of radioactive contamination but stops short of appraising the system in terms of its morality and ethics. "The Business of Atomic War" leaves that task to the individual reader. Some might be taken aback by this approach and wonder if this manuscript will at least investigate the claim that weapons work was an illegitimate source of corporate wealth. While "The Business of Atomic War" does interrogate weapons contracts to reveal profit margins, most of which were quite low, it does not offer a framework to appraise

[18] E. I. du Pont de Nemours and company, for example, received only $1 for constructing and operating Hanford Engineer Works.

the morality and ethics of weapons work. Readers interested in the military-industrial complex and ethics would do well to consult Stuart Brandes's *Warhogs*, which examines the American tradition of mobilization, the ethical problems associated with military procurement, and the growth of administrative procedures intended to ensure that mobilization was carried out with efficiency and equity. Readers interested in ethics and the military-industrial complex's constitutional implications would also benefit from examining Rebecca Thorpe's *The American Warfare State*, which documents how American congressmen and women utilized weapons work as "pork barrel" projects which helped ensure their reelection.[19]

This project also proffers a more holistic approach to the field of business history. Drawing on the historiographical tradition forged by Alfred D. Chandler, this manuscript examines how corporate managers and corporate cultures shaped nuclear weapons manufacturing.[20] A few business historians have already implemented this approach. For example, in the fourth chapter of his monograph, *Nylon and Bombs*, Pap Ndiaye investigates the United States's attempt to procure plutonium at Hanford during World War II. Ndiaye argues E. I. du Pont de Nemours and Company (DuPont) engineers held "a preeminent position" of power in the Manhattan Project. According to Ndiaye, traditional histories of the Manhattan Project give "star billing to the great names of nuclear physics," despite the fact that DuPont engineers were in charge of building Hanford Engineer Works and imposed the company's decentralized, multi-divisional structure on the Manhattan Project.[21] In the third chapter of *Rescuing*

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[19] Brandes, *Warhogs*; Rebecca U. Thorpe, *The American Warfare State: The Domestic Politics of Military Spending* (Chicago: University of Chicago Press, 2014).
[20] Chandler prompted historians to investigate the visible hand of management in *The Visible Hand: The Managerial Revolution in American Business* (Cambridge: The Belknap Press of Harvard University Press, 1977).
[21] Pap A. Ndiaye, *Nylon and Bombs: DuPont and the March of Modern America* (Baltimore: John Hopkins University Press, 2007), 172, 162, 154-5.

Prometheus, to provide another example, Thomas Hughes demonstrates how the leadership of Ramo-Wooldridge Corporation persuaded the U.S. Air Force to adopt a systems approach to manufacture ICBMs in the 1950s.[22] Apart from these two chapters, few works have attempted to document the agency that businesses exercised in manufacturing nuclear weapons. Apart from this manuscript, I know of no book-length manuscript that investigates the hand of private business in nuclear weapons production. Most authors, including the prize-winning historians Richard Rhodes, Kai Bird, Martin Sherwin, and Ferenc Szasz, emphasize the role of nuclear physicists and the state in nuclear weapon manufacturing. Yet, the historical record shows that the physicists primarily worked in the theoretical realm and the federal government primarily acted as consumer of nuclear weapons. Private businesses mined and milled the uranium, constructed the nuclear reactors and weapons factories, and manufactured the products.[23] Furthermore, business historians have yet to integrate their histories of production with the histories of waste products. In other words, business historians have stopped short of integrating an environmental analysis in their work and contemplating the ultimate material consequences of production. By bringing waste products into business history, “The Business of Atomic War” offers a more rounded approach to business history.

Although this project provides a business history of nuclear weapons production, I have not been able to examine private corporate archives. Most of the firms that constructed and operated nuclear weapons facilities and mined and milled uranium have not allowed me, nor other historians, to examine their private records. The fact that nuclear corporations have not

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[22] Thomas P. Hughes, *Rescuing Prometheus* (New York: Pantheon Books, 1998).
[23] Rhodes, *The Making of the Atomic Bomb*; Richard Rhodes, *Dark Sun: The Making of the Hydrogen Bomb* (Simon & Schuster, 1996); Bird and Sherwin, *American Prometheus*; Ferenc Morton Szasz, *The Day the Sun Rose Twice: The Story of the Trinity Site Nuclear Explosion, July 16, 1945* (Albuquerque: University of New Mexico Press, 1984).

granted scholars and journalists access to their records has helped conceal the importance of private industry in developing nuclear weapons and shepherding that nation's effort to technologically outmaneuver the Soviet Union. At the same time, this lack of access also confirms that private industry was central to the nation's nuclear weapons program. By placing nuclear weapons work in the hands of private industry the state has ensured that the inner-workings of the nuclear weapons program would be shielded from public inspection via archival inquiries. In order to unearth the centrality of private industry to nuclear weapons production, I relied on a variety of corporate documents that found their way into archives available to the public, including the Hagley Museum and Library, the Oklahoma Historical Society, the Carl Albert Center Congressional Archives, the J. Willard Marriott Library Special Collections, the University of Virginia Libraries, and the National Archives and Records Administration. Additionally, I utilized the Freedom of Information Act, published annual reports, periodicals, and oral histories to glean how private contractors interacted with the state, constructed and operated nuclear facilities, and manufactured nuclear products. This disparate approach, undertaken out of necessity, in a way mimics the decentralized character of the United States's nuclear enterprise.

This project is divided into two parts. Part one, "Building the Atomic West," encompasses chapters one through four. This section begins with the story of manufacturing plutonium during World War II and ends in 1970. It documents the construction of the West's nuclear weapons facilities and the dawn of industrial uranium mining and milling in the region. It also investigates how the nuclear weapons industry economically transformed the region. During this time, westerners embraced the nuclear weapons industry because it granted them new jobs, new standards of living, and new suburban communities. In other words, part one establishes the creation of the Atomic West and how nuclear weapons jobs created a regional atomic workforce.

Chapter one, “Building the First Industrial Plutonium Plant,” examines the creation of Hanford Engineer Works during World War II. This chapter probes the Army’s partnership with E. I. du Pont de Nemours and Company, Hanford’s construction and operating contractor. Although Brigadier General Leslie R. Groves commanded the Manhattan Project and was the figurehead of the nation’s plutonium push, DuPont directed the effort. DuPont transformed theoretical atomic principles into detailed engineering blueprints. Implementing its own schedules, the firm designed, constructed, and operated the plutonium plant. It forced the Army to pay for the construction of a luxurious village near the plant for its engineers and managers. Furthermore, the firm decided which scientists would oversee the finished facility. In addition to documenting DuPont’s power and agency in constructing the first industrial plutonium plant, chapter one documents how DuPont’s decisions transformed the communities near Hanford in the Priest Rapids Valley.

Chapter two, “Big Uranium,” examines the uranium industry from 1947 to 1970. In order to acquire uranium as quickly as possible, the Atomic Energy Commission created incentive programs, including price-guarantees, hauling allowances, and bonuses for the discovery of high-grade deposits. These programs directed both large corporations and average westerners to scour the earth for the yellow ore. At first glance, it might appear that the federal government structured the great uranium hunt to foster competition between suppliers in order to procure the ore as quickly possible. Many westerners believed, in fact, that the uranium industry was egalitarian in nature and that individual westerners could easily compete with large mining firms as long as they happened to discover the deposits before the firms. However, chapter two contends that federal policies and natural processes privileged large corporations over small suppliers. Over time, these policies and processes gave rise to a uranium oligopoly. This chapter offers a corrective to uranium historiography, which positions uranium mining as a story of westerners fighting through lung cancer to procure an ore in the face of an inevitable economic bust. It recognizes that lung cancer, the most common disease associated with uranium mining, in most cases only manifested itself long after miners left the industry. It also challenges the notion that the uranium industry was structured in alignment with traditional marketplaces and was subjected to fluctuations associated with supply and demand. In short, "Big Uranium" contends that the story of the uranium industry was not a tale of westerners fighting through lung cancer to procure an ore in the face on inevitable economic bust. Rather, it is a story about average westerners trying to improve their economic condition but failing to overcome the forces that worked against them.

In chapter three, "Corporate Agency and Nuclear Production," I investigate two nuclear weapon factories: Rocky Flats Plant and Pantex. At Rocky Flats Plant, Dow Chemical Company designed processes to manufacture plutonium triggers at an industrial scale. To accomplish this feat, Dow implemented a distinctive corporate structure and culture at Rocky Flats that provided engineers and physicists with administrative roles and responsibilities. Meanwhile, Dow provided its blue-collar workers with opportunities to become educated experts and future factory leaders. Instead of providing its laborers with training in business administration, accounting, and scheduling, Dow trained them in nuclear physics, chemistry, and engineering. By doing so, Dow ensured that Rocky Flats Plant was run by educated experts and not traditional factory administrators. At Pantex, Procter & Gamble assembled nuclear weapon parts into finished warheads. Here, the state gave Procter & Gamble a free hand to industrialize the process as it saw fit. Consequently, the corporation applied the manufacturing and assembly processes it used for producing soap and other consumer goods to facilitate warhead assembly. Procter & Gamble followed a more traditional organizational method that placed traditional administrators in leadership roles and provided blue-collar workers with few opportunities to learn the science behind the operation. By highlighting how Dow and Procter & Gamble operated Rocky Flats Plant and Pantex, respectively, chapter three pushes against the notion that the military-industrial complex was a monolithic entity and argues that Dow and Procter & Gamble shepherded the industrialization of nuclear weapons procurement by exercising their cultural and organizational agency.

Chapter four, “Making ICBMs, Making Modern Los Angeles,” probes how Ramo-Wooldridge Corporation coordinated ICBM manufacturing from its headquarters in Los Angeles in the 1950s and the early 1960s. As Ramo-Wooldridge flooded its local subcontractors with cash, blue- and white-collar Americans flocked to the city looking to get in on ICBM work. In turn, Los Angeles real estate developers created new suburban tracts to accommodate missile workers and collect missile wages. These suburban spaces featured affordable housing, good schools, and luxurious shopping experiences. To many of the migrants, high missile wages and suburban homeownership combined to fulfill the American Dream. In sum, chapter four asserts that Los Angeles’s suburbanization, booming economy, and luxurious character were products of Ramo-Wooldridge’s ICBM program.

The second part of this manuscript, “Contesting the Atomic West,” encompasses chapters five through seven. This section begins in the early 1970s and concludes with the end of the Cold War in the 1990s. It examines how environmental and human health concerns wore away at the positive western consensus surrounding nuclear weapons work. Beginning in the 1970s, uranium miners and their families, college students, and peace advocates organized against the West's nuclear industries and factories. These anti-nuclear advocates sought compensation for their nuclear-borne illnesses, environmental justice, and an end to American militarism. While the activists demanded justice and demilitarization, the balance of the atomic workforce organized against them in an attempt to safeguard their jobs. These nuclear loyalists brandished their expertise to argue that their nuclear facilities posed few hazards to their surrounding communities. Additionally, they maintained that the nuclear materiel they produced helped safeguard the United States from Soviet aggression.

The fifth chapter, "Seeking Justice in Uranium Country," reveals how decades of exposure to radon gas harmed uranium miners and led them to fight for environmental justice beginning in the early 1970s. While grounded in the Navajo experience in the Southwest, chapter five travels across the American West and outside of the Navajo experience to chronicle how diverse Native American peoples organized to challenge the uranium industry and fight for compensation for their uranium-borne illnesses. The former miners found powerful non-Native allies, including the press, members of Congress, and Stewart L. Udall, the former secretary of the interior. By recognizing that the fight for justice in uranium country was not confined to one sub-region, one reservation, one people, or one identity group, chapter five illuminates that the fight for justice in uranium country was shepherded by diverse westerners.

Chapter six, "The Struggle Over the West's Nuclear Weapons Factories," examines how westerners organized to attack and defend the nation's nuclear weapons factories in the 1970s and the 1980s. Environmentalists, peace advocates, and whistleblowers argued that Rocky Flats Plant, Pantex, and Hanford were immoral factories of death that provoked nuclear war and saddled their respective communities with radioactive pollution and cancers. While these westerners called on workers to resign and organized demonstrations, weapons workers created counter-protest movements to safeguard their livelihoods. These nuclear loyalists maintained that the plants provided safer working conditions compared to most other industries and believed that the media was overplaying the hazards associated with manufacturing nuclear weapons. The workers also defended their plants because of the economic benefits they provided to their local communities and because they believed that producing nuclear warheads helped secure the future of the United States vis-à-vis the Soviet Union. By bringing these histories of activism together, this chapter argues that the anti-nuclear protesters were not just waging a political war against the nuclear firms and the federal government. Rather, they were also participating in a struggle on the grassroots level, fighting against local, blue- and white-collar people.

Chapter seven, “Demilitarization and the Uncertain Future,” examines all of the aforementioned facilities and industries, with the exception of the uranium industry, in the late 1980s and the early 1990s. It gives credit to the 1987 Intermediate-Range Nuclear Forces Treaty and the collapse of the Soviet Union for ending production at Rocky Flats Plant and Hanford, concluding warhead assembly at Pantex, and collapsing Los Angeles’ aerospace economy. Thousands of Rocky Flats Plant and Hanford workers survived this nuclear collapse by finding jobs ridding their respective factories and landscapes of radioactive pollutants. Pantex and aerospace workers were not as fortune. Pantex and the aerospace factories had not produced radioactive waste. Thus, when Pantex and the aerospace plants contracted, their workers struggling finding local employment. Put another way, this chapter makes the unsettling observation that nuclear waste was a source of wealth. Along with probing how demilitarization transformed Rocky Flats Plant, Hanford, Pantex, and the aerospace industry, this chapter chronicles how workers faced the uncertain future as their institutions fell apart.

The conclusion examines what happened to the uranium industry, the uranium landscape, and those uranium families that fought for environmental justice after the end of the Cold War. It also makes clear that although many of the factories examined herein closed in the 1990s, their stories continue today. Radioactive contaminants continue to plague many of the communities and environments examined in “The Business of Atomic War.” Westerners remain divided over whether the business of atomic war, and the military-industrial complex more generally, is a benefit or a burden.

Business shaped the nuclear arms race. Corporations shepherded American nuclear development by enriching plutonium, mining uranium, assembling weapons, and building weapon delivery systems. Corporations decided production schedules and pioneered the industrialization of nuclear weapons manufacturing. Moreover, the military-industrial complex was a participatory structure comprised of millions of Americans. This system economically enriched a large sector of American society. Meanwhile, other Americans suffered the burdens of the system, having to navigate environmental and physiological ruin. By examining the military-industrial complex on the ground, this project exposes an enduring rift in American society. It explains why some Americans continue to fight against the military-industrial complex and why others continue to support it.

Part One

Building the Atomic West

Chapter One

Building the First Industrial Plutonium Plant: DuPont, the Manhattan Project, and the Priest Rapids Valley, 1942-1946

Nestled in the Priest Rapids Valley in southeastern Washington State, Hanford Engineer Works was the first facility in world history to enrich uranium into plutonium-239 on an industrial scale. The United States found an appetite for plutonium-239 in the context of World War II. In 1942, the U.S. Army tasked the Army Corps of Engineers, Manhattan Engineering District (MED) with procuring plutonium-239, the critical element needed to construct the world's first atomic bombs. In order to produce plutonium-239 as quickly as possible, and deploy it against the Axis Powers, the MED granted a contract to the chemical engineering and production firm E. I. du Pont de Nemours and Company (DuPont) to construct and operate the Hanford plutonium plant. Thanks to DuPont's leadership, Hanford workers manufactured the plutonium used to create two of the three first atomic weapons. The first atomic bomb, *The Gadget*, used Hanford plutonium to detonate at the Trinity Test Site in New Mexico on July 16, 1945. The third atomic bomb, *Fat Man,* used Hanford plutonium to devastate Nagasaki on August 9 and help bring World War II to a close.

This chapter examines the construction of Hanford during World War II. In doing so, it asks several related questions: Why did the MED select DuPont to build and operate Hanford? Why was the world's first plutonium plant built in the Priest Rapids Valley? Who made the key decisions at Hanford? How did these decisions transform the region? By addressing these questions, this chapter explores the complexities of the not-yet-named military-industrial complex. Although Brigadier General Leslie R. Groves commanded the MED and was the figurehead of the nation's plutonium push, DuPont directed the effort. DuPont transformed theoretical atomic principles into detailed engineering blueprints. Implementing its own schedules, the firm designed, constructed, and operated the plutonium plant. It forced the MED to pay for the construction of a luxurious village near the plants for its engineers and managers. Furthermore, the firm decided which scientists would oversee the finished facility. As DuPont constructed Hanford and produced plutonium, it fundamentally reshaped life in the Priest Rapids Valley. Indeed, DuPont was the central actor in the nation's effort to manufacture plutonium during the Second World War. DuPont was the Manhattan Project's engineer of victory.[24]

This chapter documents how DuPont came to direct wartime plutonium production, why the world's first plutonium plant ended up in the Priest Rapids Valley, how DuPont exercised its control, and what this meant on the ground. In other words, it follows the cues of new western historiography by examining how DuPont's Manhattan Project transformed place. This stands in contrast to a historiography that emphasizes the role of the Army and the nation's atomic physicists at the expense of DuPont.[25]

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[24] I borrow the phrase "engineer of victory" from Paul Kennedy. Kennedy applied the term to the ordinary soldiers, scientists, engineers, and businessmen who helped create the cavity magnetron, the Hedgehog grenade launcher, and the B-29 Superfortress bomber during World War II. See, Paul Kennedy, *Engineers of Victory: The Problem Solvers Who Turned the Tide in the Second World War* (New York: Random House, 2013).

[25] The two official histories of the Manhattan Project note that DuPont was in charge of producing plutonium at Hanford. Yet, these works were commissioned but the Army and the Atomic Energy Commission, respectively, and for the most part concentrate on the role of the military and the state bureaucrats. The most celebrated account of the Manhattan Project, Richard Rhodes's *The Making of the Atomic Bomb*, focuses on the Los Alamos physicists who proved atomic principles and helped facilitate the United States's acquisition of the first atomic bombs by designing and cobbling-together the first three atomic weapons at Los Alamos. Rhodes structures his study to show how scientific discoveries were thrust into the arms of the state. This monopolization of knowledge, Rhodes argues, culminated in the Cold War nuclear arms race. While Rhodes's narrative should be commended for its extensive details, the structure of his text implies that the main actors of the Manhattan Project were physicists and state officials. In other words, Rhodes leaves little room for DuPont, the firm that produced the plutonium to make the atomic bombs. DuPont historians have done a better job documenting the firm's role at Hanford. In their 1988 book *Science and Corporate Strategy*, David Hounshell and John K. Smith devote a few pages to DuPont's hand at Hanford. However, Hounshell and Smith primarily examine the relation of science and technology to the market and DuPont's commercial strategy, arguing that DuPont pioneered a

Hanford's story begins overseas. In December 1938, chemists at Berlin's Kaiser Wilhelm Institute achieved atomic fission when they split the uranium atom in two by bombarding it with neutrons. In March 1939, Hitler seized the Joachimsthal mines in Bohemia, Europe's only known source of uranium. Then, on September 1, Germany invaded Poland and sparked the Second World War. By the end of the month, the German War Office took over the Kaiser Wilhelm Institute and tasked its chemists to investigate whether atomic fission could be used to produce a weapon. The Japanese Imperial Army Air Force followed suit, authorizing an atomic bomb research project in April 1941. Josef Stalin launched his own atomic program a year later.[26]

European refugee scientists alerted the American government to the menace and possibilities of nuclear weaponry. On March 17, 1939, the Italian émigré physicist Enrico Fermi went to the Navy Department to brief officers from the Naval Research Laboratory and the

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new type of vertical integration that merged research, development, and scale production. By crafting a broader history of DuPont, Hounshell and Smith do not plumb DuPont's role at Hanford in much detail. The French historian Pap A. Ndiaye also explores DuPont's role at Hanford in *Nylon and Bombs*. Ndiaye argues DuPont engineers imposed their firm's organizational structure and culture on the Hanford project. Although Ndiaye's chapter comes closest to uncovering DuPont's role at Hanford, it stops short of showcasing how DuPont made most of the key decisions at the site, including the construction and plutonium production schedules. Furthermore, Ndiaye does not probe how DuPont's leadership transformed life in the Priest Rapids Valley. See Vincent C. Jones, *Manhattan: The Army and the Atomic Bomb* (Washington, D.C.: Center of Military History, U.S. Army, 1985); Richard G. Hewlett and Oscar E. Anderson, Jr., *The New World, 1939/1946, Volume I of a History of the United States Atomic Energy Commission* (University Park: The Pennsylvania State University Press, 1962); Richard Rhodes, *The Making of the Atomic Bomb* (New York: Simon & Schuster, 1986); David A. Hounshell and John Kenly Smith Jr., *Science and Corporate Strategy: Du Pont R&D, 1902-1980* (New York: Cambridge University Press, 1988), 338-46, 1; Pap A. Ndiaye, *Nylon and Bombs: DuPont and the March of Modern America* (Baltimore: John Hopkins University Press, 2007), 172, 162, 154-5.

[26] Ferenc Morton Szasz, *The Day the Sun Rose Twice: The Story of the Trinity Site Nuclear Explosion, July 16, 1945* (Albuquerque: University of New Mexico Press, 1984), 9; Gray Brechin, *Imperial San Francisco: Urban Power, Earthly Ruin* (Berkeley: University of California Press, 1999), 313; Rhodes, *The Making of the Atomic Bomb*, 310-1; Mark Fiege, *The Republic of Nature: An Environmental History of the United States* (Seattle: University of Washington Press, 2012), 290; David M. Kennedy, *Freedom from Fear: The American People in Depression and War, 1929-1945* (New York: Oxford University Press, 1999), 659.

Army's Bureau of Ordnance on the recent discoveries in the field of atomic physics. Fermi suggested that the military pursue an atomic weapon in order to challenge the growing German hegemony in atomic research. The officers doubted the feasibility of the project and sent Fermi on his way. In March 1941, Glenn T. Seaborg's research team at the University of California created the first submicroscopic amounts of plutonium-239, a highly fissionable element, by transmuting uranium-238. The group later confirmed the theory that plutonium-239 atoms fissioned under neutron bombardment. This meant that the United States could potentially produce atomic weapons using either uranium or plutonium-239. Meanwhile, the Hungarian émigré physicist Leo Szilard wrote to U.S. President Franklin D. Roosevelt to warn him that Germany might develop an atomic bomb using uranium-235, an isotope of the element. To add weight to his letter, Szilard convinced Albert Einstein, perhaps the best-known scientist in America, to sign it. Alexander Sachs, an economist with access to the White House, agreed to deliver the message to the president.[27]

On October 11, Sachs finally met with Roosevelt. After reviewing the Szilard-Einstein letter, the president quickly grasped the point. "Alex," he said, "what you are after is to see that the Nazis don't blow us up." Roosevelt immediately acted, organizing the Advisory Committee on Uranium to develop atomic weapons, utilizing both uranium-235 and plutonium-239, for the United States. Over time, the Advisory Committee gave way to the National Defense Research Committee and the Office of Scientific Research and Development. In December, the Office of Scientific Research and Development sponsored the University of Chicago's Metallurgical Laboratory (Met Lab) to research plutonium-239 in order to develop the knowledge needed to design, construct, and operate a plant to convert uranium into plutonium-239. In June 1942, the

[27] Kennedy, *Freedom from Fear*, 659-60; Hewlett and Anderson, *The New World*, 75; Leslie R. Groves, *Now It Can Be Told: The Story of the Manhattan Project* (New York: Da Capo Press, 1983), 8-9.

Army took control of the project and assigned it to the MED. In September, the Army placed the entire operation, the Manhattan Project, under the command of Groves.[28]

Recognizing that the Army needed private help to procure plutonium, Groves immediately searched for a contractor to build and operate the nation's first plutonium plant. Groves had to decide whether to separate the engineering, construction, and operation responsibilities between several firms or contract one company for all the tasks. Groves reasoned that one firm was preferable for logistical purposes. After studying dozens of leading chemical companies, Groves concluded that "only one firm was capable of handling all three phases of the job." That firm was DuPont. The company was skilled in technical management and large operations. It had a diverse chemistry and chemical engineering profile. DuPont also had an established relationship with the Army. It had engineered, constructed, and operated gunpowder facilities for the military since 1802. Groves took his case for DuPont to the Military Policy Committee and Arthur Compton, the head of Met Lab. All agreed DuPont was the best fit for the plutonium project.[29]

After selecting DuPont, Groves had to convince the firm to take the job. On October 30, 1942, Groves called Willis Harrington, a senior vice president of DuPont, and asked to meet with him to discuss "a highly secret matter of the utmost importance." The next day, Groves met with Harrington and another DuPont vice president, Charles M.A. Stine, in his office in Washington,

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[28] Hewlett and Anderson, *The New World*, 75; Groves, *Now It Can Be Told*, 8-9; Harry Thayer, *Management of the Hanford Engineer Works in World War II: How the Corps, DuPont, and the Metallurgical Laboratory Fast Tracked the Original Plutonium Works* (New York: ASCE Press, 1996), 21.

[29] Groves, *Now It Can Be Told*, 42-3; E.B. Yancey to W.S. Carpenter, memorandum, 11 August 1942, folder 5, box 830, Papers of Walter S. Carpenter, Jr., Records of E.I. du Pont de Nemours & Co., Acc. 542, Hagley Museum and Library, Wilmington, Delaware; H.C. Engelbrecht and F.C. Hanighen, *Merchants of Death: A Study of the International Armament Industry* (New York: Dodd, Mead & Company, 1934), 23.

D.C. There, Groves pitched the plutonium project to the vice presidents. Harrington and Stine said that the project "seemed beyond human capability." Groves insisted that the stakes were too high and that the project had to go ahead no matter what. After the meeting, the DuPont men brought the issue to the president of the company, Walter S. Carpenter, Jr., and the DuPont Executive Committee.[30]

The company hesitated and for good reason. After World War I, the writers H.C. Engelbrecht and F.C. Hanighen branded DuPont a "merchant of death" for profiteering from wartime munitions manufacturing. In 1936, the Nye Committee documented DuPont's wartime profits and led to the popular conclusion that the country's entry into the war was spurred by commercial interests. Pierre du Pont disagreed with this notion, arguing that wars were fundamentally bad for business and were not dependable sources of profit. Carpenter and the Executive Committee feared that undertaking the plutonium project would provide more evidence for the "merchant of death" thesis and lead to the death-knell of the firm. While Carpenter and the Executive Committee discussed the project behind closed doors, the MED allowed eight DuPont officials to visit Met Lab and learn some of the theoretical principles behind plutonium production. Despite this visit, Carpenter told Groves that the company was still apprehensive about the job. Carpenter made a cogent argument about why DuPont was not a good fit for the project. He explained that the firm was inexperienced in atomic physics, doubted the feasibility of the operation, and worried that plutonium's radioactive properties would pose health hazards to the firm's workforce. Moreover, DuPont's existing military contracts left it with few engineering and operating personnel for the new project. During World War II, the firm

30 Groves, *Now It Can Be Told*, 46-51; Leslie Groves, "Record of Preliminary Negotiations," n.d., folder 12, box 57, DuPont Atomic Energy Division Records, Acc. 1957, Hagley Museum and Library, Wilmington, Delaware.

had 182,000 employees working on 18 projects in 14 states and was spending $1 million per day in labor and materials in its smokeless powder facilities.[31]

Groves persisted. On November 10, Groves traveled to DuPont's corporate headquarters in Wilmington, Delaware, to meet with Carpenter. Groves spoke of a dire international situation. He mentioned that Nazi Germany "could very easily soon" build an atomic weapon. Brandishing a nascent nuclear deterrence argument, Groves said that there was no known defense against atomic weapons "except the fear of their counteremployment." He also said that using an atomic weapon would shorten the war and spare thousands of American lives. After speaking with Carpenter, Groves met with the Executive Committee and repeated his points. All were still apprehensive. They said that it took the firm 25 years to get nylon into mass production and that nylon was simple to manufacture compared to plutonium. They also pointed out that they had a moral obligation to their employees. The committee worried that the plant would feature "extraordinary and unpredictable health hazards" because of plutonium's radioactivity. Groves understood these concerns. He knew that producing plutonium would create radioactive particles that might endanger personnel. In his memoirs, the general noted that during the planning process he often thought about the World War I women who painted watch dials using radioactive materials and subsequently fell ill and died. At the end of the meeting the Executive Committee told Groves that DuPont could not refuse the project if the government asked the

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[31] Engelbrecht and Hanighen, *Merchants of Death*; U.S. Congress, Senate, *Report of the Special Committee on Investigation of the Munition Industry (Nye Report)*, 74th Cong, 2nd sess., 1936, 3-13; Groves, *Now It Can Be Told*, 46-51; Stuart D. Brandes, *Warhogs: A History of War Profits in America* (Lexington: University Press of Kentucky, 1997), 222; C.H. Greenewalt to W.F. Raskob, 23 March 1943, and enclosed document titled "Chicago Project," folder 3, box 1, DuPont Atomic Energy Division Records, Acc. 1957, Hagley Museum and Library, Wilmington, Delaware (hereafter Greenewalt to Raskob and Enclosure); Thayer, *Management of the Hanford Engineer Works in World War II*, 34.

company to take it. Two days later, Carpenter told Groves that DuPont would take the job as long the firm's board of directors approved.[32]

The next DuPont board meeting would determine the fate of the Manhattan Project. The directors filed into the boardroom and took their seats. Carpenter placed a stack of papers face-down on the table in front of them. The papers contained sensitive information on plutonium production and the scope of the project. Carefully choosing his words, Carpenter explained that the Executive Committee recommended that the company accept a government contract for a novel project that would strain the capacity of the firm. He also said that the project was hazardous and could very well harm DuPont employees and financially destroy the company. He emphasized that the project was necessary for the security of the nation. He told the board that they could read the face-down papers if they wished but maintained that the project was secretive and that it would be for the best if they knew little about its details. No board member flipped the papers over, despite the fact they were all heavy stockholders. All approved the project.[33]

Although DuPont had committed to project, it was still uncertain if plutonium-239 could actually be manufactured on an industrial scale. On November 18, Stine met with Groves and Compton. He told the duo that DuPont was going forward with the project but wanted to make sure the two realized the scale of the task. DuPont needed to design and build a plant to fulfill processes that were completely new. The company would also have to design, manufacture, and install novel equipment. Finally, the firm would have to instruct technicians and laborers using principles that were not fully understood. Stine doubted that entire project could be completed during the war. Compton was appalled. Stine pressed further, stating that the MED and Met Lab

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[32] Greenewalt to Raskob and Enclosure; Groves, *Now It Can Be Told*, 46-51, 57-9.
[33] Groves, *Now It Can Be Told*, 51.

had not yet proven that they could create a radioactivity amplifier, a device which could generate a sustained chained reaction of radioactive materials. Such a device was needed, Stine reasoned, in order to use its controlled fission to transmute uranium into plutonium-239.[34]

Following the meeting, Compton and Met Lab built a small test pile, or reactor, to determine if it could produce a sustained chain reaction. The group stationed the pile under the west stands of Stagg Field at the University of Chicago. On November 26, 1942, DuPont sent Crawford H. Greenewalt to Chicago in preparation for the pile's first test. Greenewalt was no ordinary DuPont chemical engineer. After marrying Margaretta du Pont in 1926, Greenewalt won 18 patents for DuPont and pioneered the development of the company's nylon program. Taken together, Greenewalt's relationship with the du Pont family and the success of his nylon program provided him with extraordinary influence in the company. On December 2, Greenewalt watched the Chicago pile go online for the first time. The experiment proved that the reactor system could achieve a controlled chain reaction. According to Compton, Greenewalt's "eyes were aglow" after witnessing the test. The experiment reassured Greenewalt that the plutonium project was feasible. "The overall result was much better than expected," Greenewalt wrote. "It was for me a thrilling experience." Greenewalt gave a glowing report on the event to the DuPont brass. From that point on, DuPont shared no misgivings about the project with the MED. DuPont was in the fold.[35]

[34] Arthur Holly Compton, *Atomic Quest: A Personal Narrative* (New York: Oxford University Press, 1956), 132-3; Sean F. Johnston, *The Neutron's Children: Nuclear Engineers and the Shaping of Identity* (New York: Oxford University Press, 2012), 3.

[35] Groves, *Now It Can Be Told*, 52-5; "Corporations: The Wizards of Wilmington," *Time*, 16 April 1951; Compton, *Atomic Quest*, 144; Crawford Greenewalt, Crawford Greenewalt Manhattan Project Diary Transcripts, Volume 1, 2 December 1942, 111-4, Acc. 1889, Hagley Museum and Library, Wilmington, Delaware.

Over the next few weeks, DuPont and Groves gave Greenewalt unheard of power and authority within the Manhattan Project. On December 17, DuPont made Greenewalt the technical director of the plutonium project. In this role, Greenewalt would oversee the construction and operation of the plutonium plant and serve as a liaison between the company and Met Lab.[36] After learning about Greenewalt's appointment, Groves immediately contacted the engineer. The general wanted Greenewalt to leave Wilmington and spend most of his time in Chicago to "watch" the laboratory and "see to it that the research went in a way that would provide the right technical information at the right time." Greenewalt left days later for Chicago. When he arrived, Greenewalt had unlimited access to the nation's leading atomic physicists, information on plutonium, and experimental technologies. Groves subjected nearly everyone involved in the Manhattan Project to security restrictions that compartmentalized access to individuals, information, and technologies. However, Groves lifted "compartmentation" restrictions for Greenewalt to ensure that the director had a "clear channel" to anyone he wanted to see. This allowed Greenewalt to collect information from the atomic scientists and use it to construct and operate the plutonium plant.[37]

[36] Crawford Greenewalt, Crawford Greenewalt Manhattan Project Diary Transcripts, Volume 2, 17 December 1942, 2, Acc. 1889, Hagley Museum and Library, Wilmington, Delaware.
[37] Greenewalt, Crawford Greenewalt Manhattan Project Diary Transcripts, Volume 2, 18 December 1942, 3, Acc. 1889, Hagley Museum and Library, Wilmington, Delaware.

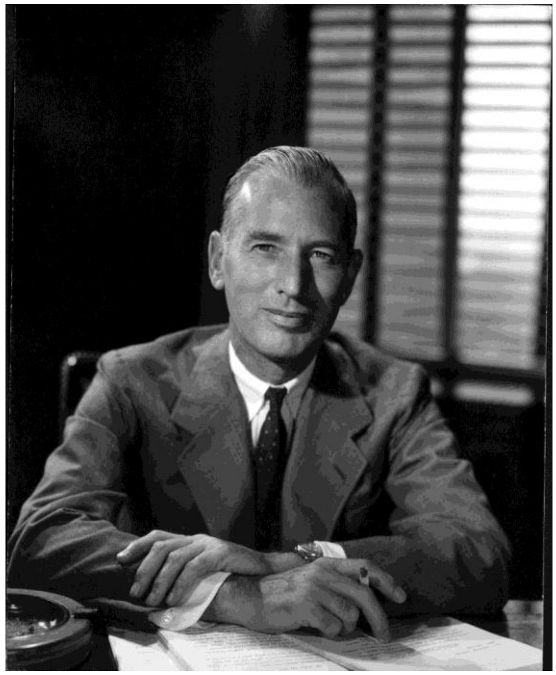

Figure 1: Crawford Greenewalt. n.d. Photo by Wallace Seawell. Box 14, DuPont Company Public Affairs Department Photographs, Acc. 1984.225, Audiovisual Collections and Digital Initiatives Department, Hagley Museum and Library, Wilmington, Delaware.

Instead of merely observing Met Lab and collecting information, Greenewalt assumed a leadership role at the facility. When Greenewalt first returned to Met Lab, Compton seemed relieved that the engineer was merely a liaison and not an authority figure. This meant that Greenewalt "couldn't successfully 'boss' the physicists; this can only be done by Compton, for whom they all have the greatest respect." But Greenewalt quickly sought to change this calculus. He realized that he had "no authority over the Chicago crowd—but am to see to it by diplomacy and pleading that they do the right things at the right time and don't chase too many butterflies." Following a tactic he called "infiltration," Greenewalt met with Compton and Met Lab's senior scientists a few days after arriving in Chicago.[38] He told them that he was there to help them transform their abstract ideas into concrete technologies and would do anything in his power to

[38] Greenewalt, Crawford Greenewalt Manhattan Project Diary Transcripts, Volume 2, 18 December 1942 through 28 December 1942, 3-7, Acc. 1889, Hagley Museum and Library, Wilmington, Delaware; Johnston, *The Neutron's Children*, 54-5.

ensure their success. "We must play to win was his theme," Compton wrote. Greenewalt told the scientists that he was willing to spend "an extra fifty million" of the government's money to increase the project's speed and the technologies' reliability if necessary. By styling himself as a force of technical and economic aid, Greenewalt persuaded the balance of the laboratory to embrace his influence. Next, he went to work. Over the next three years, Greenewalt and his engineers prepared detailed engineering designs using Met Lab's research data. In Compton's words, Greenewalt helped Met Lab push its research "toward a definite production goal."[39]

While Greenewalt ascended to prominence within the Manhattan Project, the Army sent DuPont a cost-plus fixed fee letter contract regarding the plutonium plant on December 6, 1942. The document, Contract W-7412 Eng-1, stipulated that DuPont "in the shortest possible time, furnish the labor, material, tools, machinery, equipment, facilities, supplies…and services, and do all things necessary for securing the completion of required research, development of designs, procurement of equipment, and for the construction of a plant for manufacturing" plutonium-239. The contract clarified that the government would indemnify and hold DuPont harmless against any loss, expense, or damage of any kind "and from any cause whatsoever arising out of or connected with the work." Secrecy required that neither party involve an insurance firm. DuPont signed the contract on December 21, 1942.[40]

The Army and DuPont would later sign another iteration of Contract W-7412 Eng-1, which backdated the agreement to December 1 and tasked the company to "ensure that the plant will have "an estimated output when in normal operation at rated capacity, of about one pound of

[39] Greenewalt, Crawford Greenewalt Manhattan Project Diary Transcripts, Volume 2, 18 December 1942, 3, Acc. 1889, Hagley Museum and Library, Wilmington, Delaware; Compton, *Atomic Quest*, 164.
[40] Letter Contract W-7412 Eng-1 Between the United States of American and E.I. du Pont de Nemours & Company, 6 December 1942, box 44, entry# (A1)5, General Administrative Files: General Correspondence 1942-1948, Office of the Chief of Engineers, RG 77, National Archives and Record Administration, College Park, Maryland.

Plutonium per day.” In addition to the plutonium project, DuPont also became responsible for designing and constructing a uranium-235 production plant at Oak Ridge, Tennessee. Met Lab would operate this facility. Fearing that the projects would lead journalists and politicians to once again brand DuPont as a merchant of death, Carpenter insisted that the contract stipulate that DuPont would not have any patent rights for the products and would not profit from the work. Carpenter’s argument aligned with FDR’s anti-war profiteering rhetoric. In the wake of the Second World War, Roosevelt stated: “I don’t want to see a single war millionaire created in the United States as a result of this world disaster.” In the end, the federal government paid DuPont one dollar for its work.[41]

While DuPont leadership and MED officials tended to the contract’s details, Compton traveled to Wilmington and met with DuPont engineers to begin the search for a location fit for the world’s first plutonium plant. Groves also sent a representative to the meeting, Colonel Franklin T. Matthias. Although Matthias was not formally assigned to the MED, Groves trusted him. He called on Matthias for a variety of special projects in the past, including overseeing the construction of the Pentagon earlier in 1942.[42] The group started by outlining the environmental requirements for the plant. They determined that the facility required a large amount of land to facilitate the construction of plutonium production piles, chemical separation plants, a laboratory, and an employee “village.” For security purposes, the plant also needed to be situated in an

[41] “Memorandum Covering Technical Basis for Work Under Contract Numbered W-7412 Eng-1 Between the United States of American and E.I. du Pont de Nemours & Company,” retroactively dated 1 December 1942, Accession No. 20035, U.S. Department of Energy, Pacific Northwest National Laboratory Public Reading Room, Richland Operations Office, Richland, Washington; Hounshell and Smith, *Science and Corporate Strategy*, 339; Groves, *Now It Can Be Told*, 57-9. FDR quoted in Brandes, *Warhogs*, 227.

[42] Franklin Matthias, interview by Stephane Groueff, 1965, Voices of the Manhattan Project, https://www.manhattanprojectvoices.org/oral-histories/colonel-franklin-matthiass-interview-part-1-1965; Groves, *Now It Can Be Told*, 72-3. Groves oversaw the construction of the Pentagon from 1941 until its completion in January 1943.

isolated landscape. Finally, plutonium production also required ample water for cooling atomic products, abundant electricity for running the machines, and access to roads and railways for easy transportation.[43]

After identifying the environmental requirements for the plant, the group set its sights on the West. The region was a logical choice for the facility. It had a long history of federal development and corporate development. The state first militarized the West in the early nineteenth century, erecting forts to combat Native Americans and facilitate settler colonialism.[44] During the Gilded Age, the state underwrote institutions and businesses that pillaged the West of its natural resources and funneled the region's wealth to the East. In the early twentieth century, the state eyed the West for technological experiments, including new dams and conservation techniques.[45] New Deal programs fundamentally transformed the region, providing electric power, transportation infrastructure, and economic interventions.[46] When World War II broke

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[43] Groves, *Now It Can Be Told*, 70-3; Franklin T. Matthias, oral history, in *Working on the Bomb: An Oral History of WWII Hanford*, by S.L. Sanger (Portland, OR: Continuing Education Press, 1995), 20 (hereafter Matthias Oral History).

[44] There is a rich literature on western conquest and settler colonialism. Readers interested in these topics would do well to start with Walter L. Hixson, *American Settler Colonialism: A History* (New York: Palgrave Macmillan, 2013); Benjamin Madley, *An American Genocide: The United States and the California Indian Catastrophe* (New Haven: Yale University Press, 2016); Jeffrey Ostler, *The Plains Sioux and U.S. Colonialism from Lewis and Clark to Wounded Knee* (New York: Cambridge University Press, 2004); Bethel Saler, *The Settlers' Empire: Colonialism and State Formation in America's Old Northwest* (Philadelphia: University of Pennsylvania Press, 2014). For more on the early history of the militarization of the West see, Gerald D. Nash, "The West and the Military-Industrial Complex," *Montana The Magazine of Western History* 40, no. 1 (Winter 1990): 72-5.

[45] William G. Robbins, *Colony and Empire: The Capitalist Transformation of the American West* (Lawrence: University Press of Kansas, 1994); Donald J. Pisani, *To Reclaim a Divided West: Water, Law, and Public Policy, 1848-1902* (Albuquerque: University of New Mexico Press, 1981); Donald J. Pisani, *Water and American Government: The Reclamation Bureau, National Water Policy, and the West, 1902-1935* (Berkeley: University of California Press, 2002); Donald Worster, *Rivers of Empire: Water, Aridity, and the Growth of the American West* (New York: Oxford University Press, 1985).

[46] Richard Lowitt, *The New Deal and the West* (Norman: University of Oklahoma Press, 1993); David P. Billington and Donald C. Jackson, *Big Dams of the New Deal Era: A Confluence of Engineering and Politics* (Norman: University of Oklahoma Press, 2006); Donald Worster, *Dust Bowl: The Southern Plains in the 1930s* (New York: Oxford University Press, 2004); Marsha Weisiger, *Dreaming of Sheep in*

out, the state constructed Japanese American prison camps in the West and partnered with private firms to erect new military arsenals.[47] Wartime planners valued the West's abundance of federal land and generally regarded the region as relatively empty and undeveloped.[48] Several steppes across the West met the plutonium plant's space and isolation requirements. However, the facility's water, electricity, and transportation access requirements disqualified many remote areas of the region.[49]

While discussing the West, Compton raised the issue of constructing a pilot plant. The MED, Met Lab, and DuPont agreed that a pilot plant was needed to test reactor technologies before they were implemented at scale. Compton told the group that his Met Lab staff favored constructing the plant in Argonne Forest, just outside of Chicago. Greenewalt and the other DuPont representatives protested this suggestion. They argued that locating the pilot plant at Argonne would potentially threaten Chicagoans with radioactive hazards. Furthermore, DuPont objected to the Met Lab staff "assuming it could dictate plans and policies on matters that the company held to be its own prerogatives." The firm had a long-established policy that research staff should not be permitted to exert control over project design and construction. Simply put, DuPont believed that the research laboratory was the servant of management, not its master. In the end, DuPont won the exchange and constructed the pilot plant alongside its uranium-235

Navajo Country (Seattle: University of Washington Press, 2011); Bruce Hevly and John M. Findlay, "The Atomic West: Region and Nation, 1942-1992," in *The Atomic West*, ed. Bruce Hevly and John M. Findlay (Seattle: University of Washington Press, 1998), 10.

[47] Gerald D. Nash, *The American West Transformed: The Impact of the Second World War* (Lincoln: University of Nebraska Press, 1985); Richard White, *"It's Your Misfortune and None of my Own": A New History of the American West* (Norman: University of Oklahoma Press, 1993).

[48] Hevly and Findlay, "The Atomic West: Region and Nation, 1942-1992," 4. For more general information on the West's long history of development and exploitation, see Patricia Nelson Limerick, *The Legacy of Conquest: The Unbroken Past of the American West* (New York: W.W. Norton & Company, 1987).

[49] Groves, *Now It Can Be Told*, 70-3; Matthias Oral History, 20.

reactor at Oak Ridge. The pilot plant debate, and its outcome, was a keystone moment in the Manhattan Project. It demonstrated that DuPont, and not the Met Lab physicists, ultimately held the power.[50]

At the conclusion of the conference, Matthias reported back to Groves. The general concurred that “the only areas that are really possible are out west.” Groves calculated that the Pacific Northwest was probably the only area in the nation to meet all the requirements.[51] The Northwest contained a comparatively large amount of isolated, undeveloped land. More importantly, the area had access to large amounts of water and electricity. With the completion of the Bonneville Dam in 1937 and Grand Coulee Dam in 1942, the nation had captured the hydroelectric potential of the Columbia River, the region’s largest river. The Pacific Northwest seemed to offer the key elements. Furthermore, Groves “very much preferred” the region because “the open winters and the long, dry, not excessively hot summers” would permit year-round construction.[52]

Groves wanted to ensure that his appraisal was sound and sent Matthias to survey the Pacific Northwest in person. Groves requested that two DuPont men, A.E.S. Hall and Gilbert P. Church, accompany Matthias on his journey. As Groves explained in his memoirs, “it was Matthias’ responsibility to see that my wishes were carried out, just as it was the responsibility of Hall and Church to make certain that nothing was overlooked from du Pont’s standpoint.”[53] On December 22, the search team’s airplane flew over the Rattlesnake Hills in southeastern Washington. Matthias scanned the landscape from the fuselage. South of the sixteen-mile ridge,

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[50] Jones, *Manhattan*, 111-2.
[51] Matthias, interview by Stephane Groueff.
[52] Groves, *Now It Can Be Told*, 73; Matthias Oral History, 20.
[53] Groves, *Now It Can Be Told*, 73-4.

nearly sixty miles away, sat the Priest Rapids Valley and the Columbia River. Sagebrush, orchards, and five small communities dotted the land. Matthias leaned over and wrote down a few notes. Only a few thousand people called the isolated location home. According to Matthias, the site was "perfect." Church and Hall agreed.[54] After touring the Priest Rapids Valley, Matthias called Groves from Portland, Oregon. He told Groves that he "had found the only place in the country that could match the requirements for a desirable site." The region had good roads, railroad access, a reliable water supply, and ample electric power. Furthermore, it had "almost no people" and was "very underdeveloped." To Matthias "it had all the advantages."[55]

In January 1943 the MED and DuPont reviewed the search team's report on the Priest Rapids Valley. On January 1, Matthias met with Groves in Washington, D.C. to discuss the location. The general was pleased with Matthias's appraisal and officially appointed him Officer in Charge of the MED's plutonium project. From that point forward, it was Matthias's responsibility to oversee the construction of the plutonium plant on the Army's behalf. Additionally, Groves gave Matthias complete authority for approval of DuPont's field procurement of materials, equipment, and subcontracts.[56] After the meeting, Groves had MED officials brief Greenewalt on the Priest Rapids Valley. "Looks good," Greenewalt said.[57] In Greenewalt's estimation, the location had enough room for eight piles spaced three miles apart along the river. It also provided space for three separation units spaced four miles apart, and

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[54] Matthias Oral History, 19; Franklin T. Matthias, "Diary and Notes of Col. Franklin Matthias, 1942-1945," 22 December 1942, https://reading-room.labworks.org/edocs/matthias_diary.pdf; Hill Williams, *Made in Hanford: The Bomb that Changed the World* (Pullman: Washington State University Press, 2011), 8.
[55] Groves, *Now It Can Be Told*, 73, 70-1; Matthias Oral History, 20.
[56] Groves, *Now It Can Be Told*, 73; Matthias, interview by Stephane Groueff; Thayer, *Management of the Hanford Engineer Works in World War II*, 27.
[57] Greenewalt, Crawford Greenewalt Manhattan Project Diary Transcripts, Volume 2, 9 January 1943, 31, Acc. 1889, Hagley Museum and Library, Wilmington, Delaware.

"plenty of room left" for waste basins.[58] Concerned about how radioactive products would interact with the environment, Greenewalt met with Compton and Ted Yancey, the head of DuPont's explosives department, to discuss the site. After reviewing the Priest Rapids Valley's landscape, the men concluded that the area was "ok."[59] Before finalizing the location, Groves toured the region, himself. He confirmed what Matthias saw: an environment perfect for plutonium production. The matter had been settled. DuPont would build the plutonium plant in southeastern Washington.[60]

The MED began acquiring land for the plant weeks later. Other federal agencies owned one-third of the land that the MED desired. The remaining land belonged to private individuals and included three towns: Hanford, White Bluffs, and Richland. On February 8, 1943, Secretary of War Henry Stimson authorized the MED's acquisition of 670 square miles of the Priest Rapids Valley. The acquisition dispossessed Hanford and White Bluffs entirely. The order affected only a portion of Richland. On March 6, the federal government distributed letters to the property holders, informing them that they thirty days to leave their land. The letters also related to the residents that the federal government would appraise their property and purchase it. In truth, the Army and DuPont worked together to evaluate the properties over the next few weeks. The letters and subsequent appraisals infuriated the property owners. They argued that thirty days was a short amount of time pack-up belongings and find a new home. Furthermore, they maintained that the appraisals undervalued their property. The Army and DuPont had evaluated the land based on its aridity and infertility. However, the owners argued that they were having a

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[58] Greenewalt, Crawford Greenewalt Manhattan Project Diary Transcripts, Volume 2, 28 January 1943, 67, Acc. 1889, Hagley Museum and Library, Wilmington, Delaware.
[59] Greenewalt, Crawford Greenewalt Manhattan Project Diary Transcripts, Volume 2, 18 February 1943, 102, Acc. 1889, Hagley Museum and Library, Wilmington, Delaware.
[60] Groves, *Now It Can Be Told*, 73.

great growing year. Several took their claims to court and won higher prices for their property thanks to sympathetic local juries and worn-down federal officials. Most simply begrudgingly took the payments, packed-up their belongings, and left the region.[61]

During the eviction process, Matthias worked with DuPont officials on plans to transform Richland into a village for the plant's future engineers, scientists, and supervisors. Using MED funding, DuPont subcontracted this construction project to several local firms and a prefabricated housing company in Portland, Oregon. Matthias made it clear to DuPont that this village project should be a modest affair. He told DuPont that the village should provide single-family housing only for those white-collar workers with families that had to "be kept under control for security reasons." The MED wanted the rest of the engineers, scientists, and supervisors to live alongside manual laborers in dormitories in order to keep costs low. To this end, Matthias told DuPont to construct 380 two-bedroom units and 120 three-bedroom units for the village.[62]

DuPont initially agreed to this housing arrangement, but later pursued a more expansive vision for the village. The company began by demanding that the MED provide funding to build 400 three-bedroom homes, as well as four-bedroom units for plant supervisors. The firm reasoned that the village needed "adequately large housing units" in order to attract and maintain

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[61] Matthias Oral History, 20; Groves, *Now It Can Be Told*, 74-5; DuPont, *Construction—Hanford Engineer Works: History of the Project, Volume 1* (Wilmington, DE: E.I. du Pont de Nemours and Co., 1945), 2-8; Matthias, "Diary and Notes of Col. Franklin Matthias," 8 March 1943; U.S. Department of Energy, Hanford Cultural Resources Program, *Hanford Site Historic District: History of the Plutonium Production Facilities, 1943-1990* (Columbus, OH: Battelle Press, 2002), 1.12; Robert Bauman, "'It Was Like an Invasion!' The Federal Government and the Displacement of People in the Priest Rapids Valley," in *Nowhere to Remember: Hanford, White Bluffs, and Richland to 1943*, ed. Robert Bauman and Robert Franklin (Pullman: Washington State University Press, 2018), 92-4, 96-9; John M. Findlay and Bruce Hevly, *Atomic Frontier Days: Hanford and the American West* (Seattle: Center for the Study of the Pacific Northwest in association with the University of Washington Press, 2011), 83, 19-21.

[62] James W. Parker Memoir, 7, Acc. 2110, Hagley Museum and Library, Wilmington, Delaware (hereafter Parker Memoir); Matthias, "Diary and Notes of Col. Franklin Matthias," 2 March 1943; Matthias to Yancey, 19 April 1943, "Richland" folder, box 2, F.T. Matthias Papers, Acc. 2086, Hagley Museum and Library, Wilmington, Delaware.

the best managers.[63] Matthias attempted to find a middle ground. On April 19, he allowed the housing project to "go forward as planned" but increased the number of three-bedroom units in the village from 120 to 200.[64] The next day, DuPont issued contracts for the village project. Upon reviewing the contracts, Matthias learned that DuPont officers ignored the MED and ordered four-bedroom houses for "the higher cost groups."[65] The MED Captain J.S. Barrish took the issue to DuPont, explaining that the Army "could not provide anything more than the essential facilities, and that any plans made for house sizes should be based on the projected number of families of each size; no extra rooms are to be provided." Barrish also argued that it was not "reasonable, economical, or sound thinking to design houses up to a ceiling figure if the necessary space and facilities can be provided for less." DuPont stood-by its decision, arguing that it could not attract the best supervisors unless it provided large, spacious housing. Furthermore, the firm told the MED that it planned to house all its managers in the village.[66] Then Groves got involved. Yet, the general seemed to have no authority to tell DuPont how to spend the Army's money. As Matthias put it, Groves "very strongly requested" that the village only house "those people who are required to live there for security reasons." DuPont did not budge. Although the MED bankrolled the Richland project, it appeared to have no control over it.[67]

DuPont's vision for Richland came to fruition. Construction started in the spring of 1943. Following DuPont's orders, subcontractors built what they called the alphabet homes, or the ABC houses. Consisting of eight different models, each named after a letter of the alphabet,

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[63] Matthias, "Diary and Notes of Col. Franklin Matthias," 16 April 1943.
[64] Matthias, "Diary and Notes of Col. Franklin Matthias," 19 April 1943.
[65] Matthias, "Diary and Notes of Col. Franklin Matthias," 20 April 1943.
[66] Matthias, "Diary and Notes of Col. Franklin Matthias," 21 April 1943.
[67] Matthias, "Diary and Notes of Col. Franklin Matthias," 24 June 1943.

these dwellings contained multiple bedrooms, a living room, a dining room, a kitchen, a bathroom, and closet space. One of the larger models, the L houses, offered 1,536 square feet of living space and four bedrooms. The smallest units, the B houses, measured 882 square feet and contained two bedrooms. As construction unfolded, DuPont came to the MED with more demands for the village. The firm was not satisfied with just providing large indoor spaces for its engineers and managers. It wanted the MED foot the bill for constructing outdoor amenities, including porches, landscaped yards, swimming pools, and parks. The MED once again argued against this extravagance in the name of cost. However, in the end, the MED caved to all of DuPont's demands.[68]

While local subcontractors transformed Richland into a luxurious village, DuPont broke ground at the plant construction site on the ruins of Hanford town. In April 1943, Matthias used the War Manpower Commission to locate, recruit, and bus in 125,668 laborers to work for DuPont at the construction site. Established one year earlier, the commission was charged with allocating workers between civilian and military demands during the war. Matthias personally provided job orientation to each new batch of workers as they arrived at the construction site. He stressed that they worked for DuPont but were supervised by the Corps of Engineers and were subjected to military regulations. He challenged the workers to "convert from words to action your desire to end the war." Although he did not let on what the workers were building, he noted that they were "pioneering" a new facility. After orientation, DuPont assigned the workers into

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[68] Kate Brown, *Plutopia: Nuclear Families, Atomic Cities, and the Great Soviet and American Plutonium Disasters* (New York: Oxford University Press, 2013), 37-9; Hanford Engineer Works, "Alphabet House B," Hanford History Project, accessed 30 November 2018, http://www.hanfordhistory.com/items/show/650; Hanford Engineer Works, "Alphabet House L," Hanford History Project, accessed 30 November 2018, http://www.hanfordhistory.com/items/show/659; Matthias, "Diary and Notes of Col. Franklin Matthias," 21 August 1943; "Park Pool is Opened," *Richland Bulletin*, 7 July 1944; Findlay and Hevly, *Atomic Frontier Days*, 86.

gangs to pour concrete, cut timber, fasten wires, drive bulldozers, and erect buildings.[69] Secrecy ruled the construction area. DuPont did not inform their workers what they were building and told them to keep quiet about their compartmentalized jobs. "You couldn't talk about nothing you was doing. With nobody." one worker said. To ensure secrecy, DuPont created a patrol team and partnered with the FBI to monitor Hanford Camp and spy on employees.[70]

The Hanford project transformed the racial composition of the region. Before the war, there were only a handful of African American families living in the Priest Rapids Valley. For example, in 1940, some 27 blacks lived in Pasco, one of the cities near the future construction site. When the project began, the War Manpower Commission recruited thousands of black and white laborers to the region to work for DuPont. This was done in order to abide by the standards set by the Fair Employment Practices Commission. Between 1943 and 1945, the commission brought 15,000 African Americans into the Priest Rapids Valley. In all, African Americans made up approximately 10 percent of Hanford Camp's workforce, serving as manual laborers, janitors, and mess hall attendants. Along with recruiting black men for manual labor, the War Manpower Commission funneled black women to Hanford, promising them jobs as clerks. When the women arrived, however, DuPont made them maids, waitresses, and kitchen helpers. Many of the workers came from other wartime industries in the West, including the Kaiser Shipyards in the San Francisco Bay Area and the Boeing airplane factories in Seattle. Many more came from the American South, from places like Alabama, Arkansas, Mississippi, Oklahoma, and Texas.

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[69] Matthias Oral History, 77; Otto S. Johnson, "Manpower Meant Bomb Power," September 1945, 2, 5-6, "Hanford-Labor Relations" folder, box 2, F.T. Matthias Papers, Acc. 2086, Hagley Museum and Library, Wilmington, Delaware; Kennedy, *Freedom from Fear*, 620; Franklin T. Matthias, "Orientation Speech," "Hanford-Labor Relations 1943-1956" folder, box 2, F.T. Matthias Papers, Acc. 2086, Hagley Museum and Library, Wilmington, Delaware; K.D. Nichols, *The Road to Trinity: A Personal Account of How America's Nuclear Policies Were Made* (New York: Morrow, 1987), 138.
[70] Joe Williams, interview by Vanis Daniels, Hanford History Project, Washington State University Tri-Cities, Richland, Washington.

Their migration and settlement in the Pacific Northwest, part of what the historian James Gregory calls the southern diaspora, transformed the cultural, political, and racial landscape of the Priest Rapids Valley.[71]

Segregation was the ruling principal at Hanford Camp. Initially, workers lived in tents among the wreckage of Hanford town. Over time the MED constructed barracks for DuPont's laborers, which the firm segregated along the lines of race. This policy aligned with military segregation practices but defied the rules of the Fair Employment Practices Commission. The MED consented to segregation because its leadership deemed it a practical strategy for minimizing race-based violence and crime. Groves and Matthias worried that white workers from the South would cause disorder, and possibly resort to violence, if they were forced to live alongside blacks. Yet, racism was not limited to southern whites. Although they had little experience living near African Americans, local white workers also exhibited similarly racist attitudes and insisted on housing segregation.[72] According to Matthias, an African American contingent at Hanford Camp also lobbied for segregated barracks, citing their fear that they would encounter "trouble" if DuPont housed them with white workers.[73]

Race not only delineated where people lived, but also where they ate, shopped, and relaxed. The MED allowed DuPont to segregate Hanford Camp's mess halls, commissaries, and

[71] Robert Bauman, "Jim Crow in the Tri-Cities, 1943-1950," *The Pacific Northwest Quarterly* 96, no. 3 (Summer 2005): 124-5; Matthias, "Diary and Notes of Col. Franklin Matthias," 18 August 1943; James T. Wiley, Jr., "Race Conflict as Exemplified in a Washington Town," (Master's thesis, State College of Washington, 1949), 14; E.R. Dudley, "Investigation of Civilian Defense Project at Hanford, Washington," June 1944, box II: B64, NAACP Records, Library of Congress, Washington, D.C.; James N. Gregory, *The Southern Diaspora: How the Great Migrations of Black and White Southerners Transformed America* (Chapel Hill: University of North Carolina Press, 2005).
[72] Findlay and Hevly, *Atomic Frontier Days*, 27; Brown, *Plutopia*, 27; Memo from Richland Human Rights Commission to Richland City Council, 6 August 1969, Human Rights Commission folder, Richland Public Library.
[73] Matthias Oral History, 79.

recreational spaces. The camp brass created "separate but equal" Christmas and New Year's parties for blacks and whites. Like other historical expressions of segregation, these separate events were hardly equal. White parties received more funding and better entertainment than their black counterparts. For example, on December 28, 1944, white workers enjoyed a stage show while black workers were given a card table. Later, on New Year's Eve, DuPont threw a dance for whites, and offered bingo and ping-pong for blacks.[74]

DuPont also segregated workers on the basis of gender to limit procreation and the outbreak of sexually transmitted diseases. The company separated men and women as they arrived at Hanford Camp, assigning them to same-sex barracks. Husbands and wives were not spared from this practice and could only visit one another with permission from the camp officials. DuPont's patrol force enforced sex segregation.[75] In order to visit the female barracks, men had to sign-in with a patrolman. The patrol did not allow the men to move freely through the barracks. Rather, the patrol designated the recreational room as a visitation spot. This, DuPont, reasoned would help limit sexual contact at the camp. Joe Williams, an African American worker, described sex segregation at Hanford Camp. He arrived at the construction site in February 1943 with his wife Velma Ray from Atmore, Alabama, by way of California. DuPont separated the couple when they entered the camp. "She lived in the women's barracks and I lived in the men's barracks," William explained, "and they had wired fences up like penitentiary around all the women's barracks." "You didn't know what room she slept in, or

[74] Bauman, "Jim Crow in the Tri-Cities," 126; Dudley, "Investigation of Civilian Defense Project at Hanford, Washington"; Annette Cary, "Exhibit Chronicles Hard Life for Blacks at WWII Hanford, *Tri-City Herald*, 27 February 2016; Christmas 1944 Schedule, The Atomic Frontier: Black Life in Hanford exhibit, Northwest African American Museum, Seattle, Washington, 20 January 2018. For more on segregation at Hanford Camp, see Parker Memoir, 2.
[75] Findlay and Hevly, *Atomic Frontier Days*, 27; Robert E. Bubenzer, oral history, *Working on the Bomb: An Oral History of WWII Hanford*, by S.L. Sanger (Portland, OR: Continuing Education Press, 1995), 93.

didn't know nothing," he continued. "You could go in the rec-room, that's as far as you could go."[76] Matthias jokingly explained sex segregation at the construction site to an interviewer in 1986. "All the women in the area were behind fences and it was pretty hard to do it through a fence," he began. "We tried to control access [to the women]. We know we didn't succeed 100 percent."[77]

As Matthias observed, despite his orders and DuPont security, men and women found ways to be together at Hanford Camp. Encounters ranged from the romantic to the violent. At night a few men lined up alongside the fences behind the women's barracks. Chancing cuts, blood, and scars they negotiated the fence for intercourse. Other couples snuck away while on the job and made their way down to the Columbia River to have sex in the bushes and sagebrush.[78] Although it is unclear how common sexual assaults were at Hanford Camp, Velma Ray had vivid memories of sexual predators and instances of rape. While her husband worked pouring concrete, Ray worked in the camp's mess halls. Thinking back on the men's barracks, Ray recalled that "those men was rapin' women so bad. And so, I hate to tell this. 'Cause one thing, see, I didn't know it was dangerous as it was." One day Ray went looking for her husband by the men's barracks. On the way she was accosted by several men. As they approached her, Ray pointed to another man in the distance and pretended he was her husband to warn off potential attackers. Although the memory clearly disturbed her, Ray found some humor in the horror. "I had so many husbands," she laughed.[79]

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[76] Williams, interview by Vanis Daniels.
[77] Matthias Oral History, 78.
[78] Sam Campbell, oral history, in *Working on the Bomb: An Oral History of WWII Hanford,* by S.L. Sanger (Portland, OR: Continuing Education Press, 1995), 125.
[79] Velma Ray, interview by Vanessa Moore, Hanford History Project, Washington State University Tri-Cities, Richland, Washington.

Although gender segregation failed to prevent sexual assaults, it did limit instances of prostitution at the construction site. Robert E. Bubenzer, DuPont's patrol supervisor, recalled that "there was some prostitution but not too much." His records indicate that there were 69 reported "sex crimes," out of 7,602 total crimes at Hanford Camp. It is not clear how many of these "sex crimes" were related to prostitution, although Bubenzer did note that some women brought forth rape charges when "a customer didn't want to pay." Furthermore, sexual assaults are frequently underreported crimes, even more so in the 1940s when shame would be placed on the victims. Prostitution thrived outside of the camp. Men traveled elsewhere in the Priest Rapids Valley to trade money for sex. Common haunts included the bordellos in Pasco, as well as the "shacks along the river." DuPont attempted to crackdown on these establishments and mitigate the outbreak of sexually transmitted diseases. The firm tasked its industrial medicine division to investigate potential hotspots, despite lacking the authority to operate in these areas or to conduct searches.[80]

In many respects, Hanford Camp resembled an Old West company town. The promise of high wages for manual labor and a fresh start in a faraway place attracted many drifters, felons, and gamblers. During the construction period, between March 1943 and August 1944, DuPont's patrol detained 217 individuals wanted for crimes across the United States. The charges ranged from robbery to homicide. Olive Coldiron, for example, was wanted in connection to a Western Union stickup. Meanwhile, D.W. Lindsey was wanted in Missouri for murder. Gambling was a popular activity in the camp. DuPont's patrol adopted a nuanced stance on gambling. It refused to allow professional gambling but ignored underground dice and poker games in the barracks. Gambling was accompanied by heavy drinking. DuPont barred alcohol from the camp, at least

[80] Bubenzer, oral history, 93, 96; Matthias Oral History, 78.

officially. Bootlegging was common in the barracks and, according to Bubenzer, "drunkenness was prevalent." The combination of cards and booze led to fights and homicides. Bubenzer reported that most homicides in the camps were caused by drunken arguments over a round of craps or a bad poker hand. In one case, a young man, who had snuck in a gun, shot a cheating gambler "four or five times" after losing money. The victim recovered and refused to prosecute. The perpetuator got to keep his job. Exhibiting a type of outlaw honor, the cheater remarked that his assailant was "a good kid." To stop brawls from becoming deadly, DuPont's patrol used tear gas to clear the scene. The patrol had little legal authority to prosecute suspects. Thus, it held its own "kangaroo court." Every morning the patrolmen screened their captives and, unless their crimes were "awfully serious," released them back into the camp community. "A pat on the back and 'Don't do it anymore' was our theory," Bubenzer said. Although the MED designated the construction site as a military reservation, jurisdiction over the civilian workers remained with the State of Washington. Consequently, Hanford's patrol referred severe crimes to the local police. The State of Washington tried the suspects in Prosser, some thirty miles away.[81]

While Hanford Camp buzzed with atomic construction and crime, DuPont tasked one of its employees, Hester Moore, to organize the plutonium project's communication system. Moore specialized in operating telephone switchboards and had worked in other DuPont facilities in the past. In 1943, DuPont commissioned Moore to travel to Hanford Camp, train switchboard operators and lead the communication-wing of DuPont's plutonium project. After arriving at Hanford Camp, Moore trained one hundred female DuPont employees to operate the camp's switchboard system. These telephone operators serviced 1,600 local calls per hour in addition to

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[81] Bubenzer, oral history, 92-4; DeWitt "Bill" Bailey, oral history, in *Working on the Bomb: An Oral History of WWII Hanford,* by S.L. Sanger (Portland, OR: Continuing Education Press, 1995), 137; Dudley, "Investigation of Civilian Defense Project at Hanford, Washington."

thousands of long-distance calls associated with the Manhattan Project. Thanks to Moore's management, the DuPont communications team insured that information traveled easily from Wilmington, Chicago, Los Alamos, and Washington D.C. to Hanford Camp.[82]

While Moore and her team facilitated communication between Hanford Camp and the outside world, the nearby cities of Kennewick and Pasco transformed under the burdens of the Manhattan Project. Founded in the mid-1880s alongside the Northern Pacific Railroad, Kennewick was a small, dusty town along the southwest bank of the Columbia River. Directly across the river sat Pasco. Connected by a railroad bridge, the two communities grew together over time.[83] In 1902, the two cities received federal funding for irrigation projects thanks to the Newlands Reclamation Act. With new ditches in place, Kennewick and Pasco became quaint farming communities, growing peaches, apricots, strawberries, and grapes. Like other communities in southeastern Washington, Kennewick and Pasco were almost exclusively white.[84] When the Hanford project began, black and white workers eyed Kennewick and Pasco as an alternative to living in Hanford Camp. The cities were deluged with barracks and trailers to accommodate the temporary workforce. Owners of local boarding houses and rental properties got in on the action and quickly expanded their living spaces to soak up housing dollars. One establishment, Camel's Cabins, threw together a few "boards," covered them in "canvas," and

[82] C.E. Anderson, *Keep Your Ducks in a Row!: The Manhattan Project Hanford, Washington 1943-1945* (New York: Page Publishing, 2016), 11, 195.

[83] David W. Harvey, "An Oasis in the Desert?: White Bluffs, Hanford, and Richland, The Early Years," in *Nowhere to Remember: Hanford, White Bluffs, and Richland to 1943*, ed. Robert Bauman and Robert Franklin (Pullman: Washington State University Press, 2018), 21; Emma Kleinknecht, interview by Robert Franklin, 12 June 2013, Hanford History Project, Washington State University Tri-Cities, Richland, Washington.

[84] Bauman, "Jim Crow in the Tri-Cities, 1943-1950," 124; Robert Franklin and Robert Bauman, "'Making a History of It May Help': The Hanford Site and Its Spaces and Places of Meaning," in *Nowhere to Remember: Hanford, White Bluffs, and Richland to 1943*, ed. Robert Bauman and Robert Franklin (Pullman: Washington State University Press, 2018), 8.

rented the space for eight hours at a time. "You moved in, ate, slept, got out," one resident explained.[85]

Hanford's workforce dominated local businesses and transformed Kennewick and Pasco to reflect the culture and desires of single, working men. The laborers brought a rough-and-tumble element to the cities, which cut against their identity as a family-focused, agricultural community. In the words of one resident, the cities "just entirely changed." Department stores and groceries increased their inventories and operating hours. Entrepreneurs opened new bars and restaurants to collect dining and drinking dollars. "Things were just chock full. Everything was chock full."[86] The strong sense of community that the farmers forged in the first few decades of the twentieth century gave way to transience. Workers slept and took their meals in the cities but spent most of their time at Hanford Camp. Few men attempted to lay down roots and bond with their neighbors. Most focused on earning money and planned to leave the area when the work dried up. To be sure, quite a few workers brought their families with them, and there were some modest social interactions in the cities. However, social events and small talk were often superficial. Hanford's "need to know" security measures dictated that workers could not speak about their jobs to their family, friends, and acquaintances. The pressures of secrecy made it seem like all topics were off-limits when it came to conversation. As one man put it, "you could hardly ask a person if it was daylight outside without them asking you 'what is your need to know?'"[87]

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[85] Ken Silliman, interview by Robert Franklin, 2 July 2013, Hanford History Project, Washington State University Tri-Cities, Richland, Washington.
[86] Silliman, interview by Robert Franklin.
[87] Harvey, "An Oasis in the Desert?," 21, 26; Robert Franklin, "'We Worked in the Orchards and We Played in the River': Life in the Towns of Richland, White Bluffs, and Hanford," in *Nowhere to Remember: Hanford, White Bluffs, and Richland to 1943*, ed. Robert Bauman and Robert Franklin (Pullman: Washington State University Press, 2018), 37; Bauman, "Jim Crow in the Tri-Cities," 124;

Although the Hanford project shook up the two cities, Kennewick remained a white enclave. Throughout the Manhattan Project, Kennewick's original families partnered with the new workers to prevent African Americans from settling in the community. Although blacks could shop in Kennewick during the day, they were barred from the city at night. Kennewick passed a sundown ordinance requiring African American to leave at sunset. As one African American man put it, "you might have been invited to spend your money but just don't stay too long and don't seek to be a part of that."[88] Another black man described the relationship between blacks and whites in the region as "very prejudice. Very racist. I was surprised when I came here to find a place that I had left a few years back in Mississippi and came here and found the same thing that I found in Mississippi."[89] Local residents also pressured banks and homeowners to refuse real estate sales to African Americans. "If anybody in this town ever sells property to a nigger, he's liable to be run out of town," the Kennewick sheriff explained.[90] The Kennewick Sheriff's Department not only recognized that race-based vigilantism was present in the city, it also actively participated in it. The Sheriff's Department brutalized blacks for defying segregation practices or for committing minor offenses. In one case, Sheriff Ward Rupp arrested a black man for riding in a car with white men. Instead of placing him in jail, Rupp tied him to a power pole for all to see. Eventually, Pasco police came for him and unfastened his ropes.[91] It is

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Franklin and Bauman, "'Making a History of It May Help,'" 7; Findlay and Hevly, *Atomic Frontier Days*, 83.

[88] Dallas Barnes, interview by Robert Franklin, 22 March 2018, Hanford History Project, Washington State University Tri-Cities, Richland, Washington.

[89] James Pruitt, interview by John Skinner, 18 October 2001, Hanford History Project, Washington State University Tri-Cities, Richland, Washington.

[90] Findlay and Hevly, *Atomic Frontier Days*, 127.

[91] Bauman, "Jim Crow in the Tri-Cities," 126; Brown, *Plutopia*, 151.

no wonder that Jack Tanner, the president of the northwest branches of the National Association of Colored People, called Kennewick "The Birmingham of Washington."[92]

Facing racism in Kennewick, African Americans looked to settle in Pasco. Recognizing that Hanford was drawing African Americans to the city, the Pasco City Council quickly redlined Pasco along the railroad tracks that cut through city. West Pasco became white Pasco. East Pasco became black Pasco, and the only neighborhood in the Priest Rapids Valley where African Americans could live outside of Hanford Camp. Housing in East Pasco was hard to come by because of the influx of new arrivals. Redlining worked together with high demand to allow landlords to charge high prices, and soaked-up black wealth, in exchange for poor housing. Many of the units were small, had electricity only suitable for lighting, and wooden stoves. When they ran out of housing options, African Americans lived in tents or chickencoops. Some gathered cardboard and constructed small shacks.[93]

Packing blacks into East Pasco threatened their health. Bordered by the Columbia River, a stockyard, and a garbage dump, East Pasco was a space for waste. Meanwhile, West Pasco remained comparatively clean—free from the burdens of the stockyard and the dump. Although the term "environmental racism" was coined decades after World War II, its conditions existed in East Pasco in the 1940s.[94] By forcing African Americans to live near waste, the Pasco City

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[92] Bauman, "Jim Crow in the Tri-Cities," 124.

[93] Virginia Crippen, interview by Vanessa Moore, Hanford History Project, Washington State University Tri-Cities, Richland, Washington; Findlay and Hevly, *Atomic Frontier Days*, 126-7; Brown, *Plutopia*, 152.

[94] Defined by the Reverend Benjamin Chavis in 1992, environmental racism is the "racial discrimination in environmental policy-making and the enforcement of regulations and laws, the deliberate targeting of people of color communities for toxic waste facilities, the official sanctioning of the life-threatening presence of poison and pollutants in our communities, and the history of excluding people of color from leadership in the environmental movement." See Chavis as quoted in Karl Grossman, "From Toxic Racism to Environmental Justice," *E Magazine*, May-June 1992, 31. My analysis of environmental racism and injustice in East Pasco is influenced by the works of Carl Zimring and Sylvia Hood

Council crafted a community of environmental injustice. Some skeptics might argue that locating the African American neighborhood up against the stockyard and the junkyard was a mere coincidence. However, time and time again, Pasco city leaders made it clear that targeting African American bodies with hazardous waste was a deliberate plan. Faced with a burgeoning population, and little resources, city leaders chose to not provide water and regular garbage services to the east side. Some residences did not have access to sewer lines. Those that did navigated broken pipes and sewage failures. Without water and dependable trash and sewage services, pollutants festered in East Pasco. The waste gathered in the unpaved streets as well as in the cramped living spaces.[95]

Despite the racism and the poor living conditions, African Americans chose to stay on the Manhattan Project. Many remained because of the comparatively high wages they received for manual labor at Hanford Camp. Take the experience of Olden Richmond, for example. Richmond came to Hanford from Kildare, Texas, in the spring of 1943. While living in Kildare, Richmond worked on a farm for "a whole five days a week" and brought home $3.75 weekly. The Hanford job, in contrast, paid $1 an hour. In exchange for this higher pay, Richmond had to navigate racism while on the job at Hanford. Thinking back on his time at Hanford, Richmond recalled one incident when he was working in a cement hole. "There was this one red-neck," Richmond said, "he walked by me, looked down in the hole on me. He said, 'I should kick your ass.'" Not allowing himself to be intimidated, Richmond replied, "No you won't kick my ass. We gonna fight." The white man jumped down the hole and Richmond met him with a shovel. After the scuffle, Richmond's supervisor fired the "red-neck" for starting the fight. Richmond's

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Washington. See Carl A. Zimring, *Clean and White: A History of Environmental Racism in the United States* (New York: New York University Press, 2016); Sylvia Hood Washington, *Packing Them In: An Archaeology of Environmental Racism in Chicago, 1865-1954* (New York: Lexington Books, 2005).

[95] Findlay and Hevly, *Atomic Frontier Days*, 126-7; Crippen, interview by Vanessa Moore.

story illustrates that blacks were willing to deal with racism for higher pay at Hanford. It also shows that although racism was indeed present in the Priest Rapids Valley, it was in some ways fragile. In this case, Richmond's supervisor did not tolerate racial violence. As Richmond explained it, supervisors at Hanford "treated everybody the same. If you did wrong, you went."[96] Richmond, and many of the other African Americans, concluded that the discrimination they faced in Washington was marginally better than the racial regimes they came from in the South. After reflecting on the hardships of living in East Pasco, Rose Allen commented that she was still "so glad to get out of Arkansas." Compared to the challenges of living in Arkansas, under a more formal system of Jim Crow, Allen "enjoyed" her time in the Priest Rapids Valley.[97] In short, blacks living in the region ran a sort of cost-benefit analysis during the Manhattan Project. Better pay and a friendlier Jim Crow in southeastern Washington trumped low wages and a harsher Jim Crow in the South.

This is not to suggest that African Americans acquiesced to the injustices they suffered in the Priest Rapids Valley. On the contrary, blacks attempted to improve their condition by working with the National Association for the Advancement of Colored People (NAACP) to legally combat discrimination. Shortly after blacks began settling in East Pasco, the Pasco City Council demanded that DuPont used separate buses to transport their black and white laborers from Pasco to Hanford Camp. The company consented, hoping to placate local leaders and keep them from asking too many questions. In 1943, African American workers contacted the Spokane branch of the NAACP about DuPont's discriminatory busing practices. After hearing

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[96] Olden Richmond, interview by Vanis Daniels, 21 June 2001, Hanford History Project, Washington State University Tri-Cities, Richland, Washington; Velma Ray reported that Hanford supervisors treated both her and her husband "real nice." See Ray, interview by Vanessa Moore.

[97] Rose Allen, interview by Robert Franklin, 12 January 2018, Hanford History Project, Washington State University Tri-Cities, Richland, Washington.

about the segregated buses, the NAACP pressured state officials, including Governor Arthur B. Langlie, to intervene and end the bussing discrimination. In New York, the NAACP special counsel Thurgood Marshall wrote to Washington State and federal authorities about the issue, framing it as Jim Crowism in a federal defense facility. Four months later, DuPont integrated the busses. The victory inspired black workers to form their own NAACP branch in Barracks 210 on the construction site. In one week, the branch raised $250 and hired two attorneys to challenge the Pasco cafes that refused to service to blacks.[98]

As the workers, black and white, flowed into the Priest Rapids Valley, Greenewalt and his team of engineers designed the plutonium facility and reactor technologies. That is to say, design unfolded simultaneously with the construction of the plant. For example, on October 26, 1943, Greenewalt met with his engineers to discuss final product storage at the Hanford plant. The team agreed that workers would construct a single plutonium storage area at Hanford. Furthermore, the group decided that the storage area would feature a series of vaults to secure the plutonium and that the facility's plutonium inventory would be kept to a minimum. All of these determinations were made without input from the MED. During the same meeting, Greenewalt and the engineers decided that a DuPont workshop in Delaware, Wilmington Shops, would create new technologies to pilot various plutonium production processes. This would allow DuPont to "demonstrate adaptability" of Met Lab's theories "to production at Hanford." The group concluded the meeting by discussing jackets, the layers of coating that would encapsulate

[98] Bauman, "Jim Crow in the Tri-Cities," 125; Thurgood Marshall to Charles F. Schaefer, 23 December 1943, reel 19, pt. 15, series A, Papers of the NAACP, Library of Congress, Washington, D.C.; Thurgood Marshall to F.A. Stokes, 17 January 1944, reel 19, pt. 15, series A, Papers of the NAACP, Library of Congress, Washington, D.C.; Quintard Taylor, *The Forging of a Black Community: Seattle's Central District, from 1870 through the Civil Rights Era* (Seattle: University of Washington Press, 1994), 170; Lucille Black to Carlton B. Smith, 14 June 1944, folder 8, box II: C212, NAACP Records, Library of Congress, Washington, D.C.; Dupree Davis to Mary White Overton, 2 July 1944, folder 8, box II: C212, NAACP Records, Library of Congress, Washington, D.C.

the plutonium slugs in the reactor. The team examined a jacket design featuring affixed end caps, air gaps, and zinc dipping. Greenewalt thought the prototype was “good looking.” He suggested that the engineers test its soldering continuity by heating it “at Hanford level” and coating it with a “sensitive compound…which would change color over any significant discontinuity in solder bond.” Such a test, Greenewalt argued, could be implemented on an industrial scale for all jacket designs. The colorful compound would easily allow engineers to see which jacket designs had the best soldering continuity and help indicate which jacket model to use at Hanford. Taken together, these three discussions on October 26 demonstrate the power Greenewalt and his engineers held over the plant’s design and the creation of reactor technologies.[99]

Greenewalt also decided how much radiation shielding would be present in the plant. Greenewalt wanted to make sure the plant was safe but did not want to impose unnecessary safety measures and infrastructure, which would increase cost and construction time. To this end, Greenewalt asked Compton what daily radiation limit to institute at Hanford. Compton deferred the question the head of Met Lab’s health division, Robert S. Stone. In the end, Stone recommended a daily radiation limit of 0.1 roentgen over 8 hours. Greenewalt was thrilled. This limit was far higher than Greenewalt had suspected and meant that he could simplify shielding in the building’s design. This brief history of radiation shielding encapsulates the relationship between DuPont and Met Lab. Met Lab provided theoretical information to DuPont. DuPont then used this data to create technologies and procedures at Hanford.[100]

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[99] Greenewalt, Crawford Greenewalt Manhattan Project Diary Transcripts, Volume 2, 26 October 1943, 398-9, Acc. 1889, Hagley Museum and Library, Wilmington, Delaware.
[100] Greenewalt, Crawford Greenewalt Manhattan Project Diary Transcripts, Volume 2, 1 May 1943, 208, Acc. 1889, Hagley Museum and Library, Wilmington, Delaware. The roentgen is unit of measurement for the exposure of X-rays and gamma rays.

On November 6, 1943, Greenewalt arrived in the Priest Rapids Valley to check-in on the construction. First, he toured Richland, inspecting the village's layout and construction progress. Next, he made his way to Hanford Camp. The steel for one of the four reactors was in place. While at the Hanford Camp, Greenewalt met with D.O. Notman. Notman worked for Walter O. Simon, the leading DuPont manager at the construction site. Notman told Greenewalt that the project was moving at a slow pace. Labor turnover was the root of the problem. There were 18,000 laborers working at the site, however, Simon and Notman argued that they needed an additional 12,000 workers in order to complete the four plutonium reactors by the end of the war. After reviewing construction schedules and charts, Greenewalt concurred with Simon and Notman's assessment. If Hanford was to succeed, it needed more labor.[101]

Yet, procuring additional labor was a difficult task. DuPont had to rely on the War Manpower Commission to supply construction workers. The commission, however, also had to procure laborers for hundreds of war factories across the nation. Furthermore, the war sent men who would otherwise be fit for the task into foreign combat zones. In this context, Simon and Notman had to find a way to convince the commission to favor the Hanford project over other war industries. They could not share with the commission that their project had to be privileged because it was pursuing plutonium. Such an admission would blow the cover of Hanford. The duo needed to find a way to order the commission to recruit more men without leaving any room for questions. In an attempt to leverage authority, Simon had reached out to the Acting Secretary of War Robert P. Paterson in the summer of 1943. After speaking with Simon, Paterson wrote to Paul V. McNutt, the chairman of the War Manpower Commission, telling him that the Hanford

[101] Greenewalt, Crawford Greenewalt Manhattan Project Diary Transcripts, Volume 2, 6 November 1943, 410, Acc. 1889, Hagley Museum and Library, Wilmington, Delaware; Johnson, "Manpower Meant Bomb Power," 6.

project “must be given preference.” When McNutt failed to act, FDR telegraphed all the regional manpower offices and told them to supply Hanford with labor “or else.”[102]

Despite FDR’s threat, the War Manpower Commission struggled locating, recruiting, and transporting more workers to Hanford. Frustrated with the labor supply problem, Simon tried his hand at crafting a solution. On November 23, 1943, he met with Greenewalt to discuss the slow construction pace. Simon argued that it was a product of stretching the labor force too thin. He reasoned that DuPont should direct all its laborers to construct one reactor “as fast as possible” and allow the construction of the other three reactors “to lag.” According to Simon, this would assure to DuPont could produce plutonium-239 before the war ended. Greenewalt liked the idea and took the case to Groves. The general seemed intrigued by the plot and asked DuPont to create a new construction plan and a new production schedule for him to review.[103]

On December 9, Greenewalt met with Notman to revisit the plutonium production schedule. After analyzing how much plutonium-239 would be needed per bomb, the two concluded that “much smaller quantities” of plutonium were needed than Met Lab originally estimated. Consequently, Notman and Greenewalt determined that building four reactors “could not be justified.” Furthermore, Greenewalt became convinced that if Hanford laborers pushed one reactor to completion as soon as possible, DuPont might be able to produce plutonium by the fall of 1945.[104] If the Manhattan Project was an organization where its three branches, DuPont, the MED, and Met Lab, discussed plans and collectively decided on a course of action, then

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[102] Greenewalt, Crawford Greenewalt Manhattan Project Diary Transcripts, Volume 2, 6 November 1943, 410, Acc. 1889, Hagley Museum and Library, Wilmington, Delaware; Robert P. Paterson to Paul V. McNutt, 16 July 1943, “Hanford-Labor Relations Folder,” box 2, F.T. Matthias Papers, Acc. 2086, Hagley Museum and Library, Wilmington, Delaware.
[103] Greenewalt, Crawford Greenewalt Manhattan Project Diary Transcripts, Volume 2, 23 November 1943, 427, Acc. 1889, Hagley Museum and Library, Wilmington, Delaware.
[104] Greenewalt, Crawford Greenewalt Manhattan Project Diary Transcripts, Volume 2, 9 December 1943, 442-3, Acc. 1889, Hagley Museum and Library, Wilmington, Delaware.

Greenewalt would have brought the new construction schedule to Groves and Compton and received their blessing, before implementing it. This did not happen. Rather, Greenewalt and his engineers decided on their own to commit to building one reactor first and allowing the others to lag. On December 14, Greenewalt told Compton about the new production schedule. He made clear that workers would complete the first reactor, B reactor, on June 1, 1944, and tend to the second reactor "soon thereafter." Despite not having a say in this decision, Compton showed "enthusiasm."[105]

By January 6, 1944, Hanford workers had adopted the new construction and production schedules. The War Manpower Commission had heeded Roosevelt's warning and supplied 17,000 more workers to the construction site, ballooning the camp to 35,000 people. The first reactor was nearing completion and was "half loaded" with graphite. Greenewalt estimated that the workers could finish laying the remaining graphite in less than two weeks. Construction was unfolding so well, in fact, that DuPont told the War Manpower Commission that it no longer needed more laborers.[106]

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[105] Greenewalt, Crawford Greenewalt Manhattan Project Diary Transcripts, Volume 2, 14 December 1943, 447, Acc. 1889, Hagley Museum and Library, Wilmington, Delaware.

[106] Crawford Greenewalt, Crawford Greenewalt Manhattan Project Diary Transcripts, Volume 3, 6 January 1944, 5-6, Acc. 1889, Hagley Museum and Library, Wilmington, Delaware.

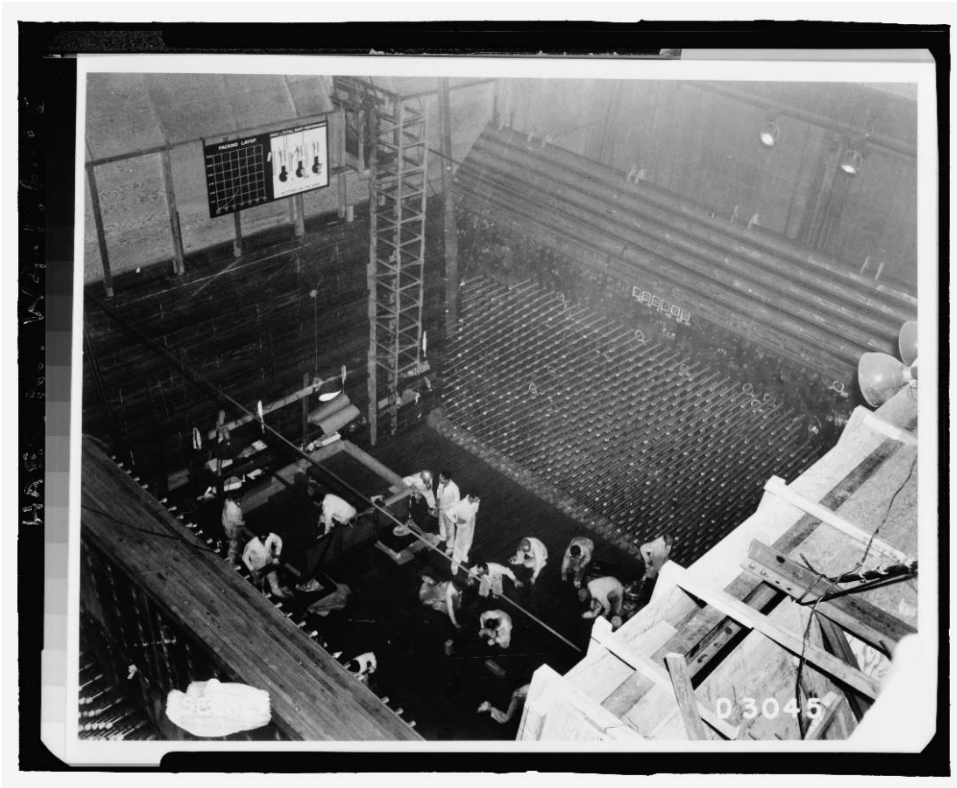

Figure 2: DuPont workers assembling the graphite core of B Reactor. 1944. Photograph courtesy of the Library of Congress.

With the new construction and production schedules on track, Greenewalt turned to his next task: deciding which American physicist would oversee the finished facility. On January 15, Greenewalt met with the DuPont plutonium manufacturing manager Roger Williams and Compton to decide the matter. Greenewalt and Williams thought that Fermi, then the director of Met Lab's nuclear physics division, would be the best candidate. Compton agreed. Months later, Fermi packed his things and relocated his office to Hanford.[107]

In February, the MED finally learned that DuPont had implemented its new construction and production schedules. Groves was furious. The general argued that operating one reactor while the remaining two were under construction could create distinct human health hazards and

[107] Greenewalt, Crawford Greenewalt Manhattan Project Diary Transcripts, Volume 3, 15 January 1944, 18, Acc. 1889, Hagley Museum and Library, Wilmington, Delaware.

pose a liability to the entire project. Yet, here again, Groves seemed powerless to change DuPont's course of action. As Greenewalt put it, Groves was "displeased with, but is accepting our production schedule."[108]

Thanks to the new construction and production schedules, DuPont's workforce completed building the first reactor, 105B or B Reactor, on September 13, 1944. On September 26, B Reactor went online for the first time. It produced its first plutonium-239 on November 6. The other two reactors, D Reactor and F Reactor, came online in December 1944 and February 1945, respectively. In the end, DuPont spent $333.7 million of the Army's money building Hanford. Put another way, the construction of Hanford Engineer Works cost approximately one-half days' worth of gross national product in 1944. For added perspective, the United States spent $8.5 billion constructing other military facilities during the war.[109]

As the facilities began producing plutonium, Hanford Camp dissolved. Thousands of the laborers left the Priest Rapids Valley, looking for work in other war industries. Others remained and took new jobs as janitors and handymen. Hanford's white working class congregated in Kennewick and West Pasco while Hanford's black working class settled in East Pasco. Local population statistics help illuminate the scale of this settlement. In 1940, 1,918 people lived in Kennewick. 3,913 lived in Pasco. After Hanford Camp closed, Kennewick claimed 7,500 residents. Pasco totaled 8,500.[110] The completion of $34.8 million Richland village in the fall of 1944 did little to relieve Kennewick and Pasco from the influx of residents. By dictating that

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[108] Greenewalt, Crawford Greenewalt Manhattan Project Diary Transcripts, Volume 3, 4 February 1944, 44, Acc. 1889, Hagley Museum and Library, Wilmington, Delaware.
[109] Greenewalt, Crawford Greenewalt Manhattan Project Diary Transcripts, Volume 3, 27 September 1944, 341, Acc. 1889, Hagley Museum and Library, Wilmington, Delaware; U.S. Department of Energy, Hanford Cultural Resources Program, *Hanford Site Historic District*, 1.22-1.27; Thayer, *Management of the Hanford Engineer Works in World War II*, 86.
[110] Findlay and Hevly, *Atomic Frontier Days*, 81, 83; Harvey, "An Oasis in the Desert?," 32. In 1942, the U.S. Navy stationed an aviation training base in Pasco. This contributed to the city's wartime growth.

Richland was a community for engineers and managers, DuPont insured that Kennewick and Pasco soaked-up the working class.[111]

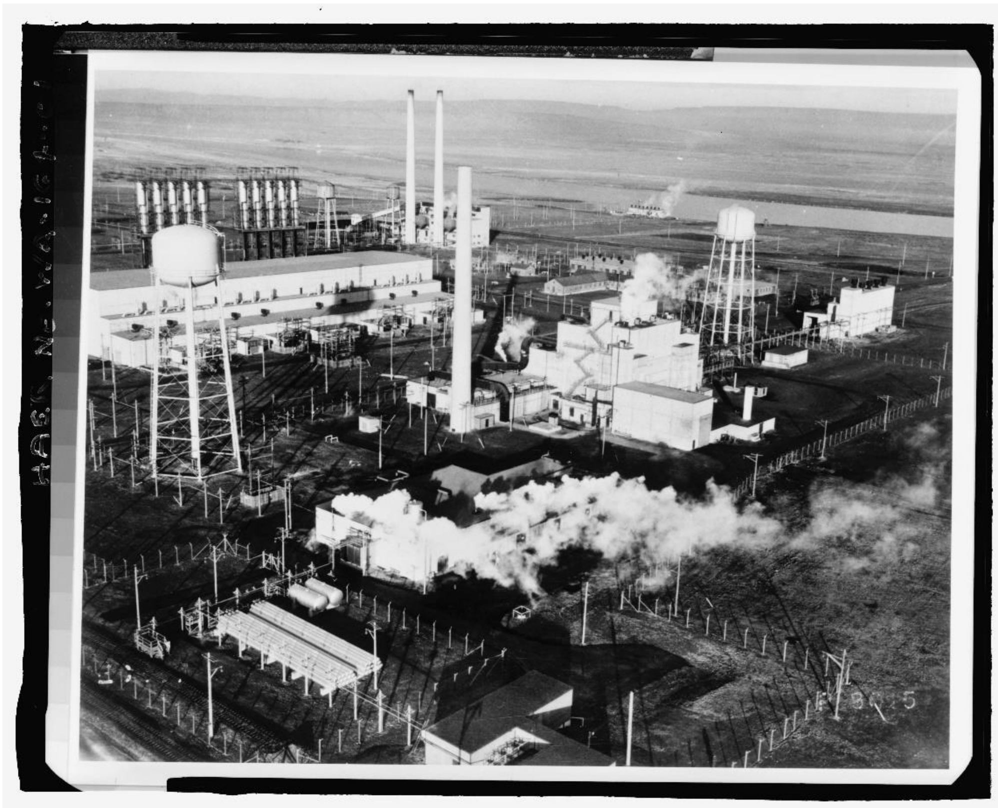

Figure 3: B Reactor. January 1945. Photograph courtesy of the Library of Congress.

In the spring of 1945, the first batch of plutonium-239 left Hanford and made its way to Los Alamos. Matthias brought the shipment himself, carrying it with him in a small box on a train to New Mexico. Other shipments journeyed from Hanford to Los Alamos by military ambulance. After the plutonium arrived at Los Alamos, chemists and physicists led by J. Robert Oppenheimer joined the material with high-energy explosives and packaged it in experimental casings to make the world's first three atomic bombs. On July 16, 1945, the MED detonated the

[111] Parker Memoir, 11; Thayer, *Management of the Hanford Engineer Works in World War II*, 82; Brown, *Plutopia*, 150.

first atomic bomb, *The Gadget*, at the Trinity Test Site in New Mexico. The blast proved that Hanford's plutonium could, indeed, produce an atomic weapon.[112]

The remaining two bombs headed for Japan. At 8:15 A.M., on August 6, 1945, Hiroshima was a vibrant city. One minute later, the 393d Bombardment Squadron B-29 Enola Gay dropped Oak Ridge's uranium-235 bomb, *Little Boy*, on the city. The Army estimated that the blast immediately killed 140,000 people in Hiroshima, or approximately 39 percent of the population. At 11:02 A.M., on August 9, the 393d Bombardment Squadron B-29 Bockscar deployed Hanford's second plutonium bomb, *Fat Man*, over Nagasaki. The Army estimated that this blast killed 70,000 people, roughly 28 percent of the population. Some survived the infernos and wandered around the wreckage like ghosts. The survivors were permanently changed. The blast burned and mangled their bodies and exposed them to high levels of ionizing radiation. Cancers followed. The horrors of the destruction, the pain of losing loved ones, and the guilt of survival rattled psyches. The Japanese called those that remained *hibakusha*, a term meaning "survivor" or "exposed one." They were, in the words of the historian M. Susan Lindee, "the first true residents of the atomic age."[113]

The atomic bombings of Hiroshima and Nagasaki coalesced with other military and political developments to bring World War II to a close. On August 9, the Soviet Union declared war against Japan. The Soviet announcement claimed that "the Allies approached the Soviet Government with a proposal to join in the war against Japanese aggression and thereby shorten the length of the war, reduce the number of victims, and assist in the prompt reestablishment of

[112] Matthias, interview by Stephane Groueff; Szasz, *The Day the Sun Rose Twice*, 5.
[113] M. Susan Lindee, *Suffering Made Real: American Science and the Survivors at Hiroshima* (University of Chicago Press, 1994), 3-5.

general peace."[114] This was a lie. The Soviet Union needed a justification for violating its neutrality pact with Japan and for invading and claiming Japanese territories. After issuing the excuse, Stalin ordered the Soviet military towards the Japanese archipelago.[115] According to the historian Herbert Bix, "the twin psychological shocks of the first atomic bomb and the Soviet entry into the war" coupled with "concern over growing popular criticism of the throne and its occupant, and their almost paranoiac fear that, sooner or later, the people would react violently against their leaders if they allowed the war to go on much longer…finally caused Hirohito to accept, in principle, the terms of the Potsdam Declaration."[116] On August 14, the Japanese government notified the United States that it had accepted the United States's terms of surrender. On August 30, the U.S. Army General Douglas MacArthur made his dramatic entry into Tokyo Bay. Three days later, a Japanese delegation met with MacArthur on the USS *Missouri* and signed the surrender documents. The war was over.[117]

Back in the Priest Rapids Valley, Hanford workers finally learned what they built. Hours after the Hiroshima bombing, the Richland newspaper *The Villager* printed the headline: "It's Atomic Bombs, President Truman Releases Secret of Hanford Project, Information is Made Public This Morning." This was a curious admission. After all, it was Oak Ridge's uranium-235 bomb that destroyed Hiroshima. On August 14, *The Villager* declared: "Peace! Our Bomb Clinched It!"[118] Taking credit for the Japanese surrender, inn September 1945, Hanford

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[114] Tsuyoshi Hasegawa, *Racing the Enemy: Stalin, Truman, and the Surrender of Japan* (Cambridge: The Belknap Press of Harvard University Press, 2005), 190.
[115] Hasegawa, *Racing the Enemy*, 189-191.
[116] Herbert P. Bix, *Hirohito and the Making of Modern Japan* (New York: Harper Perennial, 2016), 511. The historian Tsuyoshi Hasegawa argues that "the Soviet entry into the war played a greater role than the atomic bombs in inducing Japan to surrender." See Hasegawa, *Racing the Enemy*, 5.
[117] Bix, *Hirohito and the Making of Modern Japan*, 526; Hasegawa, *Racing the Enemy*, 285.
[118] "It's Atomic Bombs," *The Villager*, 6 August 1945; "Peace! Our Bomb Clinched It!," *The Villager*, 14 August 1945.

managers and workers celebrated and memorialized their war effort by holding a parade, a flower show, and a series of sporting exhibitions in Richland. The event was open to all who wished to attend and became the annual celebration "Atomic Frontier Day." The jamboree paid homage to the plutonium community's imagined similarities to the mining and timber towns of the Old West. Mobilizing frontier rhetoric, event planners asked local residents to dress up like cowboys and cowgirls to demonstrate their conquest of "the Atomic Wilderness on this, our last frontier." In the months that followed, the students at Richland's high school student body voted to change their mascot form the Beavers to the Bombers and dedicated their yearbook to the atomic bomb. Mushroom clouds decorated the school crest, class rings, letterman jackets, and football helmets.[119]

Although Hanford managers and laborers in the Priest Rapids Valley took pride in the bomb, back in Wilmington, the DuPont brass was notably ambivalent. Corporate leaders worried that the destruction of Nagasaki would lead journalists and pundits to once again dub the firm a "merchant of death." Carpenter, the Executive Committee, and the board of directors preferred getting back to producing consumer goods and stepping away from plutonium. With the conclusion of Contract W-7412 Eng-1, DuPont gave up the management of Hanford in 1946. DuPont rewarded Greenewalt for his wartime leadership by making him president of the company in 1948.[120]

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[119] "Today is a Proud Day for Richland," *The Villager*, 3 September 1945; *Atomic Frontier Days: A New Light on the Old Frontier, Richland, Washington, Sept. 4-5-6, 194*8 (Richland: Junior Chamber of Commerce, 1948); *2nd Annual Atomic Frontier Days Program* (Richland: Junior Chamber of Commerce, 1949), 9, cover; Findlay and Hevly, *Atomic Frontiers Days*, 102; Leah Sottile, "In A Small Town in Washington State, Pride and Shame Over Atomic Legacy," *Al Jazeera America*, 21 July 2015, http://america.aljazeera.com/multimedia/2015/7/richland-washingtons-atomic-legacy.html.

[120] U.S. Department of Energy, Hanford Cultural Resources Program, *Hanford Site Historic District*, 1.42–45; Findlay and Hevly, *Atomic Frontier Days*, 47; "DuPont Out-GE In," *Richland Villager*, 5 June 1946; "Corporations: The Wizards of Wilmington," *Time*, 16 April 1951; "Crawford Greenewalt of DuPont Dies," *MIT News*, 29 September 1993.

In the summer of 1946, the newly formed Atomic Energy Commission (AEC) granted General Electric Company a cost-plus $1 fixed fee contract to manage Hanford. The AEC's selection of General Electric was not surprising. The commission was interested in both procuring nuclear weapons for the growing Cold War American arsenal and developing nuclear energy. General Electric shared these goals. Instead of viewing Hanford, as DuPont did, as a plant for producing a chemical product, General Electric saw it as a versatile product in its own right, similar to the industrial transformers and generators it had operated in the past. General Electric regarded the Hanford facility as a novel product that had already been paid for by the American taxpayers. The firm desired to use this product to create atoms for war and peace. General Electric kept the balance of Hanford's managers and workers in place, installing fewer than ten of its own supervisors at the facility. During the next decade, the company ballooned Hanford, building five additional plutonium reactors and two plutonium reprocessing facilities, the Reduction Oxidation Solvent Extraction, or REDOX Plant, and the Plutonium Uranium Extraction, or PUREX Plant. This expansion attracted thousands of scientists, engineers, and manual laborers to the facility, looking for higher wages and the sense of pride displayed at the Atomic Frontier Day festivals.[121]

Over the next four decades the Tri-Cities—Richland, Kennewick, and Pasco—continued to expand to accommodate Hanford's growing workforce. Each community featured distinctive cultures, reflecting its wartime migrants. Richland displayed a white, upper-class, suburban

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[121] G.E. Contract W-31-109-ENG-52 & AT 45-1-1350, U.S. Department of Energy, Pacific Northwest National Laboratory Public Reading Room, Richland Operations Office, Richland, Washington; C.V. Bulck, "General Electric Hanford Contract Clarifications," 31 July 1946, Accession No. RL-1-386104, U.S. Department of Energy, Pacific Northwest National Laboratory Public Reading Room, Richland Operations Office, Richland, Washington; "DuPont Out-GE In," *Richland Villager*, 5 June 1946; Johnston, *The Neutron's Children*, 146; "GE Moves in Hanford' Is Business Week Title; Wine on Front Cover," *Richland Villager*, 12 September 1946; Findlay and Hevly, *Atomic Frontier Days*, 47.

environment, with good schools and outdoor spaces to match. Kennewick sported a white, working-class, urban environment, with numerous shopping centers and restaurants. Pasco presented a black and white, working-class, urban environment. East Pasco continued to act as the region's sink, featuring garbage dumps, stockyards, and saloons. But blacks worked hard to transform their part of town into a thriving community. Pooling together their wages, they built churches, created baseball teams, and opened small businesses, including restaurants, barbershops, and salvage yards. African Americans took pride in transforming East Pasco. As Joe Williams put it, "Tremendous minds got together and they did tremendous things." Over time, their efforts made the city into "the center of black culture for eastern Washington."[122]

DuPont was the Manhattan Project's engineer of victory. Although the firm was reluctant to take the plutonium production job, once committed to the task the company took the reins of the Manhattan Project. As Greenewalt and other DuPont leaders brought the Hanford initiative to fruition, the Priest Rapids Valley collected workers looking for higher wages at Hanford and, in this case, a way to escape Jim Crow. In a way, DuPont's relationship with the MED provided a prototypical model for future military-industrial relationships in the field of nuclear weapons. As we shall see in future chapters, time and time again private firms, and not the state, designed manufacturing technologies, constructed weapon facilities, and produced nuclear material for its federal consumer. In doing this work, the firms transformed communities across the West for better and for worse.

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[122] Crippen, interview by Vanessa Moore; Bessie May Williams-Fields, interview by Vanis Daniels, Hanford History Project, Washington State University Tri-Cities, Richland, Washington; Allen, interview by Robert Franklin; Williams, interview by Vanis Daniels; Bauman, "Jim Crow in the Tri-Cities," 127; Quintard Taylor, "Commentary on Reimagining the Racial Landscape at Hanford and in the Tri-Cities" (presentation at Western History Association Conference, San Antonio, Texas, 19 October 2018).

Chapter Two

Big Uranium: Wildcatters and Big Business in the West's Uranium Deposits, 1947-1970

Following Japan's surrender, a new conflict emerged between the United States and the Soviet Union. During the first few years of the Cold War, the United States was the only nation with nuclear weapons, but the Soviet Union was quickly catching up.[123] Although most American officials believed that the Soviet Union would not acquire an atomic bomb until the 1960s, the United States enlarged its atomic stockpile in the late 1940s to maintain its technological supremacy over the atomic-ascendant U.S.S.R. After the Soviet Union acquired its first atomic bomb in 1949, American officials redoubled their efforts to expand the United States's atomic arsenal and started plotting to create a fusion, or thermonuclear, bomb.[124] To procure these weapons, the federal government required large amounts of uranium ore—the raw material that Hanford Engineer Works enriched into plutonium-239. Fortunately for the United States, the American West contained vast stores of uranium.

[123] Using Gulag labor, the Soviets began constructing their first plutonium plant in the Ural Mountains in 1945. In December 1948, the Maiak plant first produced plutonium for an atomic bomb. See, Kate Brown, *Plutopia: Nuclear Families, Atomic Cities, and the Great Soviet and American Plutonium Disasters* (New York: Oxford University Press, 2013), 85-8, 117-8.

[124] Edward Teller with Judith L. Shoolery, *Memoirs: A Twentieth-Century Journey in Science and Politics* (Cambridge: Perseus Publishing, 2001), 278; Melvyn P. Leffler, *A Preponderance of Power: National Security, the Truman Administration, and the Cold War* (Stanford: Stanford University Press, 1992), 95-6, 149; Defense Nuclear Agency as Executive Agency for the Department of Defense, "Operation Ranger, Shots Able, Baker, Easy, Baker-2, Fox, 25 January-6 February 1951," by Carl Maag, Stephen Rohrer, and Robert Shepanek, 26 February 1982, Report No. DNA 6022F, 19, https://www.dtra.mil/Portals/61/Documents/NTPR/2-Hist_Rpt_Atm/1951_DNA_6022F.pdf. On August 29, 1949, the Soviet Union detonated its first nuclear weapon, RDS-1 or *First Lightning*, at Semipalatinsk in northeastern Kazakhstan. The weapon was a copy of the first American bomb, yielding twenty-two kilotons of power. See, Richard Rhodes, *Dark Sun: The Making of the Hydrogen Bomb* (New York: Simon & Schuster Paperbacks, 2005), 364-8; Harry S. Truman, *Memoirs, Volume II: Years of Trial and Hope* (Garden City, NY: Doubleday & Company, Inc., 1956), 306; R.H. Hillenkoetter, "Memorandum for: The Executive Secretary, NSC," 20 April 1949, folder 6, box 169, President's Secretary's Files, Harry S. Truman Papers, Harry S. Truman Library and Museum, Independence, Missouri.

This chapter examines the United States's uranium industry from 1947 through 1970. Using the tools of environmental history, it investigates how nature guided uranium miners to the West. This chapter also implements social and economic modes of analysis to examine how the federal government structured the new industry and what this meant for westerners. The Cold War uranium industry was a monopsony: a structure in which a single buyer controlled the market as the sole purchaser of goods and services offered by many would-be sellers.[125] The federal government was the only purchaser of uranium and relied on competing suppliers. The state's high demand for the ore led traditional mining firms and oil companies to scour the region for deposits. Thousands of westerners also participated in the hunt. Styling themselves as wildcatters, these adventurers set aside their jobs and families to search for the ore in hopes of striking it rich. While some wildcatters found large lodes, others found small deposits or nothing at all.

At first glance, it might appear that the federal government structured the great uranium hunt to foster competition between suppliers in order to procure the ore as quickly possible. Many westerners believed, in fact, that the uranium industry was egalitarian in nature and that individual westerners could easily compete with large mining firms as long as they happened to discover the deposits before the corporations. However, this chapter contends that federal policies and natural processes privileged large firms over the wildcatters. While wildcatters ventured into canyons, mountain ranges, and deserts searching for uranium, they struggled in locating and exhuming the deepest and most profitable uranium deposits. Corporations, on the other hand, had the capital to hire trained geologists and purchase heavy equipment to find and

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[125] The economist Joan Robinson developed monopsony theory in 1933. See, Joan Robinson, *The Economics of Imperfect Competition* (London: Macmillan, 1933). For a more recent analysis on the economics of monopsony see, Roger D. Blair and Jeffrey L. Harrison, *Monopsony in Law and Economics* (New York: Cambridge University Press, 2010).

unearth the large lodes. Nevertheless, the wildcatters attempted to overcome this disadvantage by quickly locating and claiming as many deposits as they could. While the wildcatters rushed to beat the firms to the deposits, the state implemented policies to accelerate corporate development and moved to consolidate its uranium suppliers. Buyers typically seek to consolidate suppliers in order to reduce chain costs and improve efficiency. However, the federal government had fixed uranium prices and provided bonuses for large lode deliveries. Thus, the state's effort to consolidate uranium suppliers cannot be adequately explained as an attempt to reduce costs. In the end, the federal agents at the helm of the uranium purchasing program simply preferred working with established firms. They believed that moving the uranium industry towards a bilateral monopoly would rationalize and stabilize the uranium supply and would incentivize private firms to vertically integrate their companies and build nuclear power reactors.[126]

Over the last three decades, historians have plumbed the history of uranium mining in the West. Most historians interested in the uranium industry have investigated how uranium mining caused cancers and environmental contamination in Native American communities, namely the Navajo. Notable uranium scholars, such as Traci Voyles, Valerie Kuletz, and Peter Eichstaedt, regard the environmental contamination of Navajo lands induced by uranium mining as environmental racism.[127] Michael Amundson has taken a different approach to uranium history and has documented how the uranium industry created a series of wildcatter boomtowns in the

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[126] A bilateral monopoly is a market structure featuring both a monopoly (a single seller) and a monopsony (a single buyer).

[127] See Traci Brynne Voyles, *Wastelanding: Legacies of Uranium Mining in Navajo Country* (Minneapolis: University of Minnesota Press, 2015), 6-10; Valerie L. Kuletz, *The Tainted Desert: Environmental Ruin in the American West* (New York: Routledge, 1998), xiv-xv, 36-7; Peter H. Eichstaedt, *If You Poison Us: Uranium and Native Americans* (Santa Fe: Red Crane Books, 1994), xv-xvi. See also Barbara Rose Johnston, Susan Dawson, and Gary Madsen, "Uranium Mining and Milling: Navajo experiences in the American Southwest," in *Indians & Energy: Exploitation and Opportunity in the American Southwest*, ed. Sherry L. Smith and Brian Frehner (Santa Fe: School for Advanced Research Press, 2010), 112.

West, including Moab, Utah, and Grand Junction, Colorado. Amundson frames the development of these uranium hubs using the lens of economic colonialism. By placing the uranium industry into the larger pattern of corporate and governmental colonialism that characterized the West during the late nineteenth and early twentieth centuries, Amundson draws parallels between the uranium booms and the precious metal booms of the Old West. Yet, Amundson maintains that the uranium boomtowns were distinctive from these historical antecedents because of their dependence on the federal government to purchase uranium. He further argues that the uranium towns were subjected to the "bust of the free market" and failed as a result of oversupply.[128]

Taken together, the scholarship on uranium mining suggests that disadvantaged peoples fought through cancers and other health hazards to procure an ore in the face of an inevitable economic bust. This is the prevalent scholarly narrative of uranium mining, but it is problematic. It implies, for one, that the health hazards associated with uranium mining and milling developed as the work unfolded. This is a historical anachronism. Lung cancer, the primary health hazard associated with uranium work, has a long latency period. Consequently, most uranium workers developed the disease years after leaving the industry and did not fight through the ailment as they worked in the mines. Furthermore, current scientific and governmental bodies have discredited the notion that leukemia, birth defects, and other diseases and health problems commonly associated with uranium mining are linked to the ore.[129] I am not suggesting that historians should not investigate and write about the health hazards associated with uranium mining. Rather, I am imploring scholars to take more care in writing about lung cancer by

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[128] Michael A. Amundson, *Yellowcake Towns: Uranium Mining Communities in the American West* (Boulder: University of Colorado Press, 2002), xv, xvii, 175-6.
[129] U.S. Department of Health and Human Services, Public Health Service, Agency for Toxic Substances & Disease Registry, "Public Health Statement: Uranium," February 2013, https://www.atsdr.cdc.gov/ToxProfiles/tp150-c1-b.pdf.

placing its appearance in the appropriate chronology. To date, nearly all discussion of uranium mining focuses on lung cancer at the expense of asking more chronologically appropriate questions. This trend has taken the air out of uranium historiography. While it is important to empathize with the afflicted and draw attention to lung cancer to further the cause of justice, we should also probe the other problems present in the uranium industry before lung cancers appeared. In this chapter, I investigate the uranium industry's problematic economic structure, namely how federal demand spurred wildcatters to seek after the ore, but federal policies worked against them in favor of big business. In chapter five of this manuscript, I investigate how diverse peoples fought for justice as lung cancers appeared in the late 1960s.

This chapter also offers a historiographical corrective to the uranium bust narrative. The notion that the uranium industry busted in Old-West fashion oversimplifies the complexities of the industry in an attempt to explain the end of the wildcatter movement and the collapse of the wildcatter towns.[130] The federal government ensured that the uranium industry did not bust. The state had structured the industry to ensure its rationalization and insulate it from the typical market fluctuations associated with pricing, supply, and demand. What, then, explains the disappearance of the wildcatters and the downfall of their towns? The federal government's uranium procurement policies, which favored large suppliers, ensured that big businesses would quickly remove wildcatters from the game. Furthermore, it is important to note that the uranium industry did not end when the federal government stopped purchasing the ore in 1970. Just before ending its uranium program, the federal government implemented new policies which gave large uranium firms permission to sell their ores to nuclear power plants. This allowed the

[130] For examples of boom and bust towns and industries in the Old West, see Eric L. Clements, *After the Boom in Tombstone and Jerome, Arizona: Decline in Western Resource Towns* (Reno, NV: University of Nevada Press, 2003); William S. Greever, *The Bonanza West: The Story of the Western Mining Rushes, 1848-1900* (Norman: University of Oklahoma Press, 1963).

industry to continue to thrive after the federal procurement program ended. In short, the federal government's favoritism towards large uranium firms, what I call Big Uranium, explains the end of the wildcatter movement, the collapse of wildcatter towns, and the persistence of the uranium industry into the twenty-first century.

Uranium hid within larger ores throughout human history. For hundreds of years, Navajos and Utes in the Southwest painted their bodies yellow and red using carnotite, an ore that contained small amounts of uranium. Outside of this decorative use, humans mostly ignored uranium for millennia. In the late nineteenth century, American miners often handled uranium as they tunneled throughout Colorado's Front Range in search of silver and gold. The uranium they encountered was hidden in pitchblende ore—a dense, black rock. Because pitchblende had no industrial application at the time, the miners regularly tossed the ore into large waste heaps, or tailing piles. By the end of the century, French scientists began isolating uranium and radium from pitchblende and experimenting with their radioactive properties.[131] In the early 1900s, companies used the uranium oxide and radium contained in pitchblende to color glazes, tint glassware, and illuminate watch faces, dials, and gunsights.[132] Humans also uncovered uranium as they searched for vanadium in carnotite deposits. At the beginning of the twentieth century, several American firms began seeking after vanadium because the ore could be used to harden steel. In 1910, for example, Joseph and Michael Flannery purchased the biggest carnotite claims

[131] Amundson, *Yellowcake Towns*, 2; Barbara Goldsmith, *Obsessive Genius: The Inner World of Marie Curie* (New York: W.W. Norton, 2005).

[132] Andrew M. Rowley, "Geiger Click No Sure Sign Uranium Wealth is Near," July 1955, folder 1, box 58, Kerr-McGee Corp. Collection, Oklahoma Historical Society, Oklahoma City, Oklahoma; Johnston, Dawson, and Madsen, "Uranium Mining and Milling," 112; Voyles, *Wastelanding*, 2; Eichstaedt, *If You Poison Us*, 8-9. For more on uranium's commercial uses in the early 1900s, see Claudia Clark, *Radium Girls: Women and Industrial Health Reform, 1910-1935* (Chapel Hill: University of North Carolina Press, 1997); Kate Moore, *The Radium Girls: The Dark Story of America's Shining Women* (Naperville: Sourcebooks, Inc., 2017).

they could find in Colorado and Utah and opened a vanadium processing mill in Uravan, Colorado. The dawn of World War I created a huge demand for vanadium and flushed the Flannery brothers' company, Vanadium Corporation of America, with cash. By the end of the war, the Vanadium Corporation of America had secured a stronghold on the United States's vanadium market and produced several large uranium tailing piles.[133]

World War II changed how humans interacted with uranium. When German scientists began enriching uranium in hopes of acquiring an atomic bomb, the Americans followed suit. Suddenly uranium became a crucial component of national security. The Army Corps of Engineers, Manhattan Engineering District (MED) relied on international pitchblende sources to acquire uranium for DuPont's Hanford and Oak Ridge facilities. Approximately ninety percent of the Manhattan Project's uranium came from pitchblende imported from Canada, the Belgian Congo, and South Africa. To supplement its uranium imports, in 1943, the MED forged an agreement with the Metal Reserve Company to gather uranium from precious metal and vanadium tailing piles in Utah and Colorado. Meanwhile, Vanadium Corporation of America opened new vanadium mines in the Colorado Plateau to procure both vanadium and uranium for the MED.[134]

After World War II, the MED gave way to a civilian bureaucracy. In 1946, Congress passed and President Harry Truman signed the Atomic Energy Act. The law gutted the MED and established the Atomic Energy Commission (AEC). Thereafter, to ensure that America's nuclear arsenal was well supplied and to keep uranium out of subversive hands, the AEC held a monopoly over uranium purchases, regulated the manufacturing of nuclear materials, and

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[133] Eichstaedt, *If You Poison Us*, 11,12, 19-21.

[134] U.S. Department of the Interior, U.S. Geological Survey, *Uranium in the Metal-Mining Districts of Colorado*, by R.U. King, B.F. Leonard, F.B. Moore, and C.T. Pierson, Geological Survey Circular 215 (Washington, D.C.: U.S. Government Printing Office, 1953), 1; Eichstaedt, *If You Poison Us*, 31, 26-7.

oversaw the manufacture and testing of atomic technologies. Recognizing that relying on uranium imports left the United States strategically vulnerable, the new bureaucracy began exploring domestic lands for uranium.[135]

Nature guided the AEC toward the West in its search for uranium. Uranium is not as rare as you might think. It is found in low amounts within all rocks, soils, and bodies of water. It is more abundant than gold, silver, and mercury. Although uranium was dispersed throughout the country in small amounts, the West contained concentrated deposits of the ore. Millions of years ago, natural processes deposited uranium in sandstone formations across the region. Before the sandstone hardened, underground water seeped through the sand. Decaying vegetation made the rushing water unusually acidic. Because of this acidity, as the water swept over the sand it left a brine of dissolved uranium. Over time, heat and pressure crystallized the sand into rock and trapped uranium inside the stone. By 1947, following nature's hand, the AEC took root in the West and ushered in a regional hunt for the mineral.[136]

The AEC created a uranium monopsony. It became the sole purchaser of uranium and left the actual mining in the hands of private firms and individuals. The AEC began its new uranium purchasing program by creating a procurement contract with Vanadium Corporation of America

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[135] Eric Mogren, "Mining the Atom: Uranium in the Twentieth-Century American West," in *Mining North America: An Environmental History since 1522*, ed. J.R. McNeill and George Vrtis (Oakland: University of California Press, 2017), 226; Eichstaedt, *If You Poison Us*, 33; *Atomic Energy Act of 1946*, Public Law 79-585, *U.S. Statues at Large* 60 (1946): 755-775; Robynne Mellor, "A Comparative Case Study of Uranium Mine and Mill Tailings Regulation in Canada and the United States," in *Mining North America: An Environmental History since 1522*, ed. J.R. McNeill and George Vrtis (Oakland: University of California Press, 2017), 257; Johnston, Dawson, and Madsen, "Uranium Mining and Milling," 117; Amundson, *Yellowcake Towns*, 21.

[136] John Emsley, *Nature's Building Blocks: An A to Z Guide to the Elements* (New York: Oxford University Press, 2001), 479-80; Howard W. Blakeslee, "Colo. Uranium Field is World's Second Largest," *Farmington Daily Times*, 22 May 1951; International Atomic Energy Agency, *Geological Environments of Sandstone-Type Uranium Deposits* (Vienna: IAEA, 1985), 11-4, 196-9; Mogren, "Mining the Atom," 226; Eichstaedt, *If You Poison Us*, 35-6.

in 1947. Along with selling uranium to the AEC from its existing vanadium mines, Vanadium Corporation of America sent prospectors across the West in search of new deposits. After giving Vanadium Corporation of America a head start in the great uranium hunt, the AEC opened offices in Arizona, Colorado, New Mexico, and Utah to attract additional would-be suppliers. The offices promoted uranium prospecting and offered $10,000 to those individuals who located high-grade deposits. The offices also served as uranium buying stations. The AEC offered a $3.50 bonus per pound of uranium as well as price guarantees and hauling allowances. The AEC's high demand for uranium combined with its incentive programs to entice both large mining corporations and the average westerners whom wanted to try their luck at locating and extracting the ore. Price guarantees minimized risk for large firms and ensured that the uranium industry was immune to price fluctuations associated with supply and demand. Meanwhile, the bonus programs gave the poorest westerners a sense that they could "get rich quick" if they located just one major lode.[137] Altogether, these programs created a structured uranium market with little economic risk. The story of uranium mining is not a tale of corporate excess in a laissez-faire system. Nor is it a story of a capricious supply and demand cycle with typical booms and busts. Rather, it is a story of an artificial marketplace curated by the federal government.

The AEC gathered data for would-be prospectors and mining firms by surveying the West for uranium formations. Take, for example, the AEC's explorations of Wyoming and Montana. Throughout the 1950s, AEC flew above the two states and surveyed airborne radiation anomalies. When airplanes located abnormal radiation levels, they radioed ground crews to

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[137] Eichstaedt, *If You Poison Us*, 35-6; Mogren, "Mining the Atom," 226; "New Mexico: How to Find Uranium," *Time*, 25 December 1950; Harold Eugene Shumway, interview by Dorothy Erick and Suzanne Simon, 23 July 1970, 15, 67, 109, Utah Uranium Oral History Project, J. Willard Marriott Library Special Collections, University of Utah, Salt Lake City, Utah (hereafter Shumway Interview).

examine the area for uranium deposits. This process led to the creation of hundreds of mines in Wyoming's Power River Basin and in Jefferson County, Montana.[138]

The U.S. Geological Survey (USGS) joined the AEC in facilitating the great uranium hunt. During the first few decades of the Cold War, the USGS assigned more than a hundred geologists to examine the West and craft reports on uranium deposits. The USGS primarily focused on the Colorado Plateau, but also investigated metal-mining districts across the West. Field work consisted of radiometric reconnaissance, sampling, searching for favorable geologic criteria, geologic mapping, and detailed geologic studies. After investigating potential deposits, the USGS issued guides and maps to prospectors and miners.[139]

Because the AEC and the USGS published the results of their surveys, some firms preferred to conduct their own surveys in order to monopolize knowledge of the lodes. In May 1952, the Homestake Mining Company of Lead, South Dakota, surveyed Wyoming's Black Hills region. The airborne surveyors found radiation anomalies and "good exposures" of carnotite two miles south of Carlile. After locating the uranium deposit, the company immediately claimed all

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[138] E.W. Grutt, interview by Richard Gibbs and Greg Brolin, 28 July 1970, 7, 11-3, 15, Utah Uranium Oral History Project, J. Willard Marriott Library Special Collections, University of Utah, Salt Lake City, Utah; Raymond E. Langden and A.L. Kidwell, "Geology and Geochemistry of the Highland Uranium Deposit," *Wyoming Geological Association Earth Science Bulletin* (December 1973): 41-48; U.S. Department of the Interior, U.S. Geological Survey, *Preliminary Report on the Comet Area, Jefferson County, Montana*, by George E. Becraft, Geological Survey Circular 277 (Washington, D.C.: U.S. Government Printing Office, 1953), 1,7; U.S. Department of the Interior, U.S. Geological Survey, *Geology of the Area Adjacent to the Free Enterprise Mine, Jefferson County, Montana*, by W.A. Roberts and A.J. Gude 3d, Geological Survey Bulletin 988-G (Washington, D.C.: U.S. Government Printing Office, 1953), 147.

[139] Mogren, "Mining the Atom," 226; Eichstaedt, *If You Poison Us*, 35-6; U.S. Department of the Interior, U.S. Geological Survey, *Uranium in the Metal-Mining Districts of Colorado*, by R.U. King, B.F. Leonard, F.B. Moore, and C.T. Pierson, Geological Survey Circular 215 (Washington, D.C.: U.S. Government Printing Office, 1953), 2, 4, 6, 11. The USGS created dozens of uranium reports. For a comprehensive list of the early reports, see U.S. Department of the Interior, U.S. Geological Survey, *Bibliography of U.S. Geological Survey Reports on Uranium and Thorium, 1942 through May 1958*, by Paul E. Soister and Dora R. Conklin, U.S. Geological Survey Bulletin 1107-A (Washington, D.C.: U.S. Government Printing Office, 1959).

open government land in the vicinity and obtained leases for several thousand acres of private property in the area. Homestake Mining began drilling in the summer of 1952 and found uranium ore in the upper part of the Lakota sandstone formation. To ensure that its workers did not pocket the ore, the company employed only five trusted laborers to work the deposit.[140]

A variety of electronics companies also helped facilitate the great uranium hunt. Beginning in the late 1940s, a handful of electronics firms manufactured portable Geiger counters en masse. These devices detected radiation and made prospecting easy. All a person had to do was purchase a Geiger counter, pass it over an exposed rock formation, and wait to hear it click. In other words, you did not need to know anything about geology to locate a surface uranium vein. All you needed to know was whether your counter was clicking or not. The most abundant and economical Geiger counter of the era was Detectron's DG-2. Manufactured in Los Angeles, California, the DG-2 weighed just over five pounds, cost just $37.50, and could be purchased through the mail. Acquiring this device was easy for most westerners, who on average took home $137.50 in pay every two weeks from their blue-collar jobs in 1950. Over the span of three years, Detectron sold over 20,000 Geiger counters to would-be prospectors.[141]

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140 J.O. Harder, "Homestake Uranium Operations in Wyoming," 2 December 1953, Uranium—Miscellaneous Reports and Letters File, Wyoming State Geological Survey, Laramie, Wyoming.

141 Robert Blanc, interview by Linda West, August 1970, 24-5, Utah Uranium Oral History Project, J. Willard Marriott Library Special Collections, University of Utah, Salt Lake City, Utah (hereafter Blanc Interview); U.S. Atomic Energy Commission, *Geiger Counter Radiation Meter*, by William H. Hinch (Oak Ridge: Atomic Energy Commission, 1947); Detectron Corp., "Find Uranium!!," advertisement, 1953, in author's possession; U.S. Department of Commerce, Census Bureau, *Income of Families and Persons in the United States: 1950* (Washington, D.C.: U.S. Government Printing Office, 1952), 1-2; Curt Cassingham, "Larry Cassingham, 1917-2007," 19 June 2005, https://www.curtcass.com/detectron/. Larry Cassingham owned and operated Detectron. His son, Curt, created the above website to tell his father's story.

Figure 4: A wildcatter searching for uranium in the American West. n.d. Image HD.11D.026. Photograph courtesy of the U.S. Department of Energy.

While an average westerner could easily acquire a uranium guidebook, purchase a Geiger counter, and prospect for the ore, natural processes favored large firms when it came to actually mining the most productive deposits. Average westerners could easily mine surface lodes. These outcrop deposits required little capital to work. All a prospector needed was a few cheap tools, such as picks, shovels, and wheelbarrows, to exhume the ore from the earth. Yet, outcrop lodes were typically small and yielded little profit. It was more difficult for individuals to discover deeper deposits because of the limits of the portable Geiger counter technology. If a lone prospector happened to find a deeper deposit, they typically would have to sell or lease their find to an established firm that had enough capital to excavate the lode using traditional mining methods. Working these deeper, more profitable, deposits required heavy equipment, the construction of mining shafts, and cash to pay dozens of laborers. If not properly ventilated, the underground uranium mines exposed workers to radon gas, a chemical that causes lung cancer. Prospector No. 1 Mine outside of Marysvale, Utah, provides an example of this process. In 1948, local prospectors Rex Smith and Leonard and Merle Anderson, found a uranium outcrop that led to a deeper deposit. After staking their claim, the trio realized they did not have the capital to exhume the lode. Thus, the group leased their claim to Vanadium Corporation of America. The company took to the landscape weeks later, using bulldozers to trench the deposit. The firm spent little cash on ventilating the mine shafts and, consequently, its miners were exposed to large amounts of radon gas. As we shall see in a later chapter, this exposure to radon caused the miners to develop lung cancer years later.

Figure 5: Hand-loading ore in a uranium mine on the Colorado Plateau. c. 1957. Image HD.11D.054. Photograph courtesy of the U.S. Department of Energy.

In some cases, firms opted to excavate the deeper lodes using open-pit methods. This process entailed drilling and blasting overburden to expose the ore body and using loaders and dump trunks to excavate the ore above ground. Open-pit mining blasted away hilltops and eroded valleys. It contributed to the formation of sinkholes and pushed mine effluent into the groundwater. Although this process was more environmentally destructive than underground mining, it was safer from a human health standpoint. As miners excavated the open pits, other workers sprayed the exposed area with water to suppress airborne dust. This kept open-pit miners from breathing radon gas as they worked the deposit.[142]

Not only did large firms have the advantage when it came to mining deep deposits, they also were favored by AEC leadership. The first chairman of the AEC was David Lilienthal. While leading the AEC from October 1946 through February 1950, Lilienthal pushed the commission to procure uranium to both manufacture nuclear weapons and supply experimental nuclear power plants. In truth, Lilienthal was far more interested in harnessing the atom for peaceful energy purposes than he was in pursuing nuclear armaments. As the former director of the Tennessee Valley Authority (TVA), he believed that abundant power supplies, whether water-based or nuclear-based, could transform any economically-backward area. However, at the time, coal was cheap and the power industry was not interested in Lilienthal's nuclear power vision. In an effort to court the power firms towards nuclear energy, Lilienthal pushed the AEC

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[142] Mellor, "A Comparative Case Study of Uranium Mine and Mill Tailings Regulation in Canada and the United States," 265-7; Johnston, Dawson, and Madsen, "Uranium Mining and Milling," 115; Shumway interview, 4, 36, 38, 41; U.S. Department of Health and Human Services, Public Health Service, Agency for Toxic Substances & Disease Registry, "Public Health Statement: Radon," May 2012, https://www.atsdr.cdc.gov/ToxProfiles/tp145-c1-b.pdf; U.S. Department of the Interior, U.S. Geological Survey, P*reliminary Examination of Uranium Deposits near Marysvale, Piute County, Utah*, by Harry C. Granger and Herman L. Bauer, Jr., Trace Elements Memorandum Report 33 (Washington, D.C.: U.S. Government Printing Office, 1950), 3-4, 23-7; Jin Li, Tong Tong Zhang, Wen Yang, and Yu Zhang, "The Environmental Impact of Mining and Its Countermeasures," *MATEX Web of Conferences* 63 (2016): 1-7.

to craft uranium mining policies that would entice big business. Simply put, Lilienthal believed that if the AEC could attract large firms towards uranium mining, the companies would then seek to maximize their earnings by undergoing vertical integration and establish nuclear power reactors.[143]

Lilienthal also favored established firms for philosophical reasons. "My conviction about Big Business," Lilienthal wrote, "is that it represents a proud and fruitful achievement of the American people as a whole; that in Big Business we have more than an efficient way to produce and distribute basic commodities, and to strengthen the nation's security; we have a social institution that promotes human freedom and individualism." Lilienthal believed that big business had "evolved" since the era of the robber barons into a force that provided "an opportunity to build the physical basis for an even stronger democracy and an even greater people."[144] According to Lilienthal, big businesses enriched the American economy and thereby afforded more individual freedoms to Americans. He argued that commonplace fears about big business, such as the notion that monopolies hurt American workers and undermined American democracy, were emotional responses not grounded in factual analysis. When it came to uranium mining, Lilienthal maintained that "big business" had the technical expertise and efficient business practices to exhume the ore "in the most effective way possible." He also maintained

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143 "Truman Atom Board Text," *New York Times*, 29 October 1946; Anthony Leviero, "Lilienthal Wins Senate Vote, 50-31, as U.S. Atom Head," *New York Times*, 10 April 1947; Rebecca S. Lowen, "Entering the Atomic Power Race: Science, Industry, and Government," *Political Science Quarterly* 102, no. 3 (October 1987): 466-8; David E. Lilienthal, *Change, Hope, and the Bomb* (Princeton: Princeton University Press, 1963), 103-4. For information on Lilienthal's role in the Tennessee Valley Authority, see Willson Whitman, *David Lilienthal: Public Servant in a Power Age* (New York: Henry Holt and Company, 1948).

144 David E. Lilienthal, *Big Business: A New Era* (New York: Harper & Brothers Publishers, 1953), ix.

that working with individual prospectors, whom often only procured low-grade surface ore, would be too time consuming and expensive and therefore "wouldn't be worth the trouble."[145]

A few AEC policies illustrate its favoritism towards big business. Under Lilienthal's leadership, on April 11, 1948, the AEC began offering a $10,000 bonus for twenty tons of uranium ore containing twenty percent or more triuranium octoxide, the most stable form of uranium. This compound, commonly referred to as yellowcake, was primarily found in deep uranium deposits. Consequently, this new bonus program primarily benefitted established firms that had the capital to exhume ores rich in triuranium octoxide. The AEC's public-domain lease program provides another example of the commission's partiality towards big business. Beginning in 1949, the AEC withdrew some 700 square miles of the public domain lands in the Colorado Plateau that contained deep uranium deposits. The AEC then divided these lands into 49 leased areas and issued the leases to a handful of large firms, such as Climax Uranium Company, in return for a royalty on ore production.[146] None of these policies benefitted individual prospectors. In fact, it placed them at a competitive disadvantage.

The AEC's favoritism towards big business outlasted Lilienthal's tenure at the commission. Throughout the 1950s and the 1960s, the AEC created additional programs to support large firms. Between 1951 and 1958, for example, the AEC partnered with the Bureau of Public Roads to create over 1,200 miles of roads in the Colorado Plateau, South Dakota, and

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145 Lilienthal, *Big Business*, 112. David E. Lilienthal, *The Journals of David E. Lilienthal, Volume II: The Atomic Energy Years, 1945-1950* (New York: Harper & Row, Publishers, 1964), 231. For more on Lilienthal's claim that big business skepticism was founded in "feelings" and not "facts," see Lilienthal, *Big Business*, 3-12.

146 U.S. Atomic Energy Commission, "Domestic Uranium Program Circular 2," *Federal Register*, Document 48-3425, 11 April 1948; Holger Albrethsen Jr. and Frank E. McGinley, *Summary History of Domestic Uranium Procurement Under U.S. Atomic Energy Commission Contracts Final Report* (Oak Ridge: U.S. Department of Energy, 1982), 6-7; U.S. Department of the Interior, U.S. Bureau of Mines, *Underground Mining Methods and Costs at Three Salt Wash Uranium Mines of Climax Uranium Co.*, by W.L. Dare (Denver: Bureau of Mines, 1959), 1-2, 5.

Wyoming, to link deep uranium deposits to corporate buildings.[147] To further support Big Uranium, the AEC financed exploratory drilling and issued loans to struggling firms. The history of Pumpkin Point, Utah, illustrates both of these forms of federal favoritism. In 1951, the AEC contracted the U.S. Bureau of Mines to drill 2,450 feet in Utah's Silver Reef mining district to identify uranium deposits for corporate development. The bureau drilled thirteen holes around Pumpkin Point, approximately seventeen miles north of St. George. Although the drills did not reveal large uranium veins, private companies still took to Pumpkin Point and extracted what they could from the land. In April 1952, the New York firm Western Gold Mines, Inc., began mining Pumpkin Point for uranium ore. The deposit yielded "a few hundred tons" of uranium.[148] However, production began to dry up in May 1953. Fearing that Pumpkin Point's declining production would threaten the financial future of the firm, the AEC issued a loan to Western Gold Mines to secure the company's finances and keep the Pumpkin Point project afloat. Individual prospectors received none of these benefits. The AEC and the Bureau of Public Roads did not pave new tracks for small-time prospectors. The AEC did not contract the Bureau of Mines to conduct exploratory drilling for individual westerners. Nor did the AEC bail out struggling mines owned by individual westerners.[149]

Westerners were slow to recognize that the AEC and natural processes favored established firms. The state's high demand for uranium, the healthy supply of USGS and AEC uranium reports, and the availability of Geiger counters seemed to signal that the great uranium

[147] Albrethsen and McGinley, *Summary History of Domestic Uranium Procurement Under U.S. Atomic Energy Commission Contracts Final Report*, 8.
[148] U.S. Department of the Interior, U.S. Geological Survey, *Physical Exploration for Uranium During 1951 in the Silver Reef District, Washington County, Utah*, by Frederick Stugard, Jr. (Washington, D.C.: U.S. Government Printing Office, 1954), 6-7, 21, 17.
[149] U.S. Geological Survey, *Physical Exploration for Uranium During 1951 in the Silver Reef District, Washington County, Utah*, 46.

hunt was an egalitarian endeavor. Consequently, thousands of westerners, including experienced miners, cattle hands, drifters, mechanics, engineers, and construction workers, left their jobs and families. These entrepreneurs, or wildcatters, enlisted in the atomic workforce and scoured the West in search of the precious ore. Most failed to find the most profitable deposits.[150]

To be sure, a handful of wildcatters struck it rich, overcoming the federal policies and natural processes that favored Big Uranium. Harold Shumway was one of these lucky westerners. Shumway grew up poor in rural Utah. One of twelve children, Shumway had to fend for himself at a young age. “I made my own way since I was probably 11 or 12 years old,” he said. When he was “14 or 15,” Shumway began prospecting and mining uranium with his brothers at Hideout Mine at White Canyon in San Juan County. This was a primitive endeavor, featuring wheelbarrows, horses, and carts. To Shumway, this kind of rugged labor was a way of life. But it was not without its dangers. One of Shumway’s brothers was killed in a mining accident. Another lost an eye and a finger. Shumway understood the risks involved in mining uranium and persevered. After locating numerous lodes, Shumway collected AEC finding-bonuses and invested in heavy equipment which he used to deliver ten thousand pounds of uranium to an AEC buying station. The AEC rewarded him with a $35,000 bonus for the yield.[151] Uranium proved so profitable that Shumway opened mine after mine to maximize his earnings. In 1954, he opened Payday Mine on Elk Ridge in San Juan County. After working the mine for nearly a decade, Shumway opened Look Mine two miles south of Payday in 1964. Although he was married, Shumway spent most of his time living on the mining range. He stopped by his home once or twice a week. The business proved so lucrative that Shumway

[150] Blanc Interview, 24-5; Shumway Interview, 4, 36-41.
[151] Shumway Interview, 1-2, 12, 56-8, 19, 15.

began to worry that his kids would "not have to do anything" and not know what it was like to struggle and make their own way. In addition to securing the AEC bonuses, Shumway made money by buying and selling unexplored mineral deposits. One firm gave Shumway $40,000 for a mine he believed was worth less than $5,000. Shumway's story was nothing short of a rags-to-riches tale. After accumulating enough cash, Shumway began investing in real estate and stocks.[152]

Charlie Steen was another fortunate wildcatter. Steen received a bachelor's degree in geology in 1943 from the Texas College of Mines and Metallurgy. Because of his poor eyesight, Steen was ineligible for the draft and spent World War II working as a petroleum geologist in Bolivia and Peru. After the war, Steen moved to Houston and took a job doing field work for the Standard Oil Company of Indiana. Standard Oil fired him two years later for insubordination. On the brink of financial collapse, Steen could not find an oil job because of his bad reputation. Then, one day, Steen read the December 1949 issue of *The Engineering and Mining Journal* and learned about the AEC's uranium mining incentives. Recognizing that the most valuable lodes were hidden deep underground, Steen borrowed $1,000 from his mother to purchase drilling equipment and headed to the Colorado Plateau to try his hand at prospecting. He brought his wife and children with him. The family lived out of a tarpaper shack in Cisco, Utah, while Steen traversed the landscape looking for uranium. Impoverished, the family often went to bed hungry. To make matters worse, Steen's wife came down with pneumonia. Her medical bills decimated what little savings the family had. Finally, on July 6, 1952, Steen was drilling through layer of sandstone when his drill bit broke off at 197 feet. He took a sample to a friend's house to be

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[152] Ibid., 1-2, 58-9, 57, 65, 63.

tested with a Geiger counter. The counter clicked several times. Steen had found a high-grade uranium deposit at Big Indian Wash in Lisbon Valley, southeast of Moab, Utah.[153]

Steen's discovery changed his life. After collecting the $10,000 high-grade finding bonus, Steen purchased excavation equipment and hired dozens of local laborers to work the deposit. He raked in millions selling the ore. Recognizing the importance of the deposit to his livelihood, Steen named the mine "Mi Vida"—my life. Flushed with cash, Steen built a $250,000 hilltop mansion in nearby Moab, fitted with a swimming pool, greenhouse, and a servants' quarters. He also formed several companies to continue his uranium work, including Utex Exploration Company, Moab Drilling Company, Mi Vida Company, Uranium Reduction Company, and Big Indian Mines, Inc. After transitioning from humble wildcatter to newfound member of Big Uranium, Steen showed off his wealth, inviting all of Moab to annual parties in a local airport hangar. Newspapers called it "a Texas-size affair." Steen encased his original prospecting boots in bronze. He purchased a private plane and flew to Salt Lake City every week for rumba lessons. He gave back to the community, too, donating $50,000 towards the construction of a new hospital in Moab. United Press turned Steen's story into a television program. "I Found Sixty Million Dollars" chronicled Steens' rags-to-riches tale and starred

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153 Mark Steen, "'My Old Man': The Uranium King, Part 1," *Canyon Country Zephyr*, February-March 2002; Ward Harkavy, "Fallout in the Family," *Westword*, 19 February 1998, https://www.westword.com/news/fallout-in-the-family-5058350; Lisa J. Church, "'Uranium King' Altered Moab 'Forever,'" *Salt Lake Tribune*, 17 October 2013; '"End of an Era: The Uranium King is Dead," *Moab Times-Independent*, 22 March 2006; Mark Steen, "'My Old Man': The Uranium King, Part 2," *Canyon Country Zephyr*, April-May 2002; Buckley Jensen, "Charles Steen-The Uranium King of San Juan," *San Juan Record*, 6 May 2009; Mark Steen, "'My Old Man': The Uranium King, Part 4," *Canyon Country Zephyr*, August-September 2002; Russel Nielsen, "Made Fortune in Uranium, Prospector Fights to Keep it," *Milwaukee Journal*, 16 October 1968; Gerald D. Nash, *The Federal Landscape: An Economic History of the Twentieth-Century West* (Tucson: University of Arizona Press, 1999), 66.

Jackie Cooper. Eventually, Steen's popularity sent him to the Utah State Senate. Steen's story resonated with thousands. It was an example of the American Dream come true.[154]

Steen's find inspired westerners to gather in Moab, hoping to duplicate his rags to riches tale. First established by cattle ranchers in 1879, Moab had grown into a commercial center for agriculture and mining by the 1950s. Yet, the town remained quite small, containing only 1,200 people as late as 1951. The wildcatter rush to Moab transformed the settlement. In 1954, the town swelled to 1,800. In 1956, 1,200 more wildcatters arrived, fighting for places to live and spaces to rent in the city's hotels and motels. Trailer courts sprouted around town and claim stakes covered its hinterlands. The boom caused property values to skyrocket, leaving poor wildcatters with high rent bills and little income. The housing costs in Moab soared even higher as tourists flocked to the city throughout the 1950s to see the nearby mountains and valleys that John Ford had filmed in *Wagon Master* and *Rio Grande.* As Moab collected prospectors and tourists, Steen stepped in, financing the construction of new neighborhoods and donating cash and land to local charities to help the struggling prospectors. His efforts temporarily helped alleviate the housing crisis in Moab, but ultimately only encouraged more wildcatters to flock to the city in search for riches.[155]

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[154] Mark Steen, "'My Old Man': The Uranium King, Part 1," *Canyon Country Zephyr*, February-March 2002; Ward Harkavy, "Fallout in the Family," *Westword*, 19 February 1998, https://www.westword.com/news/fallout-in-the-family-5058350; Lisa J. Church, "'Uranium King' Altered Moab 'Forever,'" *Salt Lake Tribune*, 17 October 2013; '"End of an Era: The Uranium King is Dead," *Moab Times-Independent*, 22 March 2006; Mark Steen, "'My Old Man': The Uranium King, Part 2," *Canyon Country Zephyr*, April-May 2002; Buckley Jensen, "Charles Steen-The Uranium King of San Juan," *San Juan Record*, 6 May 2009; Mark Steen, "'My Old Man': The Uranium King, Part 4," *Canyon Country Zephyr*, August-September 2002; Russel Nielsen, "Made Fortune in Uranium, Prospector Fights to Keep it," *Milwaukee Journal*, 16 October 1968; Mack Turner, "This, That, and the Other," *Moab Times Independent*, 9 June 1955; "The Vigor of Pres. McKay; Charlie Steen; The Aqualantes," *Logan Herald Journal*, 14 February 1955.

[155] Amundson, *Yellowcake Towns*, 55, 57; "Moab in Resume," *Moab Times Independent*, 24 March 1955; Susan R. Van Patten, "Sources of Recreational and Community Conflict from Tourism in Moab, Utah" (Master's thesis, Utah State University, 1996), 3; Lisa J. Church, "'Uranium King' Altered Moab 'Forever,'" *Salt Lake Tribune*, 24 March 2006.

Other wildcatters gathered in Grand Junction, Colorado. Established in 1882, Grand Junction began as a small peach-growing community in western Colorado. Over the next sixty years, the town became a hub for the Denver and Rio Grande Railroad, developed its own junior college, and cemented its position as the dominant town of the Western Slope. In December 1947, the AEC established the Colorado Raw Materials Office in Grand Junction to serve as the central hub of the AEC's uranium purchasing program. Although the AEC created several buying stations across the West, its Grand Junction offices administrated nearly all of its uranium procurement contracts. As the AEC took root in Grand Junction, nearly three thousand wildcatters flooded into the town and began searching for uranium outcrops nearby. For nearly two years, wildcatters dominated uranium procurement in Grand Junction. Then Big Uranium took notice.[156]

In 1950, Climax Uranium Company opened an office in Grand Junction hoping to seize control of the nearby uranium fields. As the wildcatters sold low-grade ore at the AEC buying station, Climax Uranium sent scouts into the region to claim both low-grade outcrops and deeper deposits at Calamity Mesa and Outlaw Mesa. All the while, Climax Uranium negotiated with the commission to construct a mill in Grand Junction to process its raw ore into the more-profitable yellowcake. In July 1950, the AEC and Climax Uranium forged Contract No. AT (49-1)-526, which allowed the firm to construct its mill and sell yellowcake to the commission for $10.71 per pound. The City of Grand Junction supported the plan, allowing Climax Uranium to construct

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[156] Carl Abbott, Stephen J. Leonard, and Thomas J. Noel, *Colorado: A History of the Centennial State* (Boulder: University Press of Colorado, 2005), 116-7, 309, 172-3; Albrethsen and McGinley, *Summary History of Domestic Uranium Procurement Under U.S. Atomic Energy Commission Contracts Final Report*, 3; United States Vanadium Company, *Mesa Miracle, in Colorado, Utah, New Mexico, Arizona* (New York: Union Carbide and Carbon Corporation, 1953), 5-7; United States Bank of Grand Junction, "The United States Bank of Grand Junction Welcomes You to Western Colorado," brochure, 1960, in author's possession.

the mill on city-owned property next to the Colorado River. Taken together, Climax Uranium's prospecting efforts and its move towards vertical integration limited the opportunities for wildcatters in the town. Individual wildcatters struggled to compete with Climax Uranium's coordinated horde of prospectors and knew that the completion of the mill would provide the firm with more capital to expand its prospecting efforts. Consequently, wildcatters gave up their status as entrepreneurs and became Climax contractors. Others left the town in search of uranium fields still undiscovered by Big Uranium.[157]

Some wildcatters traveled to Edgemont, South Dakota. In 1951, Rapid City resident Jerry Brennan found a uranium deposit in Craven Canyon near Edgemont along the southern edge of the Black Hills. Brennan placed his ore on a train headed to the AEC buying station in Grand Junction. After purchasing Brennan's lode, the AEC established a new buying station in Edgemont in late 1952. Within a few months, wildcatters from across the West flocked to Edgemont and staked more than 700 claims in its hinterlands. As the wildcatters worked the Black Hills, Big Uranium took notice. In 1955, Mines Development Company, a subsidiary of the Chicago-based holding company Susquehanna Corporation, forged a contract with the AEC to build a uranium mill at Edgemont. Shortly after Mines Development opened its mill, another subsidiary of Susquehanna Corporation, Susquehanna-Western, sent prospectors into Edgemont's hinterlands to claim both outcrops and deeper deposits in the name of vertical integration. As Susquehanna Corporation consolidated control of Edgemont's uranium industry, the wildcatters suffered. In 1958, the local prospector Roy Chord complained to local

[157] Ford, Bacon & Davis Utah Inc., *A Summary of the Engineering Assessment of Inactive Uranium Mill Tailings, Grand Junction Site, Grand Junction, Colorado* (Albuquerque: U.S. Department of Energy, Albuquerque Operations Office, 1981), 1-7; Albrethsen and McGinley, *Summary History of Domestic Uranium Procurement Under U.S. Atomic Energy Commission Contracts Final Report*, A-15-A-16; Lisa Pitcher Godfrey, "Mining the Colorado Plateau: The Story of Calamity Mesa, 1910-1970" (Master's thesis, Utah State University, 1991), 57, 59; United States Vanadium Company, *Mesa Miracle*, 5-7.

government officials that "small-time miners" were being "squeezed out." One year later, Alan Gray, a Susquehanna Corporation executive, declared that "the day of the Sunday uranium miner is now over." Edgemont's wildcatters, and their pickaxes and wheelbarrows, had been replaced by an integrated uranium firm and its heavy equipment. Gray also indicated that his company would soon sell uranium to nuclear power plants. Lilienthal's plan had paid off. By attracting big businesses towards uranium mining, the AEC tactfully led corporate America towards producing nuclear energy.[158]

Wildcatters also descended on Salmon, Idaho. However, big business and the region's small uranium holdings quickly pushed them out of town. Salmon began as a gold rush town. In 1866, F.B. Sharkey struck gold in nearby Leesburg. Within a year, gold prospectors from across the West flocked to the region and formed Salmon. By 1870 the Leesburg gold rush collapsed, leaving Salmon in a lurch for the next seventy years. Then, in February 1955, one Salmon man, Charles McConnell, discovered a uranium outcrop just outside of town along the Salmon River. By April, over one hundred prospectors had flooded into Salmon and staked 400 claims along the river. Local general stores supported their efforts, stocking hundreds of Geiger counters to collect prospector dollars. As the wildcatters filled local hotels and motels, word spread across the country of the new uranium field. By the end of May, the G&G Mining Company, of Cortez, Colorado, took over the region. Its prospectors claimed both small outcrops and deeper deposits,

[158] Olin M. Hart, *Ore Deposits in the United States, 1933-1967* (New York: American Institute of Mining Engineers, 1968), 832-7; "Regulations and Policies Made for Uranium Prospectors in Black Hills," *Mitchell Daily Republic*, 21 March 1952; "Cartonite Ore Mined in Hills," *Huronite and Daily Plainsman*, 6 July 1952; U.S. Department of the Interior, U.S. Geological Survey, *Uranium Deposits of the Black Hills, South Dakota, and Wyoming*, by C.S. Robinson and G.B. Gott, Trace Elements Investigations Report No. 723 (Washington, D.C.: U.S. Government Printing Office, 1958), 4, 7, 9; "Foss Helps Dedicate Uranium Plant; Points to Edgemont as Pittsburgh of Atomic Age; Sees Bright Future," *Huronite and Daily Plainsman*, 26 June 1955; Seth Tupper, "Radioactive Legacy, Part 1 of a Journal Special Report: A Yellowcake Gold Rush," *Rapid City Journal*, 1 November 2015.

dynamiting and drilling along the Salmon River without delay. Unfortunately for all, there was not much uranium to be had in Salmon. G&G Mining recovered only 11 tons of uranium ore from the land. As G&G Mining prospectors continued their search, wildcatters packed their bags and left town.[159]

As wildcatters and corporations scoured the West for uranium, the Navajo Nation took notice. For hundreds of years, the Navajo farmed and ranched on more than 25,000 square miles of the West. Their homeland, Diné Bikéyah, was situated between four sacred mountains: Tsisnaajinii (Blanca Peak) to the east, Tsoodzil (Mounta Taylor) to the south, Dook'o'oosliid (San Francisco Peak) to the west, and Dibe' Ntsaa (Mount Hesperus) to the north. It stretched across parts of Arizona, New Mexico, and southeast Utah. By the late 1940s, Diné Bikéyah was an impoverished Navajo Reservation. New Deal stock reduction programs had culled Navajo sheep herds, dealing a blow to the native economy. World War II temporarily relieved economic pressure when thousands of Navajo men enlisted in the service. When the war ended, the servicemen returned to Diné Bikéyah and searched for employment.[160] In this context, the Navajo Tribal Council contemplated leasing reservation land for uranium development in order to bring more economic opportunities to its people.[161]

Other Indigenous nations had leased their mineral deposits to private corporations for decades and, as a result, had grown rich in capital. Take the Osage Nation of Oklahoma, for

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[159] U.S. Department of the Interior, U.S. Geological Survey, *Principal Gold-Producing Districts of the United States*, by A.H. Koschmann and M.H. Bergendahl, Geological Survey Professional Paper 610 (Washington, D.C.: U.S. Government Printing Office, 1968), 120; "Uranium Hunters Stake Salmon Hills in Hurry," *Idaho Free Press*, 13 April 1955; Gene Klare, "Salmon Area Teeters on Edge of Uranium Boom," *Idaho State Journal*, 20 April 1955; Gene Klare, "Drilling Starts at Salmon Prospective Uranium Sites," *Idaho State Journal*, 21 April 1955; "McDowell Views Idaho Uranium," *Idaho State Journal*, 11 May 1955; "Boom Quiets in Salmon," *Idaho Free Press*, 27 May 1955.

[160] Voyles, *Wastelanding*, ix, 52. For more on Navajo stock reduction, see Marsha Weisiger, *Dreaming of Sheep in Navajo Country* (Seattle: University of Washington Press, 2009).

[161] Voyles, *Wastelanding*, 81.

example. In the early twentieth century, the Osage Nation leased its oil deposits to Phillips Petroleum Company, Sinclair Oil & Gas Company, Conoco Corporation, and several other firms. In return, the tribe received lease payments and royalties. To ensure that this arrangement benefitted tribal members, the Osage Nation implemented a headright program, providing each enrolled member with a share of the lease payments. This system proved profitable for the Osage. In 1923 alone, the tribe took in more than $30 million, making the Osage one of the wealthiest people per capita in the world. Yet, the Osage system did not shield the tribe from abuse. Firms ruthlessly attempted to separate the Osage Nation from its wealth, leading to a series of murders and robberies.[162]

In an attempt to follow in the economic footsteps of the Osage, the Navajo Tribal Council moved towards uranium mining. On October 14, 1949, the Navajo Tribal Council approved a resolution authorizing it "to study and actively consider such changes in procedures as are necessary for positive results in securing greater development of uranium…provided, that the interest of individual members of the Tribe shall be protected and individual Navajo initiative in mining shall be encouraged wherever possible." Furthermore, the resolution permitted "any Government Agency interested in and authorized to perform work in connection with the development of atomic energy to enter upon Navajo Tribal lands for study for geology and exploration work, provided that any information obtained shall be made available to the Navajo Tribe."[163] With this resolution, the Navajo Nation took a giant step towards uranium mining.

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[162] Kenny A. Franks, *The Osage Oil Boom* (Oklahoma City: Western Heritage Books, Inc., 1989), 55, 11; David Grann, *Killers of the Flower Moon: The Osage Murders and the Birth of the FBI* (New York: Vintage Books, 2017), 6, 57; Terry P. Wilson, *The Underground Reservation: Osage Oil* (Lincoln: University of Nebraska Press, 1985), ix, xii.

[163] Navajo Tribal Council, *Navajo Tribal Council Resolutions, 1922-1951* (Washington, D.C.: U.S. Government Printing Office, 1952), 336-7.

The Tribal Council pursued uranium solely to enrich its people, but the AEC had other plans. In its discussions with AEC officials, the Navajo Tribal Council insisted that the uranium companies employ only Navajos. Furthermore, the council maintained that uranium deposits be leased and ore sold through the Tribal Council and not through private mining corporations. These requirements would ensure that the Navajo nation would profit from the mining of reservation lands. These demands did not sit well with the AEC. Employing only Navajos and purchasing ore through the council meant that the AEC could only rely on the tribe, and not a horde of private companies and individuals, to procure uranium in Navajo country. The AEC Director of the Colorado Raw Materials Office Frank MacPherson argued that these restrictions limited potential suppliers and would slow deposit development. In other words, MacPherson maintained that these policies would not yield the economic development that the council sought. In 1950, MacPherson asked the council to ease its requirements for the sake of Navajo economic growth. Specifically, he called for the group to "authorize issuance of the license to white men as well as Indians." The Tribal Council adopted the suggestion, hoping that it would accelerate deposit development.[164] As a result, the Navajo Nation would not solely benefit from the mining of their uranium holdings. Mining and purchasing contracts would fall to Big Uranium, siphoning potential earnings from the Navajo Nation.

The next year, the council passed several resolutions to make sure that uranium dollars flowed into the tribe. These resolutions granted the Tribal Council the power to issue prospecting permits and forced ore producers to pay royalties to the tribe. The resolutions applied to outsiders

[164] Frank MacPherson, "Relations Between the Navajo Indian Tribe-Area Office of the Navajo Indian Reservation, and the U.S. Atomic Energy Commission," 13 November 1951, "Program Correspondence," box 3, National Archives Identifier 434-99-208, National Archives and Records Administration, Rocky Mountain Region, Denver, Colorado.

as well as members of the Navajo Nation that found uranium and developed individual mines.[165] With the permit and royalty programs in place, in April 1951, the Tribal Council adopted a resolution, at the suggestion of the AEC, that would "grant authority to the Commission and its contractors to perform such geological investigations and exploration for the discovery of uranium ores as the Commission might deem advisable, on any part of the Navajo Indian reservation for a period of three years." Months later, over a dozen established firms descended on 55 of the Navajo Nation's 100 chapters to prospect and mine uranium. Big Uranium had entered Indian territory.[166]

The opening of Navajo country combined with the AEC incentives to turn a few oil companies onto uranium mining. These firms had a distinct advantage over the wildcatters. Their expertise in drilling and geology gave them the ability to locate deeper deposits that Geiger counters struggled to detect. The average petroleum geologist could trace sandstone and other uranium-bearing formations underground and accurately appraise their depth below the surface and the direction they extended. The experienced petroleum geologist also knew how to analyze samples taken from the formations. Simply put, the oil geologists knew where to drill. In 1952, the Bureau of Indian Affairs (BIA) awarded a uranium mining contract to Kerr-McGee Oil

[165] Navajo Tribal Council, *Navajo Tribal Council Resolutions*, 304-7.
[166] MacPherson, "Relations Between the Navajo Indian Tribe-Area Office of the Navajo Indian Reservation, and the U.S. Atomic Energy Commission"; M.C. Bucklin to Paul Martin, 27 September 1951, "Program Correspondence," box 3, 434-99-208, National Archives and Records Administration, Rocky Mountain Region, Denver, Colorado; U.S. Environmental Protection Agency, U.S. Bureau of Indian Affairs, U.S. Nuclear Regulatory Commission, U.S. Department of Energy, Indian Health Service, Agency for Toxic Substances and Disease Registry, and Navajo Nation, *Federal Actions to Address Impacts of Uranium Contamination in the Navajo Nation* (Washington, D.C.: U.S. Government Printing Office, 2014), 1; David E. Wilkins, *The Navajo Political Experience* (New York: Rowman & Littlefield Publishers, Inc., 1999), 82-2, 88. The companies included Kerr-McGee Oil Industries, Foote Mineral Company, Vanadium Corporation of America, Climax Uranium Company, and Climax Molybdenum Company. See, "Navajo Miners Sue on Radiation," *New York Times*, 16 December 1979; Roy V. Hersey, *Forty-Ninth Annual Report of the State Mine Inspector* (Phoenix: Prescott Printing Co., 1960).

Industries, Inc. An Oklahoma-based oil company, Kerr-McGee hoped to diversify its industrial portfolio, take advantage of AEC incentives, and begin mining uranium on the Navajo Reservation. The Navajo Tribal Council endorsed Kerr-McGee's contract, viewing it as a job-creating initiative.[167]

To some extent, the council was correct. After securing its contract, Kerr-McGee hired one hundred Navajo men to work the uranium mines in the Lukachukai Mountains near Cove, Arizona. To celebrate its entry into uranium mining, Kerr-McGee held a two-day rodeo for its Navajo employees in Cove. Workers used mining equipment to construct the rodeo racetrack and supplied the event by riding out into public lands and hustling up stock. The Chairman of the Navajo Advisory Council, Sam Ahkeah, touched-off the event with a rousing speech. A Navajo miner served as the master of ceremonies, calling the event only in the Navajo language. The event included the traditional Navajo corn grinding song, led by Navajo women. More than 2,000 people attended the rodeo, including forty Navajo tribal dignitaries. Over time, Kerr-McGee and other uranium companies hired hundreds of Navajos to work as miners, guides, construction workers, and mechanics.[168]

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[167] "In Search for Uranium Deposits Oil Firms Have Advantage," July 1955, folder 1, box 58, Kerr-McGee Corp. Collection, Oklahoma Historical Society, Oklahoma City, Oklahoma; Johnston, Dawson, and Madsen, "Uranium Mining and Milling," 117; "Kermac Enters New Energy Field," *Kermac News*, Summer 1952, folder 1, box 82, Kerr-McGee Corp. Collection, Oklahoma Historical Society, Oklahoma City, Oklahoma; D.J. Wolff, "Aerial Exploration," *Kermac News*, Fall 1954, folder 2, Box 82, Kerr-McGee Corp. Collection, Oklahoma Historical Society, Oklahoma City, Oklahoma; Eichstaedt, *If You Poison Us*, xv.

[168] "Kermac Enters New Energy Field," *Kermac News*, Summer 1952, folder 1, box 82, Kerr-McGee Corp. Collection, Oklahoma Historical Society, Oklahoma City, Oklahoma; D.J. Wolff, "Aerial Exploration," *Kermac News*, Fall 1954, folder 2, Box 82, Kerr-McGee Corp. Collection, Oklahoma Historical Society, Oklahoma City, Oklahoma; Betty LeBron, "Navajo Uranium Employees Hold Two-Day Rodeo," *Kermac News*, Winter 1952, folder 1, box 82, Kerr-McGee Corp. Collection, Oklahoma Historical Society, Oklahoma City, Oklahoma; Eichstaedt, *If You Poison Us*, xv.

While Kerr-McGee hired Navajos to work its mines, other Navajos took to prospecting. Willie Cisco's family was struggling to make it through the winter of 1950. The family had few sheep and its farmlands were in disarray. Food was in short supply. Cisco had heard that the AEC was looking for uranium—and was willing to pay a lot for it. Cisco scraped together what money he had and purchased a Geiger counter and a sample of uranium ore. One cold morning, Cisco said goodbye to his family, gathered his Geiger counter and uranium sample, climbed his horse, and left his hogan for the nearby Lukachukai Mountains. He camped in the deep snow on a crest 8,500 feet up. The next day, Cisco tied his horse to a tree and made his way on foot down the steep slope to the edge of a sandstone cliff. He came to a headwall of a large box canyon when his Geiger counter began clicking. Cisco paused to investigate the rocks. They matched the ore sample in his pocket. Cisco could not claim the find for himself because the deposit was located on reservation property. Thus, Cisco reported the find to the Navajo Tribal Council. Months later, the council leased the site to the Walter Duncan Mineral Company. Although Cisco did not receive the balance of the profits from the find, he still drew royalties on every ton of ore mined from Cisco Mine, named in his honor. The royalty payments changed his life. Cisco used the money to feed his family, purchase a new pickup truck, improve his farmlands, and build up his herd of sheep.[169]

Cisco Mine not only helped the Cisco family; it benefitted the entire community. The mine employed dozens of local Navajos as drillers, loaders, and mechanics. Frank Blue Horse had no mining experience. He spoke no English. One day he showed up at Cisco Mine dressed in rags and ready to work. He got a job and ended up working at the mine for a year. By the time he quit, Blue Horse had saved up enough money to buy a spread of cattle. Other Navajo workers at

[169] Philip Newill, "The Whispering Mountains," *Arizona Highways*, July 1956, 4-5.

Cisco Mine earned enough money to support their own households and up to five other families in their community. Most built new homes, bought new cars, expanded their herds, and improved the irrigation systems on their farms. Some were apprehensive about the advent of uranium mining in their community. One man told a reporter that he thought "the white men" were "exploiting the Indians." Yet, in the same breath he admitted that his people were "getting more money than most of us ever saw before." Willie Cisco was proud that his discovery helped the community. "I have got money from my mine, yes. But I have done more than that. I have helped the Navajo Nation. I have given jobs to dozens of my people, and with what they earn they now live better," he said.[170]

Frank Nacheenbetah had a similar story. Nacheenbetah was a Navajo sheepherder. Like the Ciscos, the Nacheenbetahs were struggling through the winter of 1950. After buying a Geiger counter, Nacheenbetah journeyed into the Lukachukais and found a uranium deposit. After learning about Nacheenbetah's find, the Navajo Tribal Council leased the site to Climax Uranium. Like Willie Cisco, Nacheenbetah received royalty payments for his discovery. After feeding his family, Nacheenbetah built up his cattle and sheep herds and purchased two pickup trucks and a $7,000 house at Oak Springs, twenty-five miles north of the Lukachukais. By 1956, Climax Uranium had hired Nacheenbetah to work as a shift boss at his mine, Frank No. 1. His son, Frank, also worked at Frank No. 1 as a straw boss and maintenance man. His other son, Clifford, worked as a loader. Frank No. 1 was practically a family project. The Nacheenbetahs had become members of the atomic workforce.[171]

[170] Newill, "The Whispering Mountains," 6-8.
[171] Ibid., 5-6.

In addition to leasing its lands to uranium mining companies, the Navajo Nation worked with the AEC to issue mill contracts to private firms. In 1954, the Navajo Tribal Council and the AEC granted Kerr-McGee a contract to construct a milling station on 160 acres of reservation land on the banks of the San Juan River in Shiprock, New Mexico. This was a large-scale construction operation. Along with erecting the mill, Kerr-McGee needed to electrify the area, create roads, and build offices, houses, and apartment buildings.[172] On June 18, 1955, Kerr-McGee held an open house at its $3 million Shiprock mill. Speakers at the event included the president of the company, Dean A. McGee, the chairman of the board and the Oklahoma Senator Robert S. Kerr, the AEC bureaucrat Sheldon P. Wimpfen, and the Navajo Tribal Council Chairman Paul Jones. All praised the mill for bringing economic development to the region. Like they did at the Cove rodeo, Navajo women performed their traditional corn grinding song during the program. After the opening ceremony, 5,000 employees and members of the Navajo Nation ate a barbecue lunch and toured the plant. In the end, the plant employed 100 people, including 40 Navajos.[173] The mill primarily processed uranium ore gathered from the Lukachukai Mountains, forty miles to the west, but also used uranium from as far away as Moab. The completion of the mill attracted secondary industries to the region, including the production of

[172] "Background of Kerr-McGee Uranium Operations," 15 June 1955, folder 20, box 10, Addition Series, Robert S. Kerr Collection, Carl Albert Center Congressional Archives, University of Oklahoma, Norman, Oklahoma; "Processing Plant Construction Begun at Shiprock, New Mexico," *Kermac News*, Spring 1954, folder 2, box 82, Kerr-McGee Corp. Collection, Oklahoma Historical Society, Oklahoma City, Oklahoma; Dan Ketchum, "Navajo Construction Work Moving Rapidly at Shiprock," *Kermac News*, Winter 1953, folder 2, box 82, Kerr-McGee Corp. Collection, Oklahoma Historical Society, Oklahoma City, Oklahoma; Eichstaedt, *If You Poison Us*, 36.

[173] Kerr-McGee Oil Industries, Inc., "Press Release," 17 June 1955, folder 20, box 10, Addition Series, Robert S. Kerr Collection, Carl Albert Center Congressional Archives, University of Oklahoma, Norman, Oklahoma; "Uranium Mill Dedicated," *Kermac News*, Fall 1955, folder 2, box 82, Oklahoma Historical Society, Oklahoma City, Oklahoma.

chemicals, construction, and housing. The desert came alive.[174] Everyone seemed to be happy. The Navajo Nation got money for the land lease and royalties. Navajo workers received jobs in the mill. Kerr-McGee raked in profits. The AEC got its uranium. To be sure, the profits associated with the mill were not distributed equally. Navajo workers received far less cash than Kerr-McGee mill operators and executives. Nevertheless, the Shiprock Mill seemed to economically benefit all.[175]

The Shiprock mill processed uranium this way: As the ore came in, workers conveyed it into the screening plant where it was dried in a rotary drier and crushed into a fine powder. After the powder dried, a conveyer belt screened the ore into circular bins. Feeders and a conveyor belt sent the ore into the curing section of the plant. There, the ore traveled into a mixer containing water and concentrated sulfuric acid. After sitting in the concentration, the mixture discharged into curing cans and sat for several hours. From there, the cure went into a series of agitators to produce a pulp. Gravity pulled the pulp into a series of sand classifiers to separate the sand from the slime. The sand was then washed free of dissolved uranium salts and was sent onto a conveyer belt and into waste heaps. The slime was then pumped into a thickener after flocculating reagents were added. The thickened pulp was pumped into three additional thickeners and washed to remove the dissolved uranium salts. The final pulp was pumped to

[174] Lamar Lyons, "Uranium's Chauffeurs," *Kermac News*, Spring 1956, folder 3, box 82, Kerr-McGee Corp. Collection, Oklahoma Historical Society, Oklahoma City, Oklahoma; Mellor, "A Comparative Case Study of Uranium Mine and Mill Tailings Regulation in Canada and the United States," 265; Johnston, Dawson, and Madsen, "Uranium Mining and Milling," 117.

[175] "Uranium Mill," *Kermac News*, May 1957, folder 3, box 82, Kerr-McGee Corp. Collection, Oklahoma Historical Society, Oklahoma City, Oklahoma; "Kermac Uranium—on Stream!," *Kermac News*, Winter 1954-1955, folder 2, box 82, Oklahoma Historical Society, Oklahoma City, Oklahoma; Richard Rashke, *The Killing of Karen Silkwood: The Story Behind the Kerr-McGee Plutonium Case* (Ithaca: Cornell University Press, 2000), 44.

tailing ponds. The overflow liquid flowed into storage tanks and from there was pumped through a filter to clarify it for processing.[176]

Figure 6: Inside a Kerr-McGee Uranium Mill in New Mexico. 1959. Image 2817a, folder 1, box 27, Robert S. Kerr Collection, Photographs, Carl Albert Center Congressional Archives, University of Oklahoma, Norman, Oklahoma.

The mill proved so profitable that Kerr-McGee expanded its uranium operations in New Mexico. In August 1956, Kerr-McGee partnered with Anderson Development Corporation of Albuquerque and Pacific Uranium Mines Company of Los Angeles to create Kermac Nuclear Fuels, a company dedicated to mining uranium on Ambrosia Lake, a small, dry lakebed in northwest New Mexico. As owner of the majority interest, Kerr-McGee staffed and operated the new corporation. The company immediately began drilling and mining uranium from local

[176] Kerr-McGee Oil Industries, Inc., "Process Description, Shiprock Uranium Ore Concentrator, Shiprock, New Mexico," 16 June 1955, folder 20, box 10, Addition Series, Robert S. Kerr Collection, Carl Albert Center Congressional Archives, University of Oklahoma, Norman, Oklahoma.

sandstone deposits. A few local prospectors had already staked several hundred claims at Ambrosia Lake. However, when the wildcatters recognized that most of the surface deposits led to large underground veins, and that they did not have the capital to exhume these deposits, they sold their claims to Kerr-McGee. The Ambrosia Lake district was exceptional. Most uranium deposits contained less than one million tons of the ore. The deposit at Ambrosia Lake held 50 million tons of uranium. Kermac expected the mining operation to yield a gross value in excess of a billion dollars. In May 1957, Kermac signed an AEC contract and began constructing a mill in the region. As workers flooded into Ambrosia Lake, they created a new community, Milan. New homes, businesses, and civic clubs sprouted in the New Mexican desert. By the end of 1957, Milan contained twenty-five businesses, an Elks Lodge, a country club, and 2,000 people. Kermac's uranium mill was completed in 1958. It employed 126 workers and could process up to 3,360 tons of ore per day. The largest uranium mill in the country, it covered some 100 acres. As a result of its uranium gambit, Kerr-McGee posted record earnings over the next few years. The company reported total assets of $208 million in November 1960, more than 11 times greater than they were in 1950. To give back to the Ambrosia community, Kermac created and bankrolled a local elementary school. Once again, everyone seemed happy. The Navajo Nation received payments for the land lease and royalties. Navajo men received jobs. Kerr-McGee earned hundreds of millions of dollars. The AEC got millions of tons of uranium.[177]

[177] Kerr-McGee Oil Industries, Inc., "Press Release," 23 April 1956, folder 20, box 10, Addition Series, Robert S. Kerr Collection, Carl Albert Center Congressional Archives, University of Oklahoma, Norman, Oklahoma; Kerr-McGee Oil Industries, Inc., "Press Release," 20 July 1956, folder 20, box 10, Addition Series, Robert S. Kerr Collection, Carl Albert Center Congressional Archives, University of Oklahoma, Norman, Oklahoma; "A New Power in U.S. Uranium," *Kermac News*, September 1956, folder 3, box 82, Kerr-McGee Corp. Collection, Oklahoma Historical Society, Oklahoma City, Oklahoma; Kerr-McGee Oil Industries, Inc., "Press Release," 25 February 1957, folder 21, box 10, Addition Series, Robert S. Kerr Collection, Carl Albert Center Congressional Archives, University of Oklahoma, Norman, Oklahoma; Kerr-McGee Oil Industries, Inc., "Press Release," 3 May 1957, folder 21, box 10, Addition Series, Robert

While Big Uranium flooded into the Navajo Reservation, wildcatters uncovered uranium deposits near the Wind River Reservation. Located in central Wyoming, Wind River Reservation contained 2.2 million acres of land and thousands of Eastern Shoshone and Northern Arapaho people. Like many reservations, Wind River was impoverished. Most residents lived along the rivers in small allotment plots and eked out a living by growing wheat and oats and raising cattle. On September 9, 1953, a local prospector, Neil McNeice, discovered radioactive sandstone in the Gas Hills, less than fifty miles away from the reservation. The discovery received widespread publicity, drawing individual prospectors to Gas Hills. Within a year, the wildcatters staked "several hundred" claims in the region.[178]

Following the wildcatters' trail, three large uranium firms moved into the Gas Hills in 1954. Utah Construction & Mining Company, Vitro Minerals Corporation, and Western Nuclear, Inc. purchased most of the wildcatter claims and carved up the Gas Hills using dynamite and bulldozers. To support this new uranium field, in March 1955, the AEC opened a new buying station in Riverton, a small city that sat on the border of the Wind River Reservation.[179]

S. Kerr Collection, Carl Albert Center Congressional Archives, University of Oklahoma, Norman, Oklahoma; George H. Cobb, Untitled Article, *Kermac News*, June 1960, folder 11, box 58, Kerr-McGee Corp. Collection, Oklahoma Historical Society, Oklahoma City, Oklahoma; Kerr-McGee Oil Industries, Inc., "Press Release," 19 January 1961, folder 21, box 10, Addition Series, Robert S. Kerr Collection, Carl Albert Center Congressional Archives, University of Oklahoma, Norman, Oklahoma; Kermac Nuclear Fuels Corp., "The Kermac Story," folder 7, box 58, Kerr-McGee Corp. Collection, Oklahoma Historical Society, Oklahoma City, Oklahoma; Kerr-McGee Corporation, "Chronological History (Highlights) of Kerr-McGee Corporation," folder 3, box 24, Kerr-McGee Corp. Collection, Oklahoma Historical Society, Oklahoma City, Oklahoma; Amundson, *Yellowcake Towns*, 84-6, 90-1; "Uranium Firms Give Funds for Ambrosia Lake School," *Kermac Newsletter*, 4 September 1957, folder 3, box 82, Kerr-McGee Corp. Collection, Oklahoma Historical Society, Oklahoma City, Oklahoma.

[178] Tristan Ahtone, "Land Grab: What Happened on the Wind River Reservation?," *Wyoming Public Media*, 15 June 2012, https://www.wyomingpublicmedia.org/post/land-grab-what-happened-wind-river-reservation#stream/0; U.S. Department of the Interior, U.S. Geological Survey, *Preliminary Report on Uranium in the Gas Hills Area, Fremont and Natrona Counties, Wyoming*, by J.D. Love, Geological Survey Circular 352 (Washington, D.C.: U.S. Government Printing Office, 1954), 1-2

[179] U.S. Department of the Interior, U.S. Bureau of Mines, *Mining Practices at Four Uranium Properties in the Gas Hills, Wyoming*, by F.D. Everett, Bureau of Mines Circular 8151 (Washington, D.C.: U.S. Government Printing Office, 1963), 1-2, 5.

Figure 7: An open-pit uranium mine in Gas Hills, Wyoming. c. 1962. Image HD.11D.051. Photograph courtesy of the U.S. Department of Energy.

The development of the Gas Hills and the creation of the Riverton buying station drew the attention of Susquehanna Corporation. Like it did at Edgemont, the firm planned to establish a uranium mill near Riverton and then move to consolidate control over the nearby uranium field. On July 1, 1957, a representative from Fremont Minerals, Inc., a subsidiary of Susquehanna Corporation, sent a letter to the Wind River Superintendent Arthur N. Arntson. The letter stated that the firm was "interested in purchasing Indian land for the purpose of erecting a uranium concentrating mill" and that one member of the Arapaho Tribal Council, Scott Dewey, had already agreed to sell his 40-acre allotment. The letter also noted that Dewey was working on behalf of the firm to "approach other owners" and acquire an additional 160 acres of allotment property for the project. One of the other allotment owners was Dewey's son, Mark Soldier Wolf. Soldier Wolf had worked his allotment for nearly a decade, farming ten acres of oats and ten acres of soft barley. He also raised cattle and chickens. According to Soldier Wolf, his father never contacted him about selling his land. Rather, one day, four BIA officials visited Soldier Wolf's property and told him that "the white people want your land…they're gonna improve your land…they want you out of here." When Soldier Wolf refused to leave his allotment, the BIA officials sent him cakes and pies try to sweeten him up. They also offered him $50,000. He still refused. Eventually, Fremont Minerals wrestled control of the land away from Soldier Wolf. How it did so is not clear. Soldier Wolf claimed he never signed any sale paperwork. However, a September 1957 consent to sale form includes his signature, a BIA notary stamp, and Dewey's witness signature. According to Soldier Wolf, one day, a BIA official visited Soldier Wolf's property and told him that his land had been seized via eminent domain proceedings. That night, Dewey called on his son. "You know what, Mark, I don't want to tell you this, but you have to move out of here," Dewey began. "What do mean," Soldier Wolf replied, "what about you?" "Well, I'm one of you guys. We're moving from this land," Dewey said. Following this father's advice, Soldier Wolf packed his belongings and left the property. He maintained that Fremont Minerals never paid him for his allotment.[180]

By the end of 1958, Fremont Minerals merged with another Susquehanna Corporation subsidiary, Susquehanna-Western, and built a uranium mill on Dewey and Soldier Wolf's allotments. Because jobs were scarce on the reservation, Soldier Wolf worked at the

[180] Tristan Ahtone, "The Story of Soldier Wolf," *Al Jazeera America*, 28 September 2014; Ahtone, "Land Grab."

Susquehanna-Western mill. There, he organized the mill tailings into piles using a front-end loader. Indigenous mill workers reported several health hazards at the mill. One of the mill's drinking water fountains was constantly broken. One day, a worker took it apart and discovered that it was clogged with yellowcake. Another worker claimed that the showers in the facility spewed yellowcake-contaminated water. There is no documentation that Susquehanna-Western tended to these problems. The firm was more concerned about dominating the Gas Hills uranium field than the health of its employees. Yet, in the end, the firm failed to consolidate control over the Gas Hills. Utah Construction & Mining Company, Vitro Minerals Corporation, and Western Nuclear, Inc. had acquired the balance of the field's deposits years ago and erected their own mills nearby, leaving little for Susquehanna-Western.[181]

During the late 1950s and throughout the 1960s the AEC implemented a series of measures to consolidate its uranium suppliers and push them towards producing uranium for nuclear power. In late 1958, the AEC announced that it would purchase uranium only from "ore reserves developed prior to 24 November 1958." This forced the remaining wildcatters out of the industry and collapsed the remaining wildcatter towns. Recognizing that the wildcatters looked to him for inspiration, Steen took to the press to tell them to give up the hunt. "Anybody who goes out and prospects for uranium now is a damned fool," he said.[182] At the same time, the AEC ended its uranium monopsony and allowed nuclear power plants to purchase uranium directly

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[181] Ahtone, "Land Grab"; George J. Schwartz, "Growing Wyoming Uranium Boom Reaches Production Stage in 1957," *Billings Gazette*, 31 December 1957; "Mill Firm Gets Indian Land Title," *Billings Gazette*, 19 February 1958; U.S. Bureau of Mines, *Mining Practices at Four Uranium Properties in the Gas Hills, Wyoming*, 5; Marjane Ambler, "Uranium Mill Workers Seek Compensation for Ill Effects of Radiation Exposure," *NIHB Health Reporter*, September 1980, 10; Paul Albright, "Wyoming Business Notes Plus Marks," *Billings Gazette*, 31 December 1963; Amundson, *Yellowcake Towns*, 45-6.

[182] U.S. Atomic Energy Commission, Grand Junction Operations Office, Press Release No. 220, 24 November 1958; Charles A. Steen, "A Timely Statement From Charles A. Steen," *Uranium*, February 1958, 14; Amundson, *Yellowcake Towns*, 107.

from large producers.[183] Taken together, these measures made the AEC and nuclear power facilities completely reliant on large mining firms, such as Kerr-McGee, whom commanded the nation's largest deposits. Several medium-sized firms asked the AEC to reconsider the new policies, arguing that Big Uranium firms, such as Kerr-McGee, would use them "to get a monopoly." The complainants understood what was happening but failed to persuade the AEC to change course. After feasting on Big Uranium for nearly a decade, in 1970, the AEC ended its uranium purchases altogether, citing that it already had enough ore to develop nuclear weapons. This meant that only Big Uranium could sell uranium only to nuclear power facilities. Combined, these initiatives killed the economics of uranium mining for individual westerners and most firms. In many cases, companies simply abandoned their facilities and left hazardous uranium tailing piles nearby.[184]

Susquehanna-Western's history illustrates what these policies meant for most uranium firms. In the wake of the new AEC policies, Susquehanna-Western closed its Wind River mill in 1963. The company left 910,000 tons of uranium tailings on eighty acres of land. Natural processes, including rainfall, snow accumulation, and snow melt, washed water through the tailings, carrying uranium and other radioactive elements into the reservation's groundwater, exposing local residents to hazardous waste. This was not the only property that the company gave up on. In 1974, Susquehanna Corporation sold its Edgemont mill and nearby mines to the

[183] U.S. Atomic Energy Commission, Grand Junction Operations Office, Press Release No. 213, 8 May 1958.
[184] Johnston, Dawson, and Madsen, "Uranium Mining and Milling," 117; "AEC Criticized for Luncheon with Industry," *Chicago Tribune*, 7 April 1966; U.S. Department of Energy, *Domestic Uranium Mining and Milling Industry: 1983 Visibility Assessment* (Washington, D.C.: U.S. Government Printing Office, 1984), 1.

TVA for $6 million. The TVA planned to mine and mill uranium to produce nuclear power, however, in the end, it never reopened the Edgemont mines and mill.[185]

Yet, the new AEC policies did not spell the end of uranium mining and milling in the West. Some large corporations, such as United Nuclear Corporation (UNC), began mining and milling uranium in the wake of these policies. In 1967, UNC, a Missouri firm that enriched uranium for nuclear reactors, attempted to vertically integrate its production by opening a uranium mine on the Navajo Reservation near Church Rock, New Mexico. The Navajo Tribal Council welcomed the development and issued a mining lease to UNC without delay. Other government entities leant financial support to the project. The U.S. Economic Development Administration poured $1,783,200 into constructing roads to the mine. The State of New Mexico pitched in $445,800 for the road project. The Church Rock mine was the largest underground mine in the nation, featuring two shafts which plunged 1,000 feet underground. The mine employed more than 800 people, including 200 Navajos. On average, UNC paid $500,000 per year to the Navajo Nation in royalties for the mine's uranium. Supporting UNC's move towards monopoly, in May 1977, the Nuclear Regulatory Commission, a successor to the AEC, granted UNC a contract to construct and operate a mill on the southern border of the Navajo Reservation near the Church Rock mine. The mill was completed in July 1977 and produced more than two million pounds of yellowcake annually, providing enough fuel to power five nuclear power plants each year.[186] Indeed, we cannot read the AEC's cuts as the end of the uranium industry.

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185 U.S. Environmental Protection Agency, Office of Radiation Programs, *Radiological Survey at the Inactive Uranium Mill Site Near Riverton, Wyoming*, by Richard L. Douglas (Las Vegas: Office of Radiation Program Las Vegas Facility, 1977), 2-3; Seth Tupper, "Timeline of Edgemont's Uranium Industry," *Rapid City Journal*, 26 October 2015.

186 U.S. Environmental Protection Agency, "Northeast Church Rock Mine Site Update," January 2020, https://www.epa.gov/sites/production/files/2020-01/documents/northeast_church_rock_mine_fact_sheet-2020-01-13.pdf; "Uranium Mill Near Gallup," *Santa Fe New Mexican*, 24 July 1968; "Gallup Road

Rather, we must recognize that the federal government instituted the policies to facilitate the growth of Big Uranium. The state was happy to help Big Uranium throughout the 1960s and the 1970s while closing its hands to smaller operators and individual prospectors.

While UNC flourished, Kerr-McGee also vertically integrated its operations to cement its place in the uranium industry. In 1965, the AEC granted Kerr-McGee a contract to construct and operate the Cimarron Fuel Fabrication Site. Located on 1,000 acres near Crescent, Oklahoma, the plant pressed yellowcake into uranium pellets and produced enriched uranium dioxide. In 1970, the AEC allowed Kerr-McGee to open another installation, the Sequoyah Facility, near Gore, Oklahoma. The $25 million plant converted yellowcake into uranium hexafluoride, a compound that workers used at the Cimarron plant to enrich uranium. The Gore and Cimarron plants sold their materials directly to nuclear weapon and nuclear power reactors, including Hanford. This vertical integration ensured that Kerr-McGee's uranium mines and mills could still turn a profit despite the new AEC purchasing policies. Take the economics of uranium pellet production at the Cimarron plant, for example. It took 2,300 pounds of uranium to produce one pound of pellets. Each pellet cost about $3.75 and a typical nuclear reactor required eight million of them. Kerr-McGee raked in $30 million in pellet sales alone each time its Cimarron facility fully supplied a plant. Along with enriching the company, the Kerr-McGee plants enriched Gore and Crescent, providing hundreds of skilled and unskilled jobs to Oklahomans. This is not to suggest that Kerr-McGee culled its mining efforts in favor of producing uranium hexafluoride

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Financed," *Santa Fe New Mexican*, 4 September 1968; U.S. Nuclear Regulatory Commission, "NRC Seeks Public Comment on Environmental Review of Proposed Church Rock Mine Cleanup in New Mexico," 14 February 2019, https://www.nrc.gov/reading-rm/doc-collections/news/2019/19-008.pdf; U.S. Environmental Protection Agency, "United Nuclear Corporation, New Mexico," August 2002, https://semspub.epa.gov/work/HQ/183036.pdf; U.S. Congress, House Committee on Interior and Insular Affairs, Subcommittee on Energy and the Environment, *Mill Tailings Dam Break at Church Rock, New Mexico,* 96th Cong, 1st sess., October 22, 1979, 19-20.

and uranium pellets. In 1977, the company opened a school in Gallup, New Mexico, to train Navajos in how to mine uranium using new industrial tools and practices. With the exception of owning and operating its own nuclear reactors, Kerr-McGee had transformed itself into a fully vertically integrated uranium firm.[187]

In its quest to make the United States uranium-independent, between 1947 and 1970, the AEC followed nature's hand to launch a great uranium hunt in the American West. The AEC's incentive programs, totaling $2.9 billion dollars, enticed both wildcatters and large companies to scour the earth for uranium. Although the wildcatters believed that they could compete with Big Uranium in the quest for the yellow ore, natural processes and federal policies worked against them. While Shumway and Steen managed to strike it rich, most wildcatters failed to find fortune in the uranium fields. In the end, Big Uranium prevailed. The firms provided the AEC with nearly 348 million tons of uranium for the nation's nuclear weapon program. When the AEC stopped purchasing uranium for nuclear weapons fabrication, Big Uranium continued to flourish, procuring the ore for nuclear power.[188] The early story of uranium mining in the West is not a tale of westerners fighting through lung cancer to procure an ore in the face of an inevitable

[187] "Kerr-McGee Plans Atom Fuel Plant," *Ada Evening News*, 19 April 1964; "Kerr-McGee Awards $1.5 Million Nuclear Fuel Facility Contract," *Daily Ardmoreite*, 25 June 1964; "Kerr-McGee Shows Its Nuclear Fuel Facility," *Ada Weekly News*, 23 November 1967; Kerr-McGee Corp., "A Brief History of Kerr-McGee Corp," folder 2, box 24, Kerr-McGee Corp. Collection, Oklahoma Historical Society, Oklahoma City, Oklahoma; "Nuclear Products and Research," *Kermac News*, April 1966, folder 9, box 68, Kerr-McGee Corp. Collection, Oklahoma Historical Society, Oklahoma City, Oklahoma; "Electricity is the Fuel that Helps to make the Fuel that makes Electricity," *Daily Ardmoreite*, 7 April 1974; Kerr-McGee Corporation, "Chronological History (Highlights) of Kerr-McGee Corporation," folder 3, box 24, Kerr-McGee Corp. Collection, Oklahoma Historical Society, Oklahoma City, Oklahoma; D.C. Lini and L.H. Rogers, "Plutonium Finishing Plant," U.S. Department of Energy, June 2006, https://web.archive.org/web/20060926023643/http://www.hanford.gov/rl/uploadfiles/FACT_PFP_0606.pdf; Rashke, *The Killing of Karen Silkwood*, 43, 47; "Kerr-McGee School Graduates First Navajos," *Lawton Morning Press*, 25 June 1977.

[188] Nash, *Federal Landscape*, 66; Warren I. Finch, Arthur P. Butler, Jr., Frank C. Armstrong, and Albert E. Weissenborn, "Uranium," in *United States Mineral Resources, Geological Survey Professional Paper 820*, ed. Donald A. Brobst and Walden P. Pratt (Washington, D.C.: U.S. Government Printing Office, 1973), 458.

economic bust. Rather, it is a story about westerners believing that they could succeed in a marketplace that did not operate in their favor. It is a story about white and Indigenous people trying to improve their economic condition but failing to overcome the forces that worked against them. Those that gave up wildcatting and found themselves working in Big Uranium's underground tunnels would pay a price. But that is a story for another chapter.

Chapter Three

Corporate Agency and Nuclear Production: Dow, Procter & Gamble, and the West's Nuclear Weapons Factories, 1950-1960

With the Cold War nuclear arms race, nuclear weapons construction left the laboratory and entered a large-scale factory production system. During World War II, the United States had designed and manufactured nuclear weapons at Los Alamos, a laboratory run by the University of California in New Mexico. Immediately following the bombings of Hiroshima and Nagasaki, many Los Alamos scientists, including J. Robert Oppenheimer, returned to their prewar positions in public universities and private laboratories. As Los Alamos contracted, its director, Norris Bradbury, and its few remaining physicists argued that the Atomic Energy Commission (AEC) should use private industry to manufacture nuclear weapons. The scientists reasoned that moving weapons manufacturing from Los Alamos and into the hands of private industry would allow them to focus solely on designing new nuclear weapon models, including the experimental hydrogen bomb.[189]

Following the advice of Los Alamos leadership, the AEC moved to establish two nuclear weapon production factories in the early 1950s. One factory would shape plutonium from Hanford into nuclear weapon pits, or triggers. The triggers were plutonium-239 spheres

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[189] Edwin (Ed) McNamara, interview by Hannah Nordhaus, 23 January 2004, OH1209, Carnegie Library for Local History, Boulder, Colorado; Herbert (Herb) Bowman, interview by Hannah Nordhaus, 2 September 2004, OH1269, Carnegie Library for Local History, Boulder, Colorado; Jon Hunner, *Inventing Los Alamos: The Growth of an Atomic Community* (Norman: University of Oklahoma Press, 2007), 81, 95, 102, 108-9; Harold Orlans, *Contracting for Atoms: A Study of Public Policy Issues Posed by the Atomic Energy Commission's Contracting for Research, Development, and Managerial Services* (Washington, D.C.: The Brookings Institution, 1967), 82, 84; C.L. Tyler, "Report of the Manager Santa Fe Operations U.S. Atomic Energy Commission July 1950 to January 1954," 31 January 1954, 56, 12, Accession Number NV0079010, NNSA/NSO Nuclear Testing Archive, Las Vegas, Nevada; Gordon Dean to Brien McMahon, 9 January 1952, file 2546, RG 128, National Archives and Records Administration, College Park, Maryland.

surrounded with uranium or beryllium tampers, which reflected neutrons back into the plutonium core to facilitate criticality.[190] The other facility would package the plutonium triggers with high explosive (HE) components, which set off the detonation, and encase the finished products in munition containers. The AEC eyed the American West for both installations. It placed the plutonium trigger plant in north-central Colorado near Denver, Boulder, and Golden. This facility, Rocky Flats Plant, manufactured all the plutonium triggers in the American arsenal for the duration of the Cold War. The AEC located the HE components facility in the Texas Panhandle near Amarillo. This plant, Pantex, also served as the final assembly point for nuclear weapons.

This chapter explores the early history of these two installations. It investigates why the AEC situated these facilities in their respective environments, how the AEC decided which firms would operate the plants, and how the factories transformed their local economies. Furthermore, it interrogates how distinctive corporate policies and manufacturing processes shaped operations at Rocky Flats Plant and Pantex.

After assuming command of Rocky Flats Plant, Dow Chemical Company designed the processes to manufacture plutonium triggers at an industrial scale. To accomplish this feat, the firm implemented a distinctive corporate structure and culture at the factory that placed engineers and physicists in administrative roles. Furthermore, Dow provided its blue-collar workers with opportunities to become educated experts and future factory leaders. Instead of providing its laborers with training in business administration, accounting, and scheduling, Dow trained them in nuclear physics, chemistry, and engineering. In other words, Dow ensured that

[190] Arjun Makhijani, A. James Ruttenber, Ellen Kennedy, and Richard Clapp, "The United States," in *Nuclear Wastelands: A Global Guide to Nuclear Weapons Production and Its Health and Environmental Effects*, ed. Arjun Makhijani, Howard Hu, and Katherine Yih (Cambridge: The MIT Press, 1995), 208.

Rocky Flats Plant was run by educated experts and not traditional factory administrators. This method of operation stood in contrast to the organizational schemes in other munitions factories, including the system implemented by Procter & Gamble at Pantex.

At the Texas plant, Procter & Gamble followed a more traditional organizational method that placed traditional administrators in leadership roles and provided blue-collar workers with few opportunities to learn the science behind the operation. Further drawing on tradition, Procter & Gamble modified the manufacturing and assembly processes it used to produce soap and conventional munitions to facilitate HE fabrication and warhead assembly. By highlighting how Dow and Procter & Gamble operated Rocky Flats Plant and Pantex, respectively, this chapter pushes against the notion that the military-industrial complex was a monolithic entity and argues that Dow and Procter & Gamble shepherded the industrialization of nuclear weapons procurement by exercising their cultural and organizational agency.

Although Rocky Flats Plant posed distinctive radiological hazards to its local environment and population, this chapter crafts a nuanced story that revises the standard critical approach to Rocky Flats Plant proffered by historians.[191] In an attempt to weave a more complicated history of the factory, this chapter investigates the factory before its significant

[191] Len Ackland, a former member of Daniel Ellsberg's defense team and editor of the *Bulletin of the Atomic Scientists*, was the first writer to give scholarly attention to Rocky Flats Plant. In his 1999 book *Making a Real Killing*, Ackland advances the argument that the history of Rocky Flats Plant encapsulates the immoral nature of the broader military-industrial complex. In Ackland's view, plant leaders aggressively pursued nuclear weapons components with little regard for the local environment and population. Ackland positions Rocky Flats Plant leadership as unscrupulous capitalists dedicated solely to production and profits. The former anti-Rocky Flats Plant activist LeRoy Moore crafted another monograph on the factory, *Plutonium and People Don't Mix*. Following in Ackland's footsteps, Moore argues that Rocky Flats Plant was part of a "deleterious system" that "has undermined our democracy." According to Moore, the state granted Rocky Flats Plant operators and the leaders of other nuclear factories "blank checks to poison nature and humankind a bit—all in the name of safety, security and economy." See Len Ackland, *Making a Real Killing: Rocky Flats and the Nuclear West* (Albuquerque: University of New Mexico Press, 1999), 1-4; LeRoy Moore, *Plutonium and People Don't Mix: A Guide to Rocky Flats, Colorado's Defunct Nuclear Bomb Factory* (Boulder: Rocky Flats Nuclear Guardianship and Rocky Mountain Peace & Justice Center, 2017), 5-7.

pollutant releases in the late 1960s and the early 1970s. The early history of Rocky Flats Plant does contain instances of pollution, as this chapter will show, however, this chapter seeks to contribute to Rocky Flats Plant's historiography by exploring how Dow crafted an organizational structure and culture at the plant to facilitate the nation's plutonium push. By investigating the organization and culture at Rocky Flats Plant, this chapter challenges the notion that the plant was led by business-minded administrators interested in corporate profits. On the contrary, Rocky Flats Plant was led by a cadre of physicists and engineers well-versed in nuclear technologies and radioactive hazards. These men had little or no experience in business administration and had little interest in ledger books and profit margins. They did not operate the plant to maximize profits. Even if they had, the terms of Dow's cost-plus fixed fee contract did not grant the company higher profits for producing more units. Rather, the contract granted Dow a fixed fee of 1.5 percent of the total operating costs of Rocky Flats Plant. Put succinctly, the contract provided a fiscal incentive for Dow to run the plant using expensive procedures and did not lead the company to maximize production while minimizing cost. By placing nuclear physicist and engineers in administrative roles, Dow attempted to create a facility guided solely by expertise. This method of organization and culture became a permanent fixture of the factory and helps explain why Colorado's atomic workforce remained loyal to the factory during its disastrous environmental episodes and organized against the anti-Rocky Flats Plant protest movement in 1970s and the 1980s. Chapter six will explore this latter-day struggle over the fate of Rocky Flats Plant. This chapter establishes the origins of worker loyalty.

Along with documenting this early history of Rocky Flats Plant, this chapter also examines the early history of Pantex. It deviates from the prevalent historical analysis of Pantex, which privileges local boosters in explaining Pantex's success, and emphasizes how Procter &

Gamble's traditional organizational methods and its manufacturing and assembly processes enabled Pantex to fulfill its industrial mission.[192] Pantex left few environmental marks on West Texas. However, a few local residents worried that the factory was contaminating the region with radioactive pollutants and argued that the facility threatened world peace. Consequently, these activists organized against the factory during the 1980s. Because this chapter is concerned with Pantex's first decade of nuclear production, it will not explore the latter-day backlash against Pantex and will leave that task to later pages of this manuscript.

At first glance, some might question placing the histories of Rocky Flats Plant and Pantex in conversation with each other. However, the two facilities were intimately linked together. Nuclear triggers traveled from Rocky Flats Plant to Pantex, linking the two plants together via a nuclear supply-chain network. It is also worth noting that these two facilities have similar origins and economic histories. The AEC used similar means to establish the facilities, with environmental factors influencing location choices. The plants similarly transformed their home communities, bringing new blue- and white-collar jobs to regions lacking robust industries. By examining these factories side by side, we come closer to understanding why the AEC targeted the American West for nuclear development and how the nation's nuclear contractors economically uplifted westerners in the early years of the Cold War. Yet, Rocky Flats Plant and Pantex did perform specific and discrete functions. Therefore, in order to best appreciate the similarities and the differences between the two plants, and for the sake of chronological narrative, this chapter is divided into separate sections on the two.

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[192] Currently, there is one academic article on Pantex, Alex Hunt's "Host and Hostage," which provides an overview of the factory's history from World War II through 2011. While chronicling major developments at Pantex, Hunt showcases local boosters that supported the plant and those local residents who secretly feared that the plant was contaminating the community with radioactive products. See Alex Hunt, "'Host and Hostage': Pantex and the Texas Panhandle," *Southwestern Historical Quarterly* 118, no. 4 (April 2015): 339.

Rocky Flats Plant, Colorado

In the late 1940s, the AEC, Los Alamos Director Norris Bradbury, and leading Los Alamos physicists, including Edward Teller, determined that fabricating nuclear weapons needed to move from the laboratory to the factory. All recognized that Los Alamos simply could not manufacture nuclear weapons at the scale demanded by the state. Furthermore, Los Alamos physicists wanted to focus their attention on more creative enterprises, namely creating new models and variations of nuclear technologies. Separating the manufacturing process from Los Alamos also had strategic advantages. Dispersing nuclear weapons fabrication across several locations would make it harder for enemy agents to cripple the nation's nuclear program. After arriving at these conclusions, the AEC moved to establish nuclear weapons factories. On October 12, 1950, the AEC approved Project Apple. This program would create a factory to mold Hanford plutonium into nuclear weapons triggers on an industrial scale. The factory would also convert outdated nuclear weapons into newer models and have the capability to quickly refabricate nuclear triggers in the event that the Cold War turned hot.[193]

The first step of establishing a nuclear weapons trigger factory was selecting an operating contractor. Pursuant to the AEC's criteria, the contractor needed to have experience in inorganic chemistry and metallurgy to facilitate trigger manufacturing. Additionally, the firm needed to have a strong research and development organization and "sound top management." Los Alamos helped the AEC vet potential contractors, and, within weeks, the two organizations narrowed the

[193] Richard G. Hewlett and Francis Duncan, *Atomic Shield, 1947-1952: A History of the United States Atomic Energy Commission* (University Park: Pennsylvania State University Press, 1969), 176; U.S. Atomic Energy Commission, Division of Military Application, "Atomic Energy Commission Selection of a Site for Project Apple," 31 December 1951, Accession Number NV0318091, NNSA/NSO Nuclear Testing Archive, Las Vegas, Nevada; U.S. Atomic Energy Commission, "Note by the Secretary, Subject: Scope of Project Apple," by R.B. Snapp, 24 January 1951, Accession Number NV0317800, NNSA/NSO Nuclear Testing Archive, Las Vegas, Nevada.

search to five companies: Dow Chemical Company, National Lead Company, Aluminum Company of America, American Cyanamid Company, and Minnesota Mining and Manufacturing Company. Visiting the five firms during the vetting process, AEC representatives investigated the companies' physical facilities, appraised their working practices, and interviewed their management. Dow was the unanimous frontrunner. The firm had a "very strong" history in research, development, inorganic chemistry, metallurgy, and production. It also had an impressive track record with toxic materials and complex devices and instruments. Furthermore, after the conclusion of World War II, the company had sent several of its scientists, including John Grebe and F.H. "Heine" Langell, to the AEC's Oak Ridge facility to study nuclear energy. Dow shared AEC Chairman David Lilienthal's belief that private firms could harness nuclear technologies to provide cheap and abundant electricity to rural America. Dow seemed dedicated to the AEC's atomic vision. The firm was an easy choice for Project Apple.[194]

In January 1951, the AEC granted Dow a cost-plus fixed fee contract to operate the planned Project Apple plant. Under this deal, Dow received a yearly fee of 1.5 percent of the total operating costs of the future facility. In other words, Dow would not receive more cash for producing more units. Rather, it would receive more cash if the overall operating cost ran high. This contract provided Dow with the incentive to operate the plant using expensive processes.

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[194] U.S. Atomic Energy Commission, "Note by the Secretary, Subject: Selection of Operating Contractor for Project Apple," by R.B. Snapp, 8 January 1951, Accession Number NV0317803, NNSA/NSO Nuclear Testing Archive, Las Vegas, Nevada; U.S. Atomic Energy Commission, Division of Military Application, "Atomic Energy Commission Selection of a Site for Project Apple," 31 December 1951, Accession Number NV0318091, NNSA/NSO Nuclear Testing Archive, Las Vegas, Nevada; Don Whitehead, *The Dow Story: The History of the Dow Chemical Company* (New York: McGraw-Hill Book Company, 1968), 222-3.

This stands in contrast to typical industrial enterprises, which receive more profits for producing as many units as possible with low operating costs.[195]

After selecting Dow, the AEC began exploring potential locations for the nuclear trigger factory. The AEC established several criteria for the site. The first criterion was a matter of geography. The project needed to be "reasonably accessible" to Los Alamos to ensure that information traveled with ease between the two sites and distant from international borders for the purposes of "strategic invulnerability." This criterion narrowed the search to a particular sector of the American West–north of central Texas, south of Wyoming, east of Utah, and west of the Mississippi River. Next, the AEC crafted site-specific criteria based on environmental factors. The site needed to be at least two square miles in size on "reasonably level ground." It also needed to be high above the water table and on a geological formation that kept it from flooding. Because manufacturing nuclear weapons triggers required air conditioning, the AEC preferred a dry moderate climate to facilitate the use of evaporative cooling systems. The manufacturing process also required an ample supply of electricity and water. Thus, the AEC looked for a location that could easily provide 12,000 kilowatts of power and one million gallons of water per day. Transportation was another factor. The site needed to be within ten miles of a main railroad, "near a good main highway," and close to a major airport. For security purposes, the AEC wanted the site to be between ten and fifty miles away from a large Air Force base. The AEC also designated site-specific criteria based on demography and human factors. The

[195] U.S. Atomic Energy Commission, "Note by the Secretary, Subject: Selection of Operating Contractor for Project Apple," by R.B. Snapp, 8 January 1951, Accession Number NV0317803, NNSA/NSO Nuclear Testing Archive, Las Vegas, Nevada; U.S. Atomic Energy Commission, Division of Military Application, "Atomic Energy Commission Selection of a Site for Project Apple," 31 December 1951, Accession Number NV0318091, NNSA/NSO Nuclear Testing Archive, Las Vegas, Nevada; U.S. Congress, Senate, Subcommittee of the Committee on Appropriations, *Public Works for Water and Power Development and Atomic Energy Commission Appropriations for Fiscal Year 1972: Hearings before a Subcommittee of the Committee on Appropriations*, 92nd Cong., 1st sess., 1972, 204-5.

bureaucracy planned on hiring 700 local workers to staff the plant and, consequently, it looked for locations close to communities "of at least 25,000 people." To retain skilled personnel, the AEC wanted a site that featured good living conditions and community facilities, an "attractive" climate, and plenty of outdoor recreational opportunities. With these criteria in mind, the AEC narrowed its search to 26 communities, including Little Rock, Oklahoma City, Wichita, Amarillo, Kansas City, Denver, Pueblo, and Colorado Springs. Of these, only the three Colorado cities featured climates conducive to evaporative cooling air conditioning.[196]

Denver appeared to be the best option. The city met all the AEC's environmental requirements and was cooler than Pueblo and Colorado Springs, making a prospective Denver facility cheaper to air condition. According to the AEC, Denver's institutions and natural environment promised to keep workers from leaving the area in search of better living spaces. The city featured "adequate community and municipal facilities," "attractive residential areas," and had several outdoor recreational facilities nearby. The AEC noted that "the Denver labor pool is still being used predominantly as a source of workers for locations outside of Denver rather than locally." According to U.S. Department of Commerce, in 1950 Denver contained 174,072 blue-collar laborers, but only 11,755 construction and 27,943 manufacturing jobs.[197] As the historians Carl Abbott, Stephen Leonard, and Thomas Noel point out, in the late 1940s mining declined on the Front Range while tourism and skiing boomed. The Front Range had jumped from an extractive economy to a service economy and in the process left its industrial laborers behind. Consequently, the commission reasoned that Denver's blue-collar community

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[196] U.S. Atomic Energy Commission, Division of Military Application, "Atomic Energy Commission Selection of a Site for Project Apple," 31 December 1951, Accession Number NV0318091, NNSA/NSO Nuclear Testing Archive, Las Vegas, Nevada.

[197] U.S. Department of Commerce, *County and City Data Book, 1952* (Washington, D.C.: U.S. Government Printing Office, 1953), 28.

would embrace the job opportunities that the plant would bring to the city. Furthermore, Los Alamos vouched for Denver's workforce and informed the AEC that the city had provided "their most fruitful source of machinists, sub-professional, and clerical personnel." All agreed that Denver was the ideal location for Project Apple.[198]

After selecting Denver, the AEC and Dow studied the city to determine the best specific location for the factory. Within weeks, the AEC zoomed-in on a high, windy plateau seventeen miles northwest of the city: Rocky Flats. The plateau met all the AEC's environmental and infrastructure requirements. Additionally, it was only eight miles away from Boulder and ten miles from Golden. Both these communities were comparatively small, numbering 19,999 and 1,727 people, respectively. The AEC surmised that the new factory would help recruit westerners to these small towns and invigorate the greater Front Range economy.[199]

The Colorado press celebrated the AEC's announcement of its intention to build a nuclear weapons production facility at Rocky Flats. On March 23, 1951, the *Denver Post* ran the headline: "There's Good News Today, U.S. to Build $45 Million A-Plant Near Denver." The newspaper called the project "the first atom bomb production installation in Colorado" but stressed that the plant would not "complete the process that goes into A-bomb manufacturing." Other local newspapers ran similar stories. The *Greeley Daily Tribune* informed local residents

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[198] Carl Abbott, Stephen J. Leonard, and Thomas J. Noel, *Colorado: A History of the Centennial State* (Boulder: University of Colorado Press, 2005), 315; U.S. Atomic Energy Commission, Division of Military Application, "Atomic Energy Commission Selection of a Site for Project Apple," 31 December 1951, Accession Number NV0318091, NNSA/NSO Nuclear Testing Archive, Las Vegas, Nevada.

[199] U.S. Atomic Energy Commission, Director of Military Application, "Selection of a Site for Project Apple," AEC 394/3, 19 March 1951, Freedom of Information Act (FOIA); U.S. Atomic Energy Commission, Division of Military Application, "Atomic Energy Commission Selection of a Site for Project Apple," 31 December 1951, Accession Number NV0318091, NNSA/NSO Nuclear Testing Archive, Las Vegas, Nevada; "$45,000,000 Atomic Plant Will Be Built Northwest of Denver," *Greeley Daily Tribune*, 23 March 1951; "Rocky Flats in Colorado Added in Atomic Map," *Greeley Daily Tribune*, 6 April 1951; U.S. Department of Commerce, *Census of Population: 1950, Volume I: Number of Inhabitants* (Washington, D.C.: U.S. Government Printing Office, 1952), 6-11, 6-13.

that “a new atomic production plant will be constructed northwest of Denver. The plant will be used for a secret type of operation.” Few people knew what exactly the plant would manufacture.[200] The AEC did not relate that Rocky Flats Plant would fabricate nuclear triggers. Rather, it simply reassured the public that the plant would “not produce atomic weapons as such.” To assuage skeptical Coloradans, the AEC emphasized that there would be no danger from radioactive wastes and that the facility would be an economic boon to the local community, producing 2,000 construction jobs and 1,000 permanent positions. The announcement shocked local politicians who had not been consulted by the AEC. Despite being caught off-guard by Project Apple, Colorado Governor Daniel Thornton was positive about the project. “Of course it will provide a lot of employment,” he said.[201]

One day after the AEC announced the project, the *Denver Post* began speculating what the future facility would produce. One reporter, Joseph Givando, analyzed the factory’s water, gas, electrical, acreage, and labor needs. He concluded that the limited materials the Front Range offered the AEC “suggest that atomic explosives—the metals plutonium and uranium 235—will be fabricated or tooled here into special shapes for bombs, warheads or artillery shells.” He also surmised that Project Apple was an AEC effort to decentralize atomic production “into smaller, component manufacturing plants that would assure greater protection from crippling enemy strikes against our atomic program.”[202] He could not have been more correct.

[200] Barnet Nover, “There’s Good News Today, U.S. to Build $45 Million A-Plant Near Denver,” *Denver Post*, 23 March 1951; Joseph Givando, “State’s A-Plant Won’t Complete Bomb Assembly,” *Denver Post*, 23 March 1951; Kristen Iversen, *Full Body Burden: Growing Up in the Nuclear Shadow of Rocky Flats* (New York: Broadway Books, 2013), 5; Makhijani, Ruttenber, Kennedy, and Clapp, “The United States,” 239.
[201] “$45,000,000 Atomic Plant Will Be Built Northwest of Denver,” *Greeley Daily Tribune*, 23 March 1951.
[202] Joseph Givando, “Denver A-Plant Plans Shrouded in Strict Secrecy,” *Denver Post*, 24 March 1951.

Before the AEC could move forward with the nuclear trigger factory, it needed to tend to the few families that called Rocky Flats home. Farmers and ranchers had homesteaded and lived on the plateau for nearly one hundred years. By 1951, Katherine Church owned approximately half of the four-square miles that the AEC earmarked for the factory. From the start, the AEC could have filed legal proceedings to condemn the Church property and place it in government hands. Under the Fifth Amendment of the U.S. Constitution, the federal government possessed the power to take lands for public purposes, such as dams, roads, or national security. In return, it needed to provide "just compensation" to the property owners. Instead of immediately launching condemnation proceedings, however, the AEC tasked the real estate division of the U.S. Army Corps of Engineers to offer to the Church family $18 an acre to purchase their 1,228 acres outright, a reasonable bid as land in the area had recently sold for about $15 an acre. However, the Churches rejected the offer, arguing that the bid did not represent the true market value of the land. The dispute centered on the mineral rights. Rocky Flats contained clay, coal, oil, and gas deposits that were already claimed by the Churches, other local families, and the Union Pacific Railroad. Although the government could theoretically purchase these rights, the value of these deposits made them too costly to acquire. The AEC considered a site one mile south. As this land contained valuable minerals whose rights were similarly contested, the AEC continued to negotiate the mineral rights at Rocky Flats. After months of haggling, negotiations broke down, leading the U.S. Attorney to file a condemnation petition on July 10. Within hours, the U.S. district judge William L. Knous granted the AEC immediate possession of 2,598 acres of land on Rocky Flats. Following the condemnation order, the federal government paid the Union Pacific Railroad for its mineral rights. To build on the condemned Church land, the AEC paid Shell Oil Company and Carter Oil Company, the firms that had leases to the Church minerals, to not exercise their right to work the land. In other words, the Churches retained their mineral rights but were unable to exercise them. As one member of the Church family put it, the federal government "wanted to screw with us as much they could." The Churches continued to seek a fair price for their land. Finally, in 1955, the federal government awarded them $56 per acre for the 1,228 acres seized in July 1951.[203]

The AEC began constructing the Rocky Flats Plant on July 28, 1951. Although the AEC hired the Austin Company of Cleveland, Ohio, to serve as the general contractor for the project, it primarily relied on western subcontractors to erect the facility. McKinley-Roundtree company of Lubbock, Texas, installed the heating facility and the gas and steam distribution systems for the plant. The Midwest Contraction Company of Dallas built a water supply line to the factory and laid 23,600 feet of cast iron pipe. Meanwhile, the Denver & Rio Grande Western Railroad won a contract for a four-mile spur to the factory from its Denver-Salt Lake line near the intersection of Colorado highways 72 and 93.[204] To galvanize local support for the factory, the AEC attempted to employ as many local subcontractors as possible. For example, the AEC issued a $500,000 contract to the Colorado Pre-Mixed Concrete company for concrete. The Hinman Brothers Construction company of Denver won a $50,000 excavation contract. The AEC paid the Collier Electric company of Denver $1 million for electrical wiring. McCarty &

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[203] "Rocky Flats in Colorado Added in Atomic Map," *Greeley Daily Tribune*, 6 April 1951; U.S. Constitution, amend. 5; "Govt. Takes Over Jefferson County AEC Plant Side," *Greeley Daily Tribune*, 11 July 1951; Ackland, *Making a Real Killing*, 64-6; Charles (Charlie) Church McKay, interview by Hannah Nordhaus, 6 August 2003, OH115V A-B, Carnegie Library for Local History, Boulder, Colorado; Peter Coates, Tim Cole, Marianna Dudley, and Chris Pearson, "Defending Nation, Defending Nature? Militarized Landscapes and Military Environmentalism in Britain, France, and the United States," *Environmental History* 16, no. 3 (July 2011): 483n14.

[204] "Rocky Flats AEC Work to Start During July," *Greeley Daily Tribune*, 14 June 1951; "Rocky Flats Worker Injured in Accident," *Louisville Times*, 31 July 1952; "Gets Rocky Flats Contract," *Greeley Daily Tribune*, 20 December 1951; "AEC Says D&RG Will Build Spur to Rocky Flats," *Greeley Daily Tribune*, 13 February 1952.

Johnson, Inc., Johnson & Davis Plumbing and Heating, and Bell Plumbing and Heating—all Denver firms—received $2 million for heating and mechanical installation. In the end, all but $1,000,000 of the $14,000,000 construction payroll was paid in Colorado. The total cost of construction ran about $43 million. Roughly 90 percent of this cash went to Colorado firms.[205]

The AEC and Dow activated Rocky Flats Plant in 1953. In April, Rocky Flats Plant officials agreed to accept "on a trial basis routine Hanford production," in preparation for transforming the plutonium into triggers.[206] In late November, the AEC Field Manager Gilbert C. Hoover informed the press that production was fully underway, stressing that the plant "will work with radioactive materials."[207] A few unnamed AEC officials told the *Denver Post* that Rocky Flats "will have a direct connection with the production of atomic weapons."[208] At the main production building, Building 771, workers processed, cut, and formed plutonium-239 inside integrated contained work areas called glove boxes. The five feet long, four feet high, and three feet deep boxes featured portholes with two heavy, long-sleeved rubber gloves. Workers inserted their arms into the sleeves and looked through Plexiglass windows to transform Hanford plutonium into nuclear weapons triggers. The system worked well and kept its workers safe from plutonium contamination as long as everything functioned properly.[209] In addition to

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[205] Don Sterling, "Many Details Disclosed on Rocky Flats A-Plant," *Denver Post*, 12 October 1951; "Major Part of Rocky Flats to be Ready Early," *Greeley Daily Tribune*, 29 August 1952; "Rocky Flats Atomic Plant in Production," *Greeley Daily Tribune*, 19 November 1953; Dow Chemical Company, 1951 Annual Report, July 1951, 9.
[206] R.E. Smith, "Summary Trip Report—Dow Chemical Company, Rocky Flats, Colorado," 6 May 1953, Document Number HW-28025, Accession Number RL-1-356793, U.S. Department of Energy, Pacific Northwest National Laboratory Public Reading Room, Richland Operations Office, Richland, Washington.
[207] "Major Part of Rocky Flats to be Ready Early," *Greeley Daily Tribune*, 29 August 1952.
[208] Don Sterling, "Rocky Flats A-Weapons Center, AEC Hints," *Denver Post*, 12 October 1951.
[209] Makhijani, Ruttenber, Kennedy, and Clapp, "The United States," 208; Ackland, *Making a Real Killing*, 74. Building 771 was originally named Building 71. In order to not confuse the reader, I will refer to this building as Building 771 throughout this manuscript.

manufacturing triggers, workers also used the glove box system to recycle triggers from obsolete weapons and refurbish them for use in new weapon models.[210]

Figure 8: The glove box system in Rocky Flats Plant Building 771. 1960. Image CO-83-N-8. Photograph courtesy of the U.S. Department of Energy.

As Coloradans transformed plutonium into nuclear weapon cores, Rocky Flats Plant economically invigorated the Front Range. Instead of staffing the factory with long-time company workers, Dow tapped into the Front Range's blue-collar workforce. After construction ended in early 1953, Dow hired 700 of the 2,800 workers that had built Rocky Flats Plant to work in the facility's production buildings. Dow rewarded its laborers with wages higher than the national average. For example, in 1953, Dow paid its workers an average hourly wage of

[210] Makhijani, Ruttenber, Kennedy, and Clapp, "The United States," 240.

$2.31. The median annual income for Rocky Flats Plan workers was $4,805. Meanwhile, the median annual income for American families in 1953 was only $4,200.[211] With more disposable income at their fingertips, Rocky Flats Plant workers purchased homes in new subdivisions near the factory and funneled cash into local shopping malls and other retail establishments. A few statistics help illuminate how the factory helped spark a retail boom on the Front Range. Before the plant opened, the greater Denver area contained 5,422 retail establishments. These shops posted $594,701 in sales in 1948. One year after Rocky Flats Plant opened, the greater Denver area contained 6,050 retail establishments. These shops posted $887,548 in sales. While it would be inappropriate to attribute all of this retail growth to Rocky Flats Plant, it is reasonable to conclude that the factory's high wages significantly contributed to this boom. With the exception of Rocky Flats Plant, no other new source of significant employment opened in the Front Range between 1948 and 1954.[212]

In addition to employing nearly 1,000 workers and paying them well, Dow implemented a distinctive corporate culture and organizational structure at Rocky Flats Plant. Instead of staffing the plant's administrative offices with established corporate officers and accountants, Dow recruited and trained physics and engineering students from local colleges to lead the

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[211] "Rocky Flats Atomic Plant in Production," *Greeley Daily Tribune*, 19 November 1953; Dow Chemical Company, "Schedule 3, The Dow Chemical Company, Rocky Flats Plant, Contract No. AT(29-1)-1106, Base Employment Rate for Technically Trained Employees, Effective February 9, 1953," n.d., FOIA; Dow Chemical Company, "Schedule 4," n.d., FOIA; Dow Chemical Company, "Schedule 5, The Dow Chemical Company, Rocky Flats Plant, Contract No. AT(29-1)-1106, Base Employment Rate for Plant Protection Personnel," n.d., FOIA; Dow Chemical Company, "Schedule 3, The Dow Chemical Company, Rocky Flats Plant, Contract No. AT(29-1)-1106, Base Employment Rate for Cafeteria Personnel, Effective July 23, 1953," n.d., FOIA; U.S. Department of Commerce, *Family Income in the United States: 1954 and 1953* (Washington, D.C.: U.S. Government Printing Office, 1955), 1.

[212] U.S. Department of Commerce, *County and City Data Book, 1952* (Washington, D.C.: U.S. Government Printing Office, 1953), 30; U.S. Department of Commerce, *County and City Data Book, 1956* (Washington, D.C.: U.S. Government Printing Office, 1957), 27, 35. Real estate developers erected the Martin Acres and Frasier Meadows subdivisions near Rocky Flats Plant to house plant workers. See, Charlie Brennan, "From Los Alamos to Rocky Flats, Herb Bowman Relished Service," *Boulder Daily Camera*, 30 October 2015.

facility. Dow executives maintained that this method of organization would ensure that production was guided by scientific expertise. Furthermore, Dow leadership believed that this model would shore up local support for the factory. Dow executives styled their company as a family operation. Consequently, as the business historian Alfred Chandler notes, the Dow leadership gave “little explicit through to structure.” The company refused to clearly define relations between its various factories, departments, regional offices, divisions, and its general office. Instead, Dow conducted business “on an informal personal basis.” This lack of administrative structure allowed local experts to steer Rocky Flats Plant based on their expertise.[213]

Herb Bowman was one student that benefitted from Dow’s commitment to local experts. In 1951, Bowman was finishing his undergraduate degree in physics at the University of Colorado Boulder. While walking to class one day, Bowman saw a Rocky Flats Plant employment advertisement on campus. Bowman joined Dow’s team in April, weeks before graduation. When he reported for work in June, Dow sent him to Los Alamos to train with Group W1, the weapons design team. Bowman worked at Los Alamos for about eighteen months, learning about the design of the Los Alamos trigger assembly building so that Dow could replicate the facility at Rocky Flats. He also “had the job of putting together all the specialized equipment, tools, procedures, paperwork, and everything that would be necessary at Rocky Flats.” In 1952, Bowman returned to Colorado and started at Rocky Flats Plant in Building 91, the first operational building of the plant. Along with training local staff how to operate the plant, Bowman set up a program to train military officers how to assemble nuclear weapons in the field in the event of nuclear war. After a year, Bowman set up and ran the production control and

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[213] Bowman, interview by Hannah Nordhaus; Alfred D. Chandler, *Strategy & Structure: Chapters in the History of the Industrial Enterprise* (Mansfield Centre: Martino Publishing, 2013), 377.

assembly portion of the plant. He also got involved in scheduling production for the entire facility. In this capacity, Bowman scheduled production out of the plant and into the hands of the federal government and arranged for shipments. This eventually led to Bowman becoming the superintendent of assembly operation. In this role, Bowman helped design and construct "a whole new assembly operation and plutonium fabrication facility," which was needed to facilitate the creation of new nuclear weapons packages. Next, Bowman became the administrative services manager of the plant and was responsible for purchasing, accounting, budgeting, planning, and most of the administrative activities for the plant. From there, Bowman set up the quality department and finally worked as the manufacturing manager. Indeed, Bowman rose quickly through the ranks. This local scientist became crucial to the entire operation.[214]

Ed McNamara was another local expert that benefitted from Dow's system. After acquiring his bachelor's degree in engineering at the University of Colorado Boulder, McNamara struggled to find work in his native Colorado. Thus, he moved to Washington state to work in an aluminum reduction plant. In the fall of 1959, McNamara heard that Rocky Flats Plant had revitalized the local economy. Hoping to return to Colorado and work at Rocky Flats Plant, McNamara reached out to an old friend from his Boulder days, who was a chemist at the factory. Utilizing this connection, McNamara found himself working at Rocky Flats Plant in late February 1960 in the chemical engineering group. After about eighteen months, McNamara took a new position under Bowman's product engineering organization. In this capacity, McNamara worked as a liaison between Rocky Flats Plant and Los Alamos. He also served as a product

[214] Bowman, interview by Hannah Nordhaus.

engineer for the factory. Once again, a local expert found himself as an administrative authority at Rocky Flats Plant.

McNamara's recollections of the product engineering team frames Rocky Flats Plant as a novel factory dependent of scientific expertise and innovation. The product engineering team not only built parts, they also established "the future processing of the pit" by crafting new best practices for nuclear weapons production. This was a novel and expensive process. As McNamara put it: "the Dow Chemical Company took on this project which was never before experienced on a large scale in this country. To build a plant, to build equipment, to hire people, and to train people, and really, when I look back, we were all just kind of feeling our way in this business." "We were building probably for the whole world a means for handling radioactive materials such as plutonium and uranium in a very confined area under extreme safety requirements," McNamara continued. "And building very specialized equipment and fixtures to build the device we had to."

McNamara also pointed out that Rocky Flats Plant was, in some ways, a typical industrial factory. McNamara's department created standard operating practices for cleaning parts, how to handle and prepare parts, manufacturing procedures, and assembly procedures. Like other American industries, Rocky Flats Plant kept definite records. "Just as they do at Ford Motor Company or General Motors on your automobile so that they know on this day this product was made we were following these procedures," he explained. "The process there is that if there is something later on found out to be faulty in the product that we built, it is important to go back and find out all the product that was built according to that particular procedure on that day in order to tie it down." If a trigger mechanism was found to be faulty in a field exercise at the Nevada Test Site, the military would retrieve the device and send it back to Rocky Flats Plant.

After examining the error in the device, plant managers would revise the operating procedures and replace the faulty device with a reliable unit. "This is done in American industry all the time," McNamara explained. Automobile companies recalled automobiles. Toy companies recalled toys. "It's just a standard manufacturing routine that industry goes through," McNamara said. Revisions always occurred.[215]

Leroy Hampton's story further illustrates Dow's reliance on local university students. Hampton had received a graduate degree in pharmacy at the University of Colorado Boulder. When Rocky Flats Plant opened, Hampton was working at a Denver pharmacy for $85 a week. One day, Hampton left the pharmacy early and traveled to Rocky Flats Plant to pick up a job application. After a nine-month wait for his security clearance, Hampton found himself working at the factory in 1953. He was the first black professional employed by Dow. Dow paid him $106.25 a week to serve as an assistant to Dick Woodard, the chemist in charge of the plant's chemistry group. With Woodard's encouragement, Hampton enrolled at the University of Colorado Boulder 's chemistry graduate program. After he received his degree, Hampton took over Woodard's role as chief uranium chemist at Rocky Flats Plant. This local black professional became essential to the entire operation.[216]

Along with empowering experts, Dow provided its blue-collar workers with opportunities to become educated technicians. As one Dow pamphlet put it, "a policy of the Dow Chemical Company is to encourage professional development of its employees through the media of communication on technical data." Jack Weaver's personal history illustrates how Dow transformed blue-collar laborers into educated experts. Before coming to Rocky Flats Plant,

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[215] McNamara, interview by Hannah Nordhaus.
[216] E.N. Brandt, *Growth Company: Dow Chemical's First Century* (East Lansing: Michigan State University Press, 1997), 292.

Weaver worked in a local sheet metal shop building campers and trailers. Work in the shop was dangerous and wages were low. Wanting more money and a safer working environment, Weaver took a job at Rocky Flats Plant as an outdoor laborer. In that role, Weaver swept the streets, mended the fences, and dug pole holes. He had no idea what the plant produced but was thankful for the opportunity to get out of the metal shop. One night, factory officials phoned Weaver at 2AM and asked him to come in right away and shovel snow. At that point, Weaver decided that the labor gang was not for him and he applied for an assistant chemical operator position at the plant. He got it, despite not having a college degree. Dow provided Weaver with documents detailing chemical separation processes. After studying the materials for six months, Weaver became a full-blown chemical operator. In that role, Weaver donned lead gloves and recovered plutonium from scrap materials for refurbishment. Within a few years, Weaver advanced to foreman of the recovery process, shift manager, and finally operations manager for Building 771. In that position, Weaver was "the guy that owns the whole building." In other words, he oversaw every aspect of trigger production. Thanks to Rocky Flats Plant, Weaver saved up enough money to buy himself a vacation home. Overall, Weaver was thankful for the opportunities Rocky Flats Plant provided him. The plant combined good wages with, in Weaver's words, "a very safe" environment "guided by expertise."[217]

Jim Kelly was another unskilled worker that quickly rose through the ranks at Rocky Flats Plant. Kelly joined the Rocky Flats Plant team as a janitor in 1956. When he was not sweeping the floors and emptying wastepaper baskets, Kelly studied Dow pamphlets on nuclear

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[217] Dow Chemical Company, Rocky Flats Division, *Unclassified Publications Through 1964* (Springfield, VA: U.S. Department of Commerce, 1965), iii; Jack Dale Weaver, interview by LeRoy Moore, 2 June 1998, OH1516, Carnegie Library for Local History, Boulder, Colorado; M.H. Chew & Associates, Inc., "Facility History for Building 771 at the Rocky Flats Plant," April 1992, 3-5, https://rockyflatsambushedgrandjury.com/wp-content/uploads/1992April-FacilityHistoryforBuilidng771attheRockyFlatsPlant.pdf.

chemistry and radiation monitoring. After working as a janitor for three months, Kelly became an assistant chemical operator. Eight months later, Kelly became a radiation monitor, someone who inspected plant grounds for contamination and radiation. After landing the job, Kelly worked with plant managers to create a new program to train all unskilled laborers how to operate "all buildings on the plant." This new initiative streamlined complicated theoretical ideas and processes into concrete operating manuals for "the average cat" and made certain that plant workers did not need a college education to become proficient plant technicians. After establishing the program, Dow "required everybody" to enroll in the program. By doing so, Dow had the ability to move workers around the facility in the event of staff shortages in order to keep the operation going.[218]

While local experts and unskilled laborers found new careers at Rocky Flats Plant, other Coloradans not attached to the factory began to question the facility. Although local residents understood that Rocky Flats Plant was an AEC factory, most had no idea what the plant actually produced. Fearing that Rocky Flats Plant posed a radiological hazard to the community, a handful of Coloradans urged the press to confront the AEC and expose the mission of the factory. In the spring of 1954, the Denver newspaper *Rocky Mountain News* crafted a list of thirty-four questions about Rocky Flats Plant and submitted the document to the AEC. In June, the newspaper printed the answers it received. The AEC refused to answer several of the questions, including the one which asked what was "being produced, made, refined, research, or developed at Rocky Flats Atomic Plant?" Instead of exposing the mission of the plant, the AEC simply reminded the public that "Rocky Flats is a classified production plant and handles radioactive materials. Production is used in the industrial sense and may include phases of:

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[218] James (Jim) D. Kelly, interview by LeRoy Moore, 14 May 1998, OH1503, Carnegie Library for Local History, Boulder, Colorado.

fabrication, assembly of parts, procurement, production engineering, receipt and shipment, inspection and quality assurance, etc. Further information regarding the function of the plant would be of value to unfriendly nations and cannot be disclosed under security regulations." To assuage concerned Coloradans, the AEC noted that the factory's job hazards were not distinctive to Rocky Flats Plant and were "similar to those encountered in a normal industrial operation." The commission also maintained that "the degree of radioactivity at Rocky Flats is small" and that the factory posed "no danger to surrounding areas, populations, crops, or livestock." When asked if *Rocky Mountain News* reporters could access the plant, the AEC stated that reporters would be admitted "when they have business there." The AEC also reiterated that Rocky Flats Plant was an economic blessing to the Front Range, reporting that the factory employed 1,061 workers with an average hourly rate of $2.31. According to Dow's calculations, the factory paid out $428,000 per month in wages to Coloradans.[219]

Like other factories, Rocky Flats Plant produced a large amount of waste. Unlike other factories, the Rocky Flats Plant produced radioactive waste. The AEC balked at the idea of storing Rocky Flats Plant's waste locally, worried that it might travel with the ground water and contaminate the Front Range, especially the nearby communities of Denver, Boulder, and Golden. Consequently, the AEC directed Dow to ship the factory's waste to the AEC disposal site at the National Reactor Testing Station in the Idaho desert. The AEC first established this facility on the Snake River Plain near Idaho Falls in 1949. There, the AEC built a nuclear reactor in order to test unproven reactor technologies. It seemed a logical location for the Nuclear Reactor Testing Station. Ecologically, Idaho Falls was a desert containing lava rock and clay sediment. If any moisture managed to saturate nuclear materials and travel into the ground, the

[219] "There's No Atomic Blast Danger at Rocky Flats," *Rocky Mountain News*, 1 June 1954; Ackland, *Making a Real Killing*, 101.

lava rock and clay would bind to the radionuclides and keep them them traveling with the groundwater. Additionally, the nearby population was low, further mitigating the risk that the facility posed to American bodies. Like Rocky Flats Plant, the National Reactor Testing Station invigorated the local community. Between 1949 and 1951, Idaho Falls boomed with housing developments and atomic jobs. Along with testing new reactor technologies and techniques, the Idaho facility received and stored nuclear waste from Rocky Flats Plant.[220]

In April 1954, Rocky Flats Plant workers packed several stainless-steel drums of low-level plutonium waste into railcars and shipped them to the Nuclear Reactor Testing Station on a trial run. The shipment went well and the transportation cost was relatively cheap. Throughout the rest of 1954, Rocky Flats Plant sent 200 drums of radioactive waste to the Idaho facility each month. In 1956, the factory sent 300 drums each month. In 1957, 400 drums. When the drums arrived in Idaho, workers took them off the back of the railcars and hand stacked them in an earthen pit called the "Burial Ground." They wore nothing but common gloves and clothes.[221]

In 1963, Burial Ground operators abandoned this manual system. As Rocky Flats Plant produced more waste in the late 1950s and the early 1960s, the AEC began shipping thousands of drums to Idaho Falls using the new Interstate Highway System. When the trucks arrived, Burial Ground workers rolled the waste drums off the truck beds and into the pit. With Rocky Flats Plant drums arriving by the thousands, tipping them into the pit was faster than manhandling each barrel. Burial Mound operators further justified this new technique by arguing that it reduced potential radiation exposure to workers. The operators also claimed that the

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[220] Susan M. Stacy, *Proving the Principle* (Idaho Falls: Idaho Operations Office of the Department of Energy, 2000), 79, 76, 26-7, 31, 35.
[221] Stacy, *Proving the Principle*, 79-80; B.C. Anderson and R.M. Schletter, *A History of the Radioactive Waste Management Complex at the Idaho National Engineering Laboratory* (Idaho Falls: IDO Nuclear Fuel Cycle Division, 1979), 19, 21-2; Ackland, *Making a Real Killing*, 138.

barrels were expected to deteriorate after a few decades, so the environmental impact of the procedure, which dented or otherwise compromised some of the drums, was of “no serious consequence.” It was nature’s responsibility, in this case Idaho’s lava rock and clay formations, to bind the radionuclides in place and prevent human exposure.[222]

From the start, the AEC and Dow understood that the factory was producing more radioactive waste than it could ship off-site. Rather than hold this waste in the facility, and expose workers to its hazards while waiting for new AEC trains and trucks to arrive, the AEC allowed Dow to dispose of its excess waste on-site. Workers burned combustible waste, including workers’ clothes, in incinerators and open pits and buried the ash around the property. They buried noncombustible waste in steel drums on factory grounds. Some of this waste was radioactive. One notable local burial ground was a hillside behind Building 881 where workers dumped uranium-contaminated drums. At another waste site on the east side of the plant, workers deposited drums contaminated with plutonium and uranium in a series of eleven trenches. Between 1953 and 1962, workers buried 55,000 pounds of depleted uranium chips in 125 drums at “Trench T-1” alone. Only two feet of soil separated the drums from the open air. A third waste site, known as the “Mound,” contained 1,045 drums of waste contaminated with uranium and plutonium. Experts estimated that the Mound contained about 285 grams of plutonium.[223]

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[222] Stacy, *Proving the Principle*, 81; Anderson and Schletter, *A History of the Radioactive Waste Management Complex at the Idaho National Engineering Laboratory*, 23.

[223] Ackland, *Making a Real Killing*, 138; Edward A. Putzier, “The Past Thirty Years at Rocky Flats Plant,” November 1982, 67, 113, Edward Putzier Collection, University of Colorado Boulder Libraries, Special Collections and Archives, Boulder, Colorado; ChemRisk, “Reconstruction of Historical Rocky Flats Operations & Identification of Release Points,” August 1992, Report No. SW-A-005612, 67, 183, 188-201, https://www.lm.doe.gov/cercla/documents/rockyflats_docs/SW/SW-A-005612.pdf.

In order to understand what this pollution meant for the Front Range, we need to explore plutonium-239's toxicological profile. Plutonium-239 has a half-life of 24,100 years, meaning it takes over twenty-four thousand years for half of the element to decay. As it decays, it gives off alpha radiation, or alpha particles. Alpha particles are not very intrusive. They can be stopped by skin or a piece of paper. In other words, placing plutonium-239 in barrels and burying the drums can effectively prevent alpha particles from harming humans. However, if the drums leaked into the groundwater or corroded in the open air, plutonium-239 could find its way into digestive and respiratory systems. After entering the human body, plutonium-239's alpha particles can cause lung, bone, and liver cancer.[224]

In addition to producing a large amount of radioactive waste, Rocky Flats Plant contaminated the environment through a series of radioactive accidents. While the balance of these hazardous episodes occurred in the late 1960s and the early 1970s, and will thus be examined in a later chapter, one notable incident occurred in the late 1950s. On September 11, 1957, at 10PM, between 12 to 21 kilograms of plutonium casting residues in one of Rocky Flats Plant's glove boxes spontaneously combusted in Building 771. Plutonium burns without visible flame, similar to a charcoal briquette. As it burns, it emits intense heat and white light. Fearing that dousing the flames with water would induce criticality, the building production shift supervisor and a plant health physicist directed the firefighters to extinguish the glove box fire with carbon dioxide extinguishers. When carbon dioxide failed, the fire crews turned to water. While firefighters attempted to extinguish the blaze, heat from the plutonium spread through the

[224] Agency for Toxic Substance and Disease Registry, "Public Health Statement: Plutonium" November 2010, https://www.atsdr.cdc.gov/ToxProfiles/tp143-c1-b.pdf.

glove boxes's integrated ventilation system and ignited a second fire in the main air filter bank of Building 771.[225]

Figure 9: Worker pointing to the glove box where the 1957 fire started. 16 September 1957. Image CO-83-N-2. Photograph courtesy of the U.S. Department of Energy.

Although firefighters extinguished the original glove box fire by 10:38PM, it took them twelve hours to quell the ventilation system fire. As a result, the fire destroyed most of the filters that kept plutonium from escaping into the atmosphere through the building's stack. The destruction of the filters allowed plutonium dust and smoke to go directly into the regional environment. Researchers estimated that during and immediately following the fire between 40

[225] Dow Chemical Company, Rocky Flats Division, "Report of Investigation of Serious Incident in Building 71 on September 11, 1957," by J.G. Epp, 7 October 1957, Document IN-732, 11, 15-6, 59-60, 62, 54, 64, FOIA; Ackland, *Making a Real Killing*, 116-7.

and 500 grams of plutonium-239 were released into the air and carried off-site. Most of the plutonium-239 landed within the uninhabited buffer zone around the plant, contaminating vegetation. Dow dispatched radiation monitors across the plant and into neighboring communities to track the plutonium release. The monitoring team detected plutonium "at half tolerance" level at the plant site and found some "unidentifiable activity" that was barely detectable south of the factory on Highway 72. Following the fire, the Colorado Public Health Service in Denver monitored the air for radioactivity, primarily alpha particles. It reported "no abnormal" readings. The AEC, Dow, and the Colorado Public Health Service determined that the fire did not cause any serious injuries or deaths. After testing workers for contamination, the factory's director of health physics declared that "for all practical purposes, the plutonium contamination resulting from the fire is negligible."[226]

Despite this announcement, Dow and the AEC continued to examine the region's natural environment for contamination linked to the fire. During the months after the fire, Dow monitors took vegetation samples from the plant's buffer zone and from nine other locations less than two miles away from the factory. Although they found several pieces of vegetation contaminated with plutonium-239, including blades of grass and leaves, experts estimated that the highest plutonium off-site dose was 1.3 millirem. Examining this radiation dose alongside health risk dose standards led independent researchers in 1996 to conclude that the "health risks for the off-site public from the 1957 fire release are of a magnitude generally recognized as small even when very large populations are exposed."[227]

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[226] T.R. Mongan, S.R. Ripple, G.P. Brorby, and D.G. diTommaso, "Plutonium Releases from the 1957 Fire at Rocky Flats," *Health Physics* 71, no. 4 (October 1996): 510-1; Dow Chemical Company, Rocky Flats Division, "Report of Investigation of Serious Incident in Building 71 on September 11, 1957," 15-6, 18, 69-71, 76-7.
[227] Mongan, Ripple, Brorby, and diTommaso, "Plutonium Releases from the 1957 Fire at Rocky Flats," 513, 519-20.

After the fire, the AEC and Dow restored Building 771. Work resumed before the end of 1957 and the building became fully operational in 1962. In the end, the fire cost $818,600 in property damage. But business did not go on as usual. The AEC and Dow had learned from the inferno and installed flame-resistant filters in the plant. Dow also asked the AEC to conduct research on the best methods for controlling radioactive metal fires. It appeared that Dow was mobilizing its expertise and seeking after new best practices to prevent another plutonium fire. Unfortunately, as we will see, Dow and the AEC failed to fireproof Rocky Flats Plant.[228]

Between 1953 and 1960, Dow transformed the Colorado Front Range. The firm's Rocky Flats Plant economically enriched Denver, Golden, and Boulder, providing new high-paying jobs to local experts and blue-collar workers alike. Instead of placing traditional corporate executives and accountants in administrative roles, Dow placed the factory under the leadership of local educated experts. This factory culture and organizational scheme made sense. Dow's contract to operate the factory did not reward the company for producing more triggers. Rather, the fixed fee contract led Dow to operate the facility using costly processes guided by expertise. As a result of this contract, Dow received less than $5.5 million for operating Rocky Flats Plant between 1953 and 1960. During that same period, Dow received $405 million in profits from its other industrial facilities. In other words, Rocky Flats Plant was not a cash cow for Dow.[229] In addition to empowering local experts, Dow provided its menial laborers with opportunities to become

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[228] Dow Chemical Company, Rocky Flats Division, "Report of Investigation of Serious Incident in Building 71 on September 11, 1957," 23-4; U.S. Atomic Energy Commission, Division of Operational Safety, *Operational Accidents and Radiation Exposure Experience within the United States Atomic Energy Commission 1943-1975* (Washington, D.C.: U.S. Atomic Energy Commission, 1975), 21.
[229] Dow Chemical Company, 1953 Annual Report, July 1953, 22; Dow Chemical Company, 1954 Annual Report, July 1954, 18; Dow Chemical Company, 1955 Annual Report, July 1955, 18; Dow Chemical Company, 1956 Annual Report, August 1956, 22; Dow Chemical Company, 1957 Annual Report, August 1957, 18; Dow Chemical Company, 1958 Annual Report, August 1958, 18; Dow Chemical Company, 1959 Annual Report, August 1959, 22; Dow Chemical Company, 1960 Annual Report, August 1960, 22.

educated experts, themselves, and win leadership roles in the factory. These business practices, combined with the factory's economic footprint, galvanized local support for Dow's mission at Rocky Flats Plant. Dow had created nuclear loyalists on the Front Range. Its local experts would brandish their nuclear competence to downplay the facility's routine pollution and the disasters that befell the factory in the 1960s and the 1970s. But that is a story for another chapter.

Pantex, Texas

After Rocky Flats Plant workers molded plutonium-239 into triggers, they shipped the finished pits to an AEC facility near Amarillo, Texas. There, at Pantex, workers packaged the pits with HE components and encapsulated the finished bombs in munitions containers. In this way, Rocky Flats Plant and Pantex were inextricably linked. The history of Pantex during the 1950s is similar to the Rocky Flats Plant story. Nature guided the AEC to both landscapes. Both factories economically uplifted their surrounded communities. Yet, there are important differences between these two histories. The federal government first established Pantex during World War II to serve as a conventional munitions factory. In 1952, the AEC and the military reactivated the old munitions building and gave it a new nuclear commission. As HE component manufacturers and warhead packagers, Pantex workers produced little radioactive waste. Additionally, because Pantex work consisted of manufacturing HE explosives and assembling finished warheads, the facility's operating contractor, Procter & Gamble, had little use for physicists, chemists, and other educated experts. Consequently, Procter & Gamble followed a traditional organizational method that placed business administrators in leadership roles. Further drawing on tradition, Procter & Gamble modified the manufacturing and assembly processes it pioneered in its soap and conventional munitions factories to facilitate HE fabrication and warhead assembly. These organizational methods and techniques allowed Pantex to seamlessly fulfill its industrial mission and supply the American arsenal with thousands of nuclear weapons.

Nature guided the state towards the Texas Panhandle for military construction during World War II. Seeking to meet war demand for munitions, bombs, and military equipment, the U.S. Army forged plans to erect new arsenals and munitions factories in the United States. The factories needed to be far from international borders to secure them from enemy attack. They also needed access to major railways, water sources, and ample electricity. Although this was not a necessity in most cases, the Army preferred building its munitions factories in a dry climate to stave off flooding, snow removal, and rust. With these factors in mind, the military turned to the Texas Panhandle.

St. Francis, Texas, proved to be the ideal space to build a conventional bomb and artillery factory. Located seventeen miles east of Amarillo, in Carson County, St. Francis was a wheat farming community on the Llano Estacado, a semiarid, flat, rolling grassy plains region. Beneath the region lay the Ogallala Aquifer, the largest and most heavily used aquifer in the nation.[230] The Army deemed St. Francis ideal for several environmental reasons. The community was far from international borders, had a healthy water supply and railroad access only ten miles away. Thanks to the Rural Electrification Administration, St. Francis had recently received federal funding for an electrical network. The relatively level and unbroken land on the Llano Estacado

[230] Environmental Protection Department, Environment, Safety & Health Division, Battelle Pantex, Mason & Hanger-Silas Mason Co., Inc., "1993 Environmental Report for Pantex Plant," June 1994, 1-2, http://www.iaea.org/inis/collection/NCLCollectionStore/_Public/26/040/26040703.pdf; Makhijani, Ruttenber, Kennedy, and Clapp, "The United States," 235.

provided a good foundation for construction. After appraising the community, the Army brought its construction plans to Congress for approval.[231]

In December 1941, Congress authorized the Army to break ground on 16,000 acres in St. Francis for a conventional munitions plant. Like Rocky Flats Plant's history, the land the state selected in St. Francis was not uninhabited. Rather, it was an irrigated prairie where small farmers raised their children, tended their flocks, and grew wheat. Before the state could break ground, it needed to force these farmers off their land and seize their property.[232]

The removal process was quick. Utilizing the seizure provision of the Fifth Amendment of the U.S. Constitution, a federal court issued an order condemning nineteen family properties on March 31, 1942. Most of the properties were small farms. On April 6, 1942, the military summoned the nineteen families to a meeting at the local community civic center, Liberty Hall.[233] There, a military spokesman informed the farmers that the state was seizing their property. The families had fourteen days to leave. Most of the families quietly went along with the order. As the *Amarillo Daily News* put it: "There were so many aching hearts, the folks didn't linger and talk as was customary; they went home." "They had only two consolations," the newspaper continued, "1. By moving from their homes they would aid the war effort. 2. The

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231 Hunt, "'Host and Hostage,'" 342; John T. "Jack" Becker, "The Texas Panhandle," in *West Texas: A History of the Giant Side of the State*, ed. Paul H. Carlson and Bruce A. Glasrud (Norman: University of Oklahoma Press, 2014), 37-8; Richard Lowitt, *The New Deal and the West* (Norman: University of Oklahoma Press, 1993), 33; David M. Wrobel, *America's West: A History, 1890-1950* (New York: Cambridge University Press, 2017), 141-2; Randolph B. Campbell, *Gone to Texas: A History of the Lone Star State* (New York: Oxford University Press, 2003), 389; "After 23 Years," *Amarillo Daily News*, 6 December 1941.

232 Hunt, "'Host and Hostage,'" 341.

233 "Miracles were Asked and Performed," *Pantexan*, 15 September 1942, 8; Lewis Nordyke, "Folks in Liberty Community Gasped at Order to Move in 14 Days," *Amarillo Daily News*, 15 April 1943; Bobby Weaver, ed., *A Harvest of Memories: The St. Francis Story* (Amarillo: Southwestern Publications, 1983), 34.

government would pay them."[234] One local pastor, Monsignor John A. Steinlage, protested the Army's plan and urged that the plant be constructed elsewhere. The Army and the families ignored him.[235] The Army did not allow the farmers to tear down their homes, nor cut and sell their wheat. The Army did permit them to dispose of their livestock and sell their equipment. Still, many of the families simply ran out of time and lost their moveable property. Charlie Russ did not have time to move 18,000 bundles of feed and was forced to abandon it. W.H. Lusk lost 65 head of fine hogs because he had no place to move them. As the *Amarillo Daily News* put it, "these people were caught in a mighty vise."[236]

Although the Army told the farmers that they would get fair market value for their land and property, many of the evicted believed the offers undervalued their real estate. Government appraisers set a $450,000 value on the land, later raised to $575,000. Meanwhile, private appraisers valued the land at $984,274. The state paid the farmers $2.50 per acre of wheat. Much of the wheat was worth $30 an acre. After evicting the families, the state hired laborers to harvest the crop, paying them $6.00 per acre. After selling the crop, the state reaped almost $30.00 per acre in revenue. The evicted received none of the profits. In July 1943, a few of the farmers sued the federal government over the value of their condemned land. The litigation ended in the farmer's favor and the evicted received higher payouts for their property—about $750,000 for 15,000 acres in total. However, the state failed to promptly pay the farmers. Many did not receive payments until 1944 and one was not paid until 1949. The government paid no damages to the families.

[234] Nordyke, "Folks in Liberty Community Gasped at Order to Move in 14 Days."
[235] Leroy T. Matthiesen, *Wise and Otherwise: The Life and Times of a Cottonpicking Texas Bishop* (Amarillo: Custom Printing Company, 2005), 126.
[236] Nordyke, "Folks in Liberty Community Gasped at Order to Move in 14 Days."

This delay left some of the evicted families in hard times. Take, for example, the Haiduk family experience. Fred and Edith Haiduk were a young couple with one child. After the government evicted them from their property, the Haiduks went to live with Edith's father. However, her father had no room for them and the Haiduks were forced to live in a garage for four months. They signed a contract for a farm north of Groom. Eighteen months later, the family almost lost the property because they had not received their money from the government and their contract was about to expire. The Bichsel family faced a similar situation. The family of six moved to Amarillo after the Army evicted them. The father of the family, Al, stored his machinery, livestock, and chickens with friends as he tried to secure another property. Al made a down payment on a farm near Washburn, but eighteen months later he was about to lose it because the government had not paid him yet. Unfortunately, the historical record provides little clues as to what happened to the Haiduks and the Bischels next. The archive ends their story of dispossession with the twin nightmares of financial ruin and homelessness.[237]

With the farmers evicted, the Army partnered with private firms and erected Pantex, a conventional munitions assembly plant. The Army Corps of Engineers oversaw construction and granted contracts to Freese and Nichols, McKenzie Construction Company, and H.F. McFarland to complete the work. "Today the war is literally in everyone's barnyard," wrote the *Amarillo Daily News*. Station wagons filled with government officials and surveying crews, trucks flushed with lumber and heavy machinery, and workmen's cars and road-building equipment descended on St. Francis. Workers laid railroad tracks, fastened new electric lines, and tore up the main

[237] Nordyke, "Folks in Liberty Community Gasped at Order to Move in 14 Days"; Hunt, "'Host and Hostage,'" 341; Weaver, ed., *A Harvest of Memories*, 34-5.

highway to make it a four-lane route.[238] "We have a tremendous job to do in limited time," Major H.P. Burgard told a local reporter. "Because of the urgency of this construction, we have had to do some things we otherwise would not have done. For instance, we are retaining all windmills and water facilities on the farms. We would have liked to have been able to allow the farmers to take this with them, because we know it will be hard for them to get new equipment. However, we simply had to have an immediate water supply and the windmills are the only present source of water in the area."[239] The Army used Liberty Hall and most of the homes to house personnel or as temporary office space. It bulldozed and burned most of the barns, chicken houses, and other farming buildings.[240]

The Army activated Pantex in the fall of 1942. The Certain-Teed Products Corporation operated the conventional munitions factory on the Army's behalf during the war. Anticipating a housing shortage, Certain-Teed employed local Texans wherever possible. Because the war pulled men out of West Texas and into Europe and the Pacific, Certain-Teed hired both men and women to work on bomb and artillery shell production lines. At its peak, the wartime facility employed 5,254 people, about 60 percent of whom were women. Overall, West Texans supported the plant. It brought thousands of jobs to Carson and Potter counties and was Amarillo's largest employer.[241] The plant was notable for its efficiency. The Field Director of

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[238] Mason & Hanger Corporation, "Pantex Facts, History and Missions," Publicity Materials and Photographs of the Pantex Plant in Amarillo, Wallet, S 1392.1, Southwest Collection, Texas Tech University, Lubbock, Texas; "Pantex Axes Axis," *Pantexan*, 15 September 1942, 4; Raymond Holbrook, "Giant Industry Rises in Wheat Fields," *Amarillo Daily News*, 18 April 1942. Pantex is an acronym for "Panhandle, Texas."
[239] Raymond Holbrook, "Carson County Farmers Moving Out on Deadline—Glad to Cooperate," *Amarillo Daily News*, 18 April 1942.
[240] Weaver, ed., *A Harvest of Memories*, 34.
[241] "Miracles were Asked and Performed," 8; Hunt, "'Host and Hostage,'" 342-3; "Pantex Axes Axis," *Pantexan*, 15 September 1942, 4; Amy F. Woolf and James D. Werner, *The U.S. Nuclear Weapons Complex: Overview of Department of Energy Sites* (Washington, D.C.: Library of Congress,

Ammunition Plants determined that Pantex ranked second among twelve ordnance installations in man-hour efficiency for bomb loading during April 1943. Along with producing bombs and artillery shells, the plant grew peas, radishes, and greens in its 25-acre garden. Gardeners and field hands gathered as much as 300 pounds of vegetables in a single day. Workers dined on the yield in the cafeteria. The plant donated the excess food to the local children's preventorium, a caregiving facility for children with tuberculosis. In typical West-Texan fashion, the plant also sported a calf roping club. The club had fifty charter members and was open to all employees. Members had to provide their own horses or borrow one from a coworker.[242]

Production ended with the conclusion of the war in August 1945, leaving 4,700 West Texans out of work. The unemployment statistics in Amarillo were so bad that the War Manpower Commission listed the city as one of seven Texas locations facing "serious unemployment."[243] In 1949, the state decommissioned Pantex and sold the facility to Texas Technical College for one dollar. The college used the land as an experimental agricultural site and left the main production building intact. The state retained the right to reclaim the land.[244]

The Cold War nuclear arms race necessitated that the AEC expand its facilities and move nuclear assembly out of the laboratory and into the factory. During World War II, Los Alamos assembled all the nation's nuclear warheads. Additionally, the laboratory manufactured the HE

Congressional Research Service, 2018), 19; Paul H. Carlson, *Amarillo: The Story of a Western Town* (Lubbock: Texas Tech University Press, 2006), 148.

242 "Getting the Job Done," *Pantexan*, 1 July 1943, 5; "The Payoff," *Pantexan*, 1 July 1943, 8; "Singing Lariats," *Pantexan*, 15 November 1942, 10.

243 "Closed," *Amarillo Globe*, 15 August 1945; "40,000 Workers Are Laid Off at War End," *Amarillo Globe*, 16 August 1945; "Workers Laid Off at Pantex, Cactus Plants Free of Job Controls," *Amarillo Daily News*, 16 August 1945; "Amarillo One of 7 Cities in Texas Now Facing 'Serious Unemployment,'" *Amarillo Daily News*, 17 August 1945; "Amarillo Listed among Areas Facing 'Serious Unemployment,'" *Amarillo Daily News*, 23 August 1945.

244 Mason & Hanger Corporation, "Pantex Facts, History and Missions," Publicity Materials and Photographs of the Pantex Plant in Amarillo, Wallet, S 1392.1, Southwest Collection, Texas Tech University; Hunt, "'Host and Hostage,'" 343.

components that triggered the nuclear detonations. These explosives created an imploding shock wave which compressed the fissile plutonium or highly enriched uranium into a supercritical mass and triggered the nuclear blast.[245] After the war, the AEC and the Army Ordnance Bureau forged a contract with Silas Mason Company to manufacture HE components at the Burlington Arsenal in Iowa. This move lessened the overall burden on Los Alamos. By 1950, however, the state's demand for nuclear weapons outgrew the capabilities of the Los Alamos's assembly station and Burlington's HE production facilities. On October 12, 1950, the AEC Division of Military Application recommended that the commission open a larger HE component fabrication facility and move nuclear assembly out of Los Alamos and into an industrial setting "to meet the demands for matching the planned increase in nuclear production and to provide reserve capacity for a rapid conversion of the existing stockpile when circumstances require." Specifically, the division advised the AEC to acquire an unused ordnance plant, convert it into an HE component factory and nuclear assembly plant, and hire a contractor to staff the operation. The AEC commissioners agreed and launched Project Orange, an operation that tasked the Division of Military Application to appraise mothballed plants for this new nuclear mission.[246]

After investigating potential plants, the division told the AEC commissioners that Pantex was the best fit for the project. The AEC was impressed by Pantex's environmental factors. The factory was far from international borders, had access to ample sources of electricity and water,

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[245] Greg Leroy, "Pantex: The DOE's Best Kept Secret" *Science for the People*, May/June 1989, 9; Arjun Markhijani and Scott Saleska, "The Production of Nuclear Weapons and Environmental Hazards," in *Nuclear Wastelands: A Global Guide to Nuclear Weapons Production and Its Health and Environmental Effects*, ed. Arjun Makhijani, Howard Hu, and Katherine Yih (Cambridge: The MIT Press, 1995), 61.
[246] History Associates Incorporated, "History of the Production Complex: The Methods of Site Selection," September 1987, Report No. DOE/NV/10594-H1, Accession Number 5745137, 63-4, https://www.osti.gov/servlets/purl/5745137; U.S. Atomic Energy Commission, "Selection of a Site and Method of Operation for New HE Fabricating Facility," AEC 382, 28 November 1950, FOIA; U.S. Atomic Energy Commission, "Selection of a Site and Method of Operation for New HE Fabricating Facility," AEC 382/2, 21 February 1951, FOIA.

and was near major railways. The location's arid climate lowered air conditioning costs and staved off rust and snow removal. Pantex was also relatively remote. This meant that the AEC could test its HE components at the facility without disturbing many people. Like Denver, the city had few industries and a large labor pool. According to U.S. Department of Commerce, in 1950 Amarillo contained 37,927 blue-collar laborers, but only 3,773 construction and 3,645 manufacturing jobs.[247] This meant that Pantex could tap into an underserviced labor market and provide wealth to struggling West Texans. Pantex's existing physical facilities also made the factory an easy choice for the AEC. The factory's old bomb loading lines were "in surprisingly good condition" and required few modifications to meet the AEC's specifications for HE component fabrication.[248] By selecting Pantex, the AEC could "save time instituting construction" and "avoid the necessity of acquiring private lands."[249]

In November 1950, the AEC selected Pantex and moved to acquire the facility. AEC Chairman Gordon Dean wrote to the Army Chief of Ordnance to begin the transfer arrangements. The Army insisted that the AEC grant it an oversight role at the facility, arguing that the Army had operated it in the past and had experience manufacturing HE components and assembling munitions. Dean capitulated and agreed that the operating contractor of Pantex would work under the Army Chief of Ordnance.[250] On February 23, 1951, the AEC reclaimed 9,000

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[247] U.S. Department of Commerce, *County and City Data Book, 1952* (Washington, D.C.: U.S. Government Printing Office, 1953), 12.

[248] History Associates Incorporated, "History of the Production Complex," 64; U.S. Atomic Energy Commission, "Selection of a Site and Method of Operation for New HE Fabricating Facility," AEC 382, 28 November 1950, FOIA; U.S. Atomic Energy Commission, "Selection of a Site and Method of Operation for New HE Fabricating Facility," AEC 382/2, 21 February 1951, FOIA.

[249] Gordon Dean to Senator Connally, 19 January 1951, "635.51 (11-7-50) H.E. Fabrication Facilities" folder, box 61, RG 326, National Archives and Records Administration, College Park, Maryland.

[250] History Associates Incorporated, "History of the Production Complex," 64-5; U.S. Atomic Energy Commission, "Selection of a Site and Method of Operation for New HE Fabricating Facility," AEC 382/2, 21 February 1951, FOIA; U.S. Atomic Energy Commission, "Method of Operation of New HE Fabrication Facility," AEC 382/3, 13 March 1951, FOIA.

acres of the site, including the main production buildings. The AEC allowed Texas Technical College to retain 8,000 acres of the site, viewing the college's agricultural project as a security buffer.[251]

The AEC next searched for a contractor to operate the facility. The AEC did not demand much from potential Project Orange contractors. The commission simply required that the contractor have "industrial fabrication and manufacturing experience, and a good management ability as evidenced by successful organizing background." Additionally, the AEC preferred that its contractor have "a staff competent to cope with chemical and mechanical engineering problems arising in this work, and also experienced in high quality production of chemical solids." With these requirements in mind, the AEC narrowed its search to eight firms: Tennessee-Eastman Corporation, E.I. DuPont de Nemours and Company, Procter & Gamble Company, Silas Mason Company, Firestone Tire & Rubber Company, Johns-Manville Company, Quaker Oats Company, and Remington-Rand, Inc.[252]

The AEC settled on the Procter & Gamble Company on January 9, 1951. The firm was a logical choice for Pantex in comparison to the other contenders. The AEC argued that Tennessee-Eastman and DuPont were "already too involved in defense work." The AEC disqualified Silas Mason because it was already operating a HE facility in Iowa. The commissioners reasoned that a "plurality of contractors is desirable" when it came to manufacturing HE components in order to "avoid work stoppage at more than one plant in event of any difficulties in a contractor's relations." The AEC disqualified the remaining contenders,

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[251] "AEC Obtains Pantex Land," *Amarillo Daily News*, 24 February 1951; U.S. Atomic Energy Commission, "Atomic Energy Commission Decision on AEC 382, Selection of a Site and Method of Operation for New H.E. Fabrication Facility, Note by the Secretary," by Roy B. Snapp, AEC 382/1, 28 November 1950, FOIA.

[252] U.S. Atomic Energy Commission, "Selection of Operating Contractor for Project Orange, Report by Director Military Application," AEC 382/2, 21 February 1951, FOIA.

including Firestone and Quaker Oats, because it deemed their "present day work…not too comparable with the proposed work." In contrast, Procter & Gamble had an impressive history of military production and research and development. During World War II, Procter & Gamble won a government contract to build and operate shell-loading plants in Tennessee and Mississippi. The company's large research and development division applied its packaged-goods technology to munitions assembly lines and designed a better way to build bombs. To transmute its commercial packaging processes into munitions assembly, Procter & Gamble tasked thirty of its administrators to analyze shell loading, modify commercial standard practices, and create instruction films to educate workers on the packaging operations. As the historian Alfred Lief put it, "the management methods applied to ordnance work were those practiced daily at P&G." By utilizing its traditional packaging processes and its "principles of good management," Procter & Gamble cut shell-loading costs by 66 percent. By the end of the war, Procter & Gamble produced 25 percent of all the shells and bombs used by the Allied Powers.[253]

Not only did Procter & Gamble match the AEC's vision of what ideal contractor for Pantex looked like, Pantex fit Procter & Gamble's diversification effort. After the conclusion of World War II, Procter & Gamble opened new commercial facilities and increased its production of retail goods, including soap. According to the business historian Alfred Chandler, the firm expanded its operations not because of consumer demand but to provide jobs for its existing personnel. "The motive for the initial diversification," Chandler writes, "appears to have been…that of assuring continuing and fuller use of existing resources." Searching after a new

[253] "Procter & Gamble to Run Atomic Facility in Texas," *New York Times*, 28 March 1951; U.S. Atomic Energy Commission, "Selection of Operating Contractor for Project Orange, Report by Director Military Application," AEC 382/2, 21 February 1951, FOIA; Alecia Swasy, *Soap Opera: The Inside Story of Procter & Gamble* (New York: Random House, 1993), 83; Procter & Gamble Company, *Into a Second Century with Procter & Gamble* (Cincinnati: Procter & Gamble Company, 1944), 59; Alfred Lief, *"It Floats": The Story of Procter & Gamble* (New York: Rinehart & Company, Inc., 1958), 213-5.

factory to put its administrators to work, Procter & Gamble accepted the AEC's cost-plus fixed fee contract to operate Pantex on February 28, 1951.[254]

With the selection of Procter & Gamble the AEC turned to construction. The AEC originally estimated that refurbishing the plant would cost $20 million. West Texans looked on with elation. "Twenty million dollars is a lot of money," remarked Earl O'Keefe, the president of the local Chamber of Commerce. "It looks as though Amarillo has hit the jackpot."[255] The AEC granted the Silas Mason Company, the same firm that manufactured HE components at Burlington Arsenal, a contract to engineer and draw all the renovation plans. The AEC awarded the general contractor work to the Lubbock firm Walden, Fulton & Payne. The company employed hundreds of skilled and unskilled West Texans as carpenters, cement finishers, plumbers, steam fitters, electricians, roofers, steel workers, plasterers, and common laborers. At its peak, the construction force numbered 1,500 workers. In the end, the AEC poured $25 million into refurbishing the site.[256]

On January 30, 1951, the AEC shed some light on the factory's new mission. The AEC Field Manager Walter W. Stagg told the public that "the new installation is performing varied testing and production for the Atomic Energy Commission, involving so-called conventional high explosives." He also related that the factory would be testing HE components on site and

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[254] U.S. Atomic Energy Commission, "Selection of Operating Contractor for Project Orange, Report by Director Military Application," AEC 382/2, 21 February 1951, FOIA; Chandler, *Strategy & Structure*, 346, 363.
[255] Thomas Thompson, "City Hails Huge Pantex Project," *Amarillo Sunday News-Globe*, 21 January 1951.
[256] "More Pantex Plans to be Ready Soon," *Amarillo Daily News*, 16 March 1951; "Solon Pleased with Fourfold Pantex Activity," *Amarillo Daily News*, 6 August 1952; Mason & Hanger-Silas Mason Co., Inc., "Mason & Hanger-Silas Mason Co., Inc., 1827 to 1961: Engineering, Plant Operation, Construction," c.1962, 10-10a, University of Virginia Libraries, Charlottesville, Virginia; "Lubbock Firm Low Bidder on Pantex AEC Project," *Amarillo Daily News*, 20 March 1951; "Hiring at Pantex in Week Aim," *Amarillo Sunday News-Globe*, 25 March 1951; "One Pantex Unit Completed," *Amarillo Daily News*, 31 January 1952; "Procter & Gamble to Run Atomic Facility in Texas," *New York Times*, 28 March 1951.

that these experiments would "be publicly noticeable outside the Pantex grounds." He stressed that the HE blasts would pose no hazard to the public and would simply generate intermittent noise pollution. But he kept Pantex's classified mission secret. He did not relate that the factory was the final assembly point for the nation's nuclear weapons.[257]

Throughout 1951, the AEC promoted the reactivation of Pantex, promising West Texans that it would boost the local economy. On April 20, the AEC Director of Information Richard Elliott visited the nearby town of Borger and held a meeting with the local Chamber of Commerce. He talked about the growing field of atomic energy and how it was expanding in New Mexico and Nevada. He related that people living in the Texas Panhandle and Colorado would soon see "new laboratories and huge new production plants" associated with nuclear technologies. Most importantly, he said that these new plants would benefit local economies, employing between 1,000 and 1,200 people, most of whom would be hired locally. Elliott's message emphasized economic development while offering little details on the mission of the factory. "There are a few things I can tell you about the Pantex plant," he said. "Like all of our other plants, its work has to remain classified, and I hope you West Texans won't be too curious about what is being done."[258] The AEC official Paul W. Ager shared a similar message. He told the Amarillo City Commissioner Loren Young that the balance of Pantex's workforce would come from the Amarillo area. When pressed on what the factory would produce, Young simply stated "weapons components."[259]

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[257] "One Pantex Unit Completed," *Amarillo Daily News*, 31 January 1952.
[258] "Convention Set at Borger Today," *Amarillo Daily News*, 20 April 1951; Hunt, "'Host and Hostage,'" 344; Harry Hoare, "AEC Representative Reveals Facts on Pantex Atom Plant," *Amarillo Daily News*, 21 April 1951.
[259] Fred Post, "Los Alamos to Train Pantex Supervisors," *Amarillo Sunday News-Globe*, 5 August 1951.

Local residents were delighted that the AEC selected Pantex for its new project. "The Atomic Energy Commission operation at Pantex is going to turn out to be about the biggest thing that has ever happened to Amarillo," wrote the *Amarillo Globe-Times*. Local business experts speculated that the new facility would "expand and expand" over time and flush the community with cash. Thousands waited for their chance at landing a Pantex job.[260]

Pantex began producing nuclear weapons components in May 1952. Throughout the Cold War, the factory manufactured and tested HE components and served as the final assembly point for the nation's nuclear arsenal. Like it did with Rocky Flats Plant, the AEC shipped Pantex supervisors to Los Alamos for training.[261] When they returned from New Mexico, the supervisors trained local workers how to produce HE components and test them in the fields on site. After proven HE components rolled off the production lines, Pantex workers mated them to the fissile component of the plutonium pits from Rocky Flats and placed the combined unit into a protective shell or liner, called the "physics package." In layman's terms, this package was a completed nuclear warhead. To accomplish its new nuclear mission, Procter & Gamble relied on its traditional organizational methods. The firm transplanted it soap factory managers to Pantex and tasked them to oversee and manage the packaging lines using Procter & Gamble's traditional packaging processes. Workers required little technical education in order to master the packaging process. Thus, Procter & Gamble did little to provide its blue-collar workforce with education on nuclear physics, chemistry, and engineering. Manual laborers simply followed the firm's packaging model to create the physics packages. Most of this packaging education came via a

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[260] Thomas Thompson, "Business Briefs," *Amarillo Globe-Times*, 25 June 1952.
[261] Steven Schroeder, "On Learning to See Nothing: The Institution of Pantex" (presentation at the Popular Culture Association Conference, Las Vegas, Nevada, March 1996); Fred Post, "Los Alamos to Train Pantex Supervisors," *Amarillo Sunday News-Globe*, 5 August 1951; "P&G Officials," *Amarillo Daily News*, 9 April 1952.

series of educational films produced by Procter & Gamble. Although Pantex workers produced some of the most dangerous weapons in human history, they used simple packaging and assembly schemes. Indeed, Pantex more closely resembled early twentieth century assembly factories than it did Rocky Flats Plant. Traditional management, traditional organization, and uneducated laborers made the factory work.[262]

Pantex invigorated Amarillo. Local residents took pride in having a key national security facility near their city. They also took home federal cash from Pantex's payroll. Amarillo's unemployment rate dropped to 3.4 percent, and thousands of people moved to the area looking for Pantex jobs. Along with HE fabrication and nuclear assembly positions, Pantex employed sheet metal journeymen, mechanics, electricians, pipe fitters, and other skilled laborers. In total, Pantex employed between 900 and 1,500 workers each year. The annual operating costs for the factory ranged from $20 million to $22 million. Of that number, the workforce took home $16 million per year in pay. Most of the remaining operating expenses paid out in the Amarillo area. The Texas Employment Commission calculated that the factory contributed about 16 percent of the total manufacturing employment of Amarillo and almost 20 percent of its manufacturing payroll.[263] A brief statistical comparison helps illustrate how Pantex provided a high quality of life for West Texans. In 1952, the lowest paid Pantex workers made $4,160. Meanwhile, the median annual income for American families in 1952 was only $3,900.[264]

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[262] Markhijani and Saleska, "The Production of Nuclear Weapons and Environmental Hazards," 62; Makhijani, Ruttenber, Kennedy, and Clapp, "The United States," 209; Hunt, "'Host and Hostage,'" 345; Swasy, *Soap Opera,* 83; Procter & Gamble Company, "The Procter & Gamble Model at Work," 15 May 1952, FOIA; Procter & Gamble Company, "Working at Pantex," 20 June 1952, FOIA.

[263] "Solon Pleased with Fourfold Pantex Activity," *Amarillo Daily News,* 6 August 1952; "Pantex, Almost Small City in Itself, Employs Thousands," *Amarillo Sunday News-Globe,* 6 September 1959; "Pantex Has Major Role in Community Life," *Amarillo Daily News*, 1 November 1960.

[264] "Job Level Highest in 6 Years Here," *Amarillo Daily News*, 14 November 1958; "Read for Profit—Use for Results…News & Globe-Times Want Ads," *Amarillo Daily News,* 25 June 1952; U.S.

Shortly after Pantex reopened, Amarillo experienced a building boom. Although much of the county experienced a similar construction boom in the early 1950s, Pantex was one of the few businesses that attracted new residents to the city. Pantex's employment demands and high wages deserve a good deal of credit for contributing to the growth of the city. New subdivisions, hotels, restaurants, and shopping malls sprouted in the city to soak up Pantex dollars. Before Pantex's reactivation, Amarillo contained 24,399 homes, and 1,009 retail establishments. Less than two years after the Pantex assumed its new mission, the city contained 1,241 new homes, and 140 new retail establishments.[265]

Pantex's presence near Amarillo allowed the city to receive federal impact funds. These federal payouts flowed into local school districts, allowing teachers to purchase better materials and administrators to expand classrooms and gymnasiums. Federal funds combined with a growing population to allow the Amarillo Independent School District to build twelve additional elementary schools, four junior high schools, and three high schools.[266] The *Amarillo Daily News* encapsulated how local residents felt about Pantex, writing: "There is really nothing mysterious about Pantex. It's just people doing a defense job, taking their place in the community, and contributing their share—if not a little more—to its growth, activity and prosperity."[267]

Department of Commerce, *Family Income in the United States: 1952* (Washington, D.C.: U.S. Government Printing Office, 1954), 1.

[265] Carlson, *Amarillo*, 167-9; Ray Franks and Jay Ketelle, *Amarillo, Texas: The First Hundred Years, 1887-1987: A Picture Postcard History* (Amarillo: Ray Franks Publishing, 1986), 172-9; "Building Program Faces New Amarillo Trustees," *Amarillo Daily News*, 31 March 1954; U.S. Department of Commerce, *County and City Data Book, 1952*, 494; U.S. Department of Commerce, *County and City Data Book, 1956* (Washington, D.C.: U.S. Government Printing Office, 1957), 412-4.

[266] Franks and Ketelle, *Amarillo, Texas*, 172-9; "Building Program Faces New Amarillo Trustees," *Amarillo Daily News*, 31 March 1954; "This and That," *Amarillo Daily News*, 2 September 1959.

[267] "Pantex, Almost Small City in Itself, Employs Thousands," *Amarillo Sunday News-Globe*, 6 September 1959; "Pantex Has Major Role in Community Life," *Amarillo Daily News*, 1 November 1960.

Pantex's early history is shrouded in secrecy. The government banned all airplanes from flying within a 100-mile radius of the plant. Workers asked few questions and the surrounding community refused to probe the plant's mission. Local newspapers published economic data and information on the plant's subcontractors and reassured locals that the bangs and booms they heard coming from Pantex were controlled experiments involving HE components and did not pose a hazard to the public.[268] To be sure, the *Amarillo Daily News* reported in January 1954 that the factory was "but one unit in a multiple of plants producing for a wide range of atomic armament" and that Pantex was being "realigned to fit into the over-all pattern of atomic weapons production."[269] However, no newspaper clearly articulated, nor knew, that Pantex was the nation's final assembly point for nuclear weapons. Although Pantex was shrouded in secrecy, locals did not ask many questions and, for the most part, kept quiet about the facility as it assumed its new nuclear mission. Few Pantex workers shared stories, gave interviews, and wrote "tell-all" narratives. Most joked that the plant was a soap factory.[270] The Procter & Gamble CEO Howard Morgens was less jocular about the project. "I was always scared to death that we'd blow up the state of Texas," Morgens told an interviewer. The secrecy surrounding Pantex forced Morgens to keep his concerns to himself. He never even spoke about Pantex with his wife.[271] Secrecy prevailed in the Texas Panhandle.

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[268] Fred Post, "Los Alamos to Train Pantex Supervisors," *Amarillo Sunday News-Globe*, 5 August 1951; "Hiring at Pantex in Week Aim," *Amarillo Sunday News-Globe*, 25 March 1951; Bob Bray, "Pantex Job Near Half-Way Mark," *Amarillo Globe-Times*, 15 January 1952; "Solon Pleased with Fourfold Pantex Activity," *Amarillo Daily News*, 6 August 1952; "Relax, Folks—It's Only a Blast from Pantex," *Amarillo Globe-Times*, 13 February 1953; Hunt, "'Host and Hostage,'" 343, 345.
[269] "Pantex Closing Rumor False but Working Crews Reduced," *Amarillo Daily News*, 8 January 1954.
[270] Hunt, "'Host and Hostage,'" 343-4. The author has contacted dozens of Pantex retirees about their experiences working at the site. All refused to comment. At the time of this writing, there is not an oral history program dedicated to Pantex.
[271] Swasy, *Soap Opera*, 83-4.

Morgens' concerns and the fact that Pantex did little for Procter & Gamble's profit margins ultimately led the company to step away from the facility. Procter & Gamble's efficient management combined with the terms of the cost-plus fixed fee contract, which paid the firm a fee based on the factory's overall operating costs, to work against the firm's profit margins. Although Procter & Gamble's profit margins initially increased when it began operating Pantex in 1951, after its management and packaging systems were in place the firm's operating profits sharply contracted. Although Pantex put a few dozen Procter & Gamble managers to work, the limited profits associated with the cost-plus fixed fee contract convinced corporate leaders that Pantex's managers would prove more beneficial to the company's bottom line if they moved on from the plant and operated new commercial factories. Consequently, Procter & Gamble declined to renew its five-year contract in 1956.[272]

After learning about Procter & Gamble's decision, the AEC quickly granted Mason & Hanger-Silas Mason Corporation a cost-plus fixed fee contract to operate Pantex. K.F. Hertford, the AEC manager that oversaw Pantex and Rocky Flats Plan, defended the selection of Mason & Hanger by noting that the firm had already been manufacturing HE components at its Iowa facility and had designed Pantex's infrastructure. By placing Pantex in the hands of Mason & Hanger, the AEC gave the firm the ability to centrally plan all HE component manufacturing. The decision to select Mason & Hanger, and the AEC's embrace of consolidation, seems to

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[272] Procter & Gamble Company, Statement of Year Ended June 30, 1951, August 1951; Procter & Gamble Company, Statement of Year Ended June 30, 1952, August 1952; Procter & Gamble Company, Statement of Year Ended June 30, 1953, August 1953; Procter & Gamble Company, Statement of Year Ended June 30, 1954, August 1954; Procter & Gamble Company, Statement of Year Ended June 30, 1955, August 1955; Procter & Gamble Company, Statement of Year Ended June 30, 1956, August 1956; Mason & Hanger Corporation, "Pantex Facts, History and Missions," Publicity Materials and Photographs of the Pantex Plant in Amarillo, Wallet, S 1392.1, Southwest Collection, Texas Tech University, Lubbock, Texas; P&G to Give Up Pantex Contract," *Amarillo Globe-Times*, 14 May 1956; "P&G Will Quit Pantex," *Amarillo Daily News*, 15 May 1956.

contradict the commission's previous insistence that no one firm should operate all of the nation's HE factories. Unfortunately, there is no historical documentation that explains this about-face in satisfying detail. However, it is worth noting that in the mid-1950s the commission was similarly working to consolidate its uranium suppliers. Thus, it is appropriate to deem Mason & Hanger's Pantex contract as part of the AEC's larger effort to consolidate its nuclear suppliers. "I am completely convinced that we should have fewer prime contractors," Hertford wrote. "We are attempting constantly to improve the operations at each of our present competent contractors and integrate all of them into an efficient, harmonious and flexible team." After assuming control of Pantex in late 1956, Mason & Hanger modified how Pantex scheduled and manufactured HE components to align with its Iowa plant. It also erected new buildings to store the physics packages. However, the company continued to rely on Procter & Gamble's operating techniques to package nuclear warheads.[273]

Although it might be tempting to regard Pantex as a sort of devilish bargain where workers risked their safety in exchange for good wages, history does not support this narrative.

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[273] Mason & Hanger Corporation, "Pantex Facts, History and Missions," Publicity Materials and Photographs of the Pantex Plant in Amarillo, Wallet, S 1392.1, Southwest Collection, Texas Tech University, Lubbock, Texas; K.F. Hertford to Brig. General Alfred D. Starbird, 8 August 1956, "Plants, Labs, Buildings & Land 7 HE Fabrication Plants" folder, box 94, RG 326, National Archives and Records Administration, College Park, Maryland; "Pantex Operating Contractor Named," *Amarillo Globe-Times*, 20 August 1956; Mason & Hanger-Silas Mason Co., Inc., "Mason & Hanger-Silas Mason Co., Inc., 1827 to 1961: Engineering, Plant Operation, Construction," c.1962, 10a, University of Virginia Libraries, Charlottesville, Virginia; Schroeder, "On Learning to See Nothing"; W.B. McCool, "Note by the Secretary, Part III-Weapons-Quarterly Progress Report to the Joint Committee on Atomic Energy-October-December-1957," AEC 129/86, 24 February 1958, Accession Number NV0074758, NNSA/NSO Nuclear Testing Archive, Las Vegas, Nevada; D.A. Kramer, "Shipping Report to Mason & Hanger-Silas Mason Co., Inc., Pantex Plant, St. Francis, Texas, Assemblies and Detonating Fuse," 26 March 1965, number 27831, Accession Number ALMD65046600445, U.S. Department of Energy, Office of Scientific and Technical Information, Oak Ridge, Tennessee; "Shipping Report Number 29726 to Mason & Hanger, Pantex Plant, St. Francis, Texas" 27 August 1965, Accession Number ALMD65092800638, U.S. Department of Energy, Office of Scientific and Technical Information, Oak Ridge, Tennessee; "Shipping Report Number 30254 to Mason & Hanger, Pantex Plant, Amarillo, Texas," 13 October 1965, Accession Number ALMD65105420670, U.S. Department of Energy, Office of Scientific and Technical Information, Oak Ridge, Tennessee.

Pantex was notably safe. The factory's buildings were specifically constructed to help prevent off-site contamination in the event of an accident. Much of the work took place in Gravel Gerties—buildings hulled out of the earth featuring reinforced concrete walls and topped with steel mesh covered in seventeen feet of sand and gravel.[274] The plant stored its explosive components in 100 storage buildings on site. The storage facilities, or "igloos," were specifically designed to cause an accidental blast to travel upward, rather than outward, and minimize damages. Workers covered the igloos with dirt and sealed the facilities with large doors blocked by 5-ton slabs of concrete.[275] On August 6, 1960, twelve pounds of TNT exploded in a Pantex building, causing $75,000 worth of damages. However, due to the plant's safety features none of the nine workers in the building suffered any injuries. The Chief of Ordnance recognized the success of the safety procedures at Pantex by granting the facility the Award of Honor—the highest award annually given by the chief—in December 1960.[276] The factory's management did much to promote safety. Officials frequently gave formal safety lectures to plant workers and periodically forced laborers to go through retraining programs. Pantex leaders also gave demonstrations on the hazardous nature of HE components. As the AEC Area Manager Jack

[274] John DeBaun, "Pantex Defense Role Vital," *Amarillo Daily News*, 30 September 1968; "Sandia," *Amarillo Daily News*, 30 September 1968; Rudy Abramson, "Hush-Hush Bomb Plant Chills Out," *Los Angeles Times*, 14 January 1993.

[275] Jack Simmonds, "Safety Record at Pantex AEC Plant Remains Perfect," *Amarillo Sunday News-Globe*, 20 November 1966; Rudy Abramson, "Hush-Hush Bomb Plant Chills Out," *Los Angeles Times*, 14 January 1993.

[276] "Solon Pleased with Fourfold Pantex Activity," *Amarillo Daily News*, 6 August 1952; "Pantex, Almost Small City in Itself, Employs Thousands," *Amarillo Sunday News-Globe*, 6 September 1959; "Pantex Has Major Role in Community Life," *Amarillo Daily News*, 1 November 1960; Mason & Hanger-Silas Mason Co., Inc., "Mason & Hanger-Silas Mason Co., Inc., 1827 to 1961: Engineering, Plant Operation, Construction," c.1962, 12, University of Virginia Libraries, Charlottesville, Virginia; "Pantex Rated Safest Plant," *Amarillo Globe-Times*, 24 January 1963; "Pantex: Defense Armory and Top Economic Asset," *Amarillo Daily News*, 6 December 1969. There is an important corollary to the narrative regarding Pantex's safety. On November 6, 1961, three workers were involved in "a minor radiological incident." The *Amarillo Daily News* reported that the workers were "not believed to be harmed" and that "there was no release of radioactivity into the atmosphere." See "Three Hurt at Pantex," *Amarillo Daily News*, 8 November 1961.

Blackwell explained it, "We will detonate a piece of explosive while they watch to show them that a piece no bigger than a fist can kill everyone in the room. Not only kill them, but splatter them all over the walls." Thanks to these safety measures, Blackwell happily reported in 1966 that Pantex had not one fatal accident since it opened in 1951.[277]

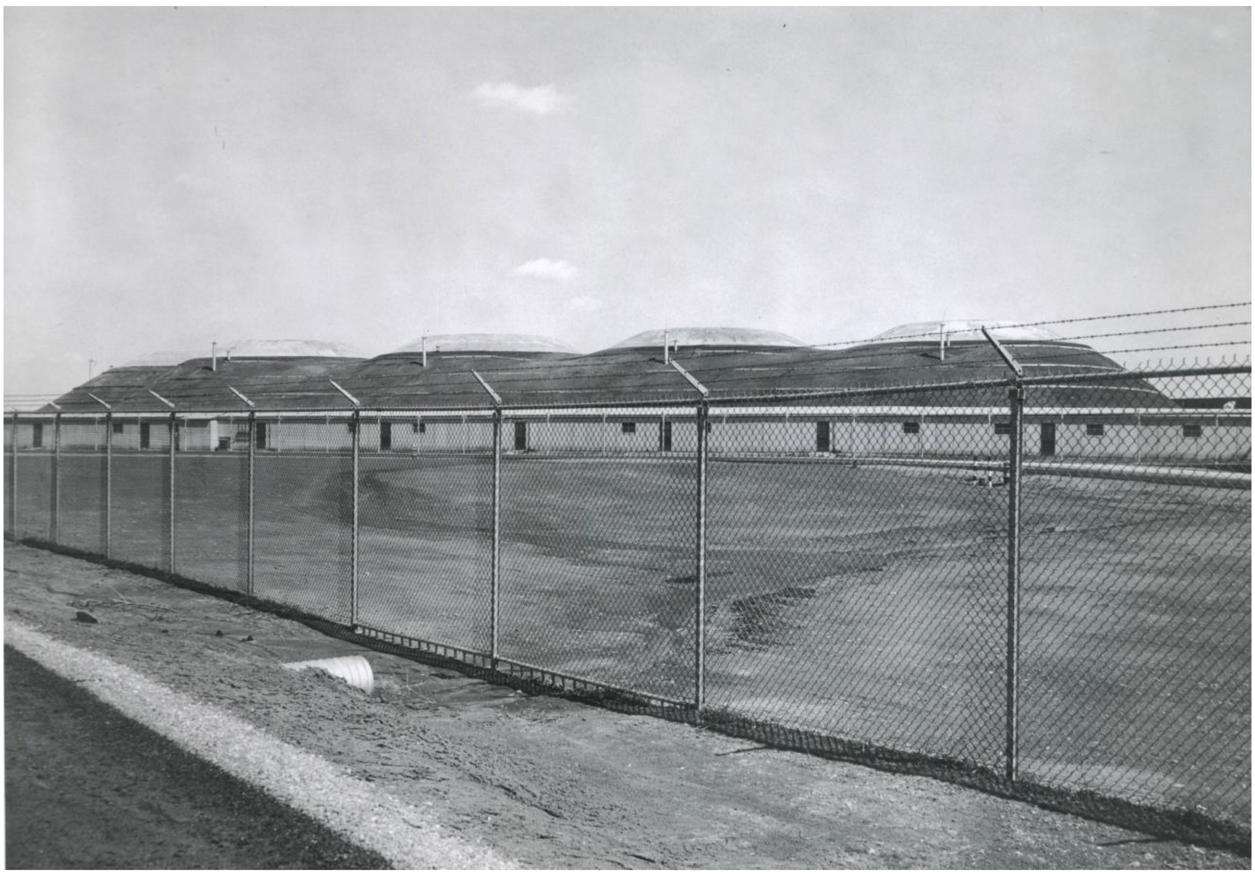

Figure 10: The Gravel Gerties at Pantex. 29 March 1958. Accession Number AECDC-B02F83P007. Photograph courtesy of the U.S. Department of Energy.

In the early 1950s, nuclear weapons construction left the laboratory and entered a large-scale factory production system. Following the advice of Los Alamos leadership, the AEC created Rocky Flats Plant and Pantex to facilitate the nation's nuclear weapons push. These

[277] Jack Simmonds, "Safety Record at Pantex AEC Plant Remains Perfect," *Amarillo Sunday News-Globe*, 20 November 1966.

factories had similar origins and economic implications for their nearby communities. Nature guided the state to both landscapes. The state relied on the Fifth Amendment to dispossess small farmers and acquire their lands. The factories brought new jobs to cities with few blue-collar opportunities. Yet, there are distinct differences between Rocky Flats Plant and Pantex. As a plutonium trigger factory, Rocky Flats Plant produced radioactive waste. As a HE fabrication facility and nuclear weapon packaging plant, Pantex's nuclear footprint was negligible. Perhaps the most important difference between the two factories was how they were operated. While Dow relied on local physicists, chemists, and engineers to operate Rocky Flats Plant, Procter & Gamble placed its long-time managers at the helm of Pantex. While Dow provided its unskilled laborers with opportunities to learn the science behind plutonium trigger manufacturing and rise through the ranks, Procter & Gamble provided little education to its workers, leaving them as cogs along the assembly line. These differences mattered. Dow's organizational scheme and culture helped procure local support for the factory and would allow Rocky Flats Plant managers to brandish their expertise against the anti-Rocky Flats Plant protest movement in the 1970s and the 1980s. Meanwhile, Procter & Gamble's focus on efficiency and production ultimately worked against the firm's profit margins and led the company to abandon Pantex. The story of manufacturing nuclear weapons is not a tale of a monolithic entity enforcing its will on the American people and the American landscape. It is a story about how private firms exercised their cultural and organizational agency to procure some of the most dangerous weapons known to humanity.

Chapter Four

Making ICBMs, Making Modern Los Angeles: Ramo-Wooldridge, Systems Engineering, and the Suburbanization of Los Angeles, 1954-1961

During the 1950s and the early 1960s, the United States raced to develop intercontinental ballistic missiles (ICBMs). These long-range missiles served as the nation's primary nuclear weapons delivery and deterrent systems for the balance of the Cold War. Instead of tasking one private firm to design and manufacture the nation's first ICBMs, the Department of Defense adopted a novel method for procuring the missiles. In 1955, the federal government granted a contract to Ramo-Wooldridge Corporation to serve as systems engineer for the missile program. Under this new organizational scheme, Ramo-Wooldridge planned and managed the ICBM program. It brought together dozens of contractors and hundreds of subcontractors to design missile technologies, manufacture missile components, and assemble the finished ordnance. In other words, this new production method enlisted hundreds of companies in the missile program and dispersed defense dollars into multiple firms. Thanks to this systems approach, the United States obtained the Atlas ICBM in 1959, the Titan I ICBM in 1961, and the Minuteman I ICBM in 1962.

This chapter examines why the federal government utilized systems engineering to obtain ICBMs, how Ramo-Wooldridge procured the weapons, and how this new organizational method transformed one western metropolis, Los Angeles. In 1954, shortly before committing to the systems engineering model, the Air Force established a new facility in Inglewood, a suburb of Los Angeles near the city's international airport, to serve as the headquarters for its ICBM initiative. In 1955, the Air Force selected Ramo-Wooldridge to organize and manage the ICBM program. Consequently, the firm erected its own ICBM headquarters in Inglewood to be near its military customer. Together, these two facilities, the Air Force's Arbor Vitae Complex and Ramo-Wooldridge's Research and Development Center, directed defense dollars into Los Angeles's aerospace, electronics, and instruments firms and attracted new weapons contractors to the city. Los Angeles transformed under this new system. As weapons workers flooded into the city, real estate developers constructed new suburban communities to soak-up defense paychecks and provide ICBM workers with housing. Defense paychecks provided old Angelenos and newcomers alike with a new degree of disposable income to purchase luxury goods. As defense dollars made their way from employee paychecks to real estate firms and shopping malls, the city's economy boomed. In other words, by adopting the systems engineering model, dispersing defense dollars into hundreds of firms, and situating the ICBM program in Los Angeles, the Air Force unknowingly set into motion a series of social, economic, and environmental changes in the city. The history of ICBM procurement is a story of organizational innovation, technical achievement, and local transformation. To understand Cold War Los Angeles is to recognize that the city's suburbanization, booming economy, and luxurious character was a product of the nation's ICBM program. By making ICBMs, Ramo-Wooldridge made modern Los Angeles.

By arguing for the centrality of Ramo-Wooldridge in making ICBMs and transforming Los Angeles, my analysis stands in contrast to the historiographies of ICBM procurement and the City of Angels. Although numerous historians have written about America's ICBM program, few have recognized the important role that Ramo-Wooldridge played in shepherding the effort. Instead, most ICBM scholars have opted to zoom-in on specific missiles and the contractors that assembled their airframes and fuel systems.[278] In a similar manner, a few scholars have documented how aerospace jobs facilitated Los Angeles's meteoric rise to prominence during the Cold War but have opted to investigate the firms that assembled ICBM airframes and not the overlord of the program, Ramo-Wooldridge. Furthermore, historians have stopped short of establishing clear connections between the nation's ICBM program, Ramo-Wooldridge, and the growth of Los Angeles's suburban communities. In other words, historians have not explored how the systems engineering organization scheme spread defense dollars across the city in a distinctive way and accelerated sprawl.[279]

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[278] In his 1960 book *Atlas*, John Chapman examines the development of the United States's first ICBM, the Atlas missile. Although Chapman recognizes that "thousands of supplier companies" contributed to the development of the ordnance, Chapman ultimately argues that the missile's airframe manufacturer, Convair, played the most "significant role" in creating the weapon. As Chapman put it, "the Atlas story is predominantly a Convair story." David Stumpf crafts a similar story in his 2000 monograph on the Titan II missile, *Titan II*. Stumpf primarily examines how Aerojet and Martin-Marietta designed and fabricated the ordnance's liquid fuel system, arguing that the liquid-propellant system was a remarkable technical achievement. By focusing on airframe and engine contractors, ICBM scholars have overlooked Ramo-Wooldridge's key role in ICBM procurement. One historian of technology, Thomas P. Hughes, noticed this historiographical oversight and drew attention to the firm in *Rescuing Prometheus*. Hughes argues that Ramo-Wooldridge's ICBM program was "representative of the management of research and development in the first postwar wave of major military-industrial projects." In crafting this argument, Hughes explores how Ramo-Wooldridge organized the ICBM program and challenges ICBM scholars to take their eyes off of component manufacturers and study the organizational schemes and systems engineers that guided military programs. This chapter accepts Hughes's challenge and places systems engineering at the forefront of the ICBM story. However, it also pushes beyond merely studying how Ramo-Wooldridge organized and operated the ICBM program by documenting how the systems engineering method dispersed federal funds to hundreds of firms and transformed place. See John L. Chapman, *Atlas: The Story of a Missile* (New York: Harper & Brothers, 1960), xi-xii; David K. Stumpf, *Titan II: A History of a Cold War Missile Program* (Fayetteville: University of Arkansas Press, 2000), xxi-xxii; Thomas P. Hughes, *Rescuing Prometheus* (New York: Pantheon Books, 1998), 70.

[279] In 1991, Ann Markusen, Peter Hall, Scott Campbell, and Sabina Deitrick drew attention to defense contractors in Los Angeles, Colorado, Texas, Florida, New England, and Seattle in their monograph *The Rise of the Gunbelt*. The four scholars maintain that Cold War defense dollars, military strategies, and "the adaptive capacities of local entrepreneurs in industry, science, and civic boosterism" altered the industrial map of the United States and gave rise to new weapons manufacturing hubs. In 1993, Allen Scott followed the historiographical cues of Markusen, Hall, Campbell, and Deitrick to explore how Southern California became a hotbed of technological innovation during the Cold War. In *Technopolis*, Scott argues that Cold War Los Angeles, Orange County, and San Diego constituted an integrated "production system" of "high-technology," or a regional "technopolis" dependent on defense dollars. Instead of showcasing how defense dollars transformed physical space and the local lives, Scott relies on

This chapter differs from the other pieces of the present study. As we have seen in previous chapters, the dawn of uranium mining and milling and the creation of Hanford, Rocky Flats Plant, and Pantex provided new economic opportunities for westerners and enlisted localities into producing nuclear weapons components. Although this chapter tells a similar story, it is important to note that by creating nuclear weapons delivery systems, and not radioactive warheads, Los Angeles differed from the other localities that participated in the business of atomic war. Chapters five and six show that mining and milling uranium, producing plutonium at Hanford, molding nuclear triggers at Rocky Flats Plant, and assembling finished warheads at Pantex were either more hazardous or perceived to be more hazardous to local human and environmental health than designing and fabricating ICBMs. Reacting to these often real and sometimes imagined radioactive hazards, westerners living near the uranium fields and the nuclear factories began to call for environmental justice, demand compensation for nuclear illnesses, and petition for the closure of the nuclear facilities in the 1970s and the 1980s. Los Angeles's ICBM industry, however, was spared from the nuclear protest movement because it did not directly work with nuclear products nor expose local residents to radioactive pollutants. Yet, as this chapter shows, Los Angeles's ICBM industry did leave an environmental footprint

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economic statistics to show how government contracts congregated in the Southland during the Cold War and became sparse in the region following the collapse of the Soviet Union. Western and Los Angeles historians have noticed this distinctive relationship between the Southland and the Pentagon. Gerald Nash, for example, recounted how defense spending transformed Los Angeles and other parts of the American West in his celebrated text *The Federal Landscape*. Mike Davis, Greg Hise, and Peter Westwick, to provide other examples, have documented how aerospace contractors congregated in Los Angeles. See Ann Markusen, Peter Hall, Scott Campbell, and Sabina Deitrick, *The Rise of the Gunbelt: The Military Remapping of Industrial America* (New York: Oxford University Press, 1991), 5-6; Allen J. Scott, *Technopolis: High-Technology Industry and Regional Development in Southern California* (Berkeley: University of California Press, 1993), xiii-xiv, 3-6; Gerald D. Nash, *The Federal Landscape: An Economic History of the Twentieth-Century West* (Tucson: University of Arizona Press, 1999); Mike Davis, *City of Quartz: Excavating the Future in Los Angeles* (New York: Verso Books, 2006); Greg Hise, *Magnetic Los Angeles: Planning the Twentieth-Century Metropolis* (Baltimore: The Johns Hopkins University Press, 1997); Peter J. Westwick, ed., *Blue Sky Metropolis: The Aerospace Century in Southern California* (Berkeley: University of California Press and The Huntington Library, 2012).

on the city by accelerating suburbanization. That is to say, the environmental history of Los Angeles's ICBM program is a story of sprawl. Although this chapter concludes with Ramo-Wooldridge's exit from the ICBM program in 1961, the missile industry continued to dominate and shape Los Angeles throughout the remainder of the Cold War. A new Los Angeles firm, The Aerospace Corporation, assumed Ramo-Wooldridge's role as ICBM systems engineer and continued to disburse missile contracts across the city, further facilitating sprawl and cementing the city's dependence on defense dollars.

The Department of Defense was not always interested in procuring ICBMs. Throughout the 1940s and the early 1950s, bomber firms and the commander of Strategic Air Command, Curtis LeMay, worked to discredit the feasibility of ICBMs within the military. Looking to maintain their supremacy within the Air Force, the bomber lobby and LeMay argued that ICBMs were "too visionary" and could not be produced. The Department of Defense swallowed on this argument and consequently provided paltry funding to ICBM research and manufacturing. Despite lacking federal resources, Convair, a firm based out of San Diego, dabbled in ICBM research, hoping to find fortune by procuring a workable missile. While the Truman Administration allowed Convair to pursue the Atlas ICBM with sparse funding, the Eisenhower Administration looked to curtail defense spending by eliminating ICBM research altogether. Thus, in 1953, Secretary of Defense Charles E. Wilson ordered Secretary of the Air Force Harold Talbott to review the poorly funded Atlas program, hoping to procure a report recommending its elimination.[280]

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[280] Simon Ramo, *The Business of Science: Winning and Losing in the High-Tech Age* (New York: Hill and Wang, 1988), 80, 83; Chapman, *Atlas*, 71-2; Timothy C. Jacobson, *TRW 1901-2001: A Tradition of Innovation* (Cleveland: TRW Inc., 2001), 62. For more information on Strategic Air Command's supremacy within the Air Force in the late 1940s and the early 1950s, see Edward Kaplan, *To Kill Nations: American Strategy in the Air-Atomic Age and the Rise of Mutually Assured Destruction* (Ithaca:

Talbott tasked his special assistant for research and development, Trevor Gardner, to head the review program. Unbeknownst to Wilson and Talbott, Gardner had faith in the ICBM. Before serving in the Air Force, Gardner came of age alongside the nation's leading aerospace engineers and physicists. After attending the University of Southern California for engineering and business administration, Gardner worked for General Electric Company and taught industrial management at Los Angeles's premier aerospace school, the California Institute of Technology (Caltech). During World War II, Gardner headed a rocket project at Caltech for the Office of Scientific and Research Development. After the war, Gardner became vice president and later president of Hycon Engineering Company, a small electronics firm in Pasadena that serviced Caltech's aerospace pioneers. Drawing on his experience working alongside aerospace innovators, Gardner maintained that the United States could, in fact, construct an operational ICBM. Furthermore, in light of the 1953 revelation that the U.S.S.R. had acquired a hydrogen bomb and was pursuing its own ICBMs, Gardner argued that the United States needed to prioritize ICBM construction and produce a workable device as quickly as possible in order to maintain its technological parity with the U.S.S.R. Although the United States had acquired the hydrogen bomb in 1952, possessing this new weapon would do little to deter Soviet aggression if the U.S.S.R. possessed the ICBM technology and the United States did not. The United States's air-defense system only provided protection from manned-bombers. It appeared that the only way to protect American cities from Soviet ICBMs was to follow the Soviet Union's lead and procure ICBMs to keep the two powers in check. The Air Force legend James Doolittle

Cornell University, 2015); Trevor Albertson, *Winning Armageddon: Curtis LeMay and Strategic Air Command, 1948-1957* (Annapolis: Naval Institute Press, 2019).

supported Gardner's reasoning and encouraged him to find a way to convince Wilson to expand, and not contract, the nascent ICBM program.[281]

Gardner believed that he could persuade Wilson to expand and accelerate the nation's ICBM program, but he needed help. Gardner reasoned he could convince Wilson to support the ICBM program if a group of the nation's eminent aerospace researchers wrote a report in defense of the technology. As Gardner explained, "the aim was to create a document so hot and of such eminence that no one could pooh-pooh it." In September 1953, Gardner organized the Strategic Missiles Evaluation Committee, or the Teapot Committee, to assess the ICBM program. To help him select which aerospace scientists to place on the committee, Gardner turned to an old friend from his General Electric days, the aerospace engineer Simon Ramo. Ramo had cut his teeth in Los Angeles's aerospace industry. After graduating from Caltech with a Ph.D. in electrical engineering, Ramo worked at General Electric before moving on to directing research at Hughes Aircraft Company in Los Angeles. In September 1953, Ramo left Hughes and partnered with another Caltech alumnus and engineer, Dean Wooldridge, to form the Ramo-Wooldridge Corporation in Los Angeles. Ramo and Wooldridge's organization was so proficient that it never lost a competition for a contract. While steering the company, Ramo pioneered a new organizational concept called systems engineering, which he defined as "the discipline of the design of the whole, to realize a harmonious and effective ensemble, as distinct from the design of parts." This system placed engineers in administrative roles and tasked them to design everything in advance with the end result in mind. In other words, systems engineers oversaw aerospace designers and manufacturers in order to anticipate and eliminate as many technical

[281] Chapman, *Atlas*, 71-2; Ramo, *The Business of Science*, 83, 78-9; Jacobson, *TRW 1901-2001*, 62; Hughes, *Rescuing Prometheus*, 75-9, 83; Northrop Grumman, "Advancing Our Legacy: Northrop Grumman's History with the ICBM System," December 2019, https://www.northropgrumman.com/wp-content/uploads/2019/12/ICBM_HistoryBrochure.pdf.

problems as possible. Recognizing Ramo's expertise in organizing aerospace experts and procuring technologies, Gardner relied on Ramo to staff the Teapot Committee with aerospace experts. Ramo tapped into his personal and professional networks to staff the committee. Consequently, most of the members came from Los Angeles. The group included: Charles C. Lauritsen, a Caltech physicist; Clark B. Millikan, a Caltech aeronautical scientist; Louis Dunn, the director of Jet Propulsion Laboratory in Pasadena; Allen E. Puckett, a Caltech alumnus and the head of Hughes Aircraft's aerodynamics department; and Lawrence A. Hyland, the vice president for research and engineering at Bendix Aviation Corporation in Los Angeles.[282]

Ramo and Wooldridge also sat on the committee. Additionally, they and their firm served as the technical and administrative staff of the group. In this role, Ramo and Wooldridge organized and presented background studies and arranged briefings. To ensure that the group had access to the latest data on structural designs, propulsion theories, and guidance technologies, Ramo and Wooldridge created a vast network of consultants from academia and industry. Ramo's role in the Teapot Committee cannot be understated. Gardner was not familiar with the latest aerospace developments and had to tend to numerous Air Force responsibilities. Consequently, Ramo often served as the de facto chair of the group.[283]

The Teapot Committee submitted its report to Wilson on February 1, 1954. In it, the committee argued that Convair's Atlas program was "thoroughly out-of-date" and that the missile required design modifications. The group also urged the Department of Defense to expand and accelerate ICBM development in order to keep the Soviet Union in check. Perhaps

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[282] Chapman, *Atlas*, 72-3; Ramo, *The Business of Science*, 84-5; Simon Ramo FBI Files, Part I, 292, 48, FOIA; Simon Ramo FBI Files, Part II, 151, FOIA; Neil Sheehan, *A Fiery Peace in a Cold War: Bernard Schriever and the Ultimate Weapon* (New York: Random House, 2009), 206; Hughes, *Rescuing Prometheus*, 84-6.
[283] Hughes, *Rescuing Prometheus*, 86-8.

most importantly, the committee raised questions about using Convair or any other prime contractor to develop the Atlas missile or any other ICBM. The group concluded that no aerospace firm should be given the reins of ICBM construction, nor would any one firm be able to quickly deliver a workable ICBM, because airframe manufacturers lacked technical expertise in electronics and computers—two necessary components of ICBMs. Instead of relying on a prime contractor, the Teapot Committee recommended that the Department of Defense place the ICBM program under a "strong management organization." The group envisioned a new organization staffed by scientists and engineers. This organization would have technical and managerial control over all aspects of ICBM research and manufacturing. Furthermore, this organization would use a systems approach and employ several contractors to make individual ICBM parts. The group argued that by increasing federal funding, making the ICBM an Air Force priority, and placing development under a systems engineer organization, the United States could acquire an operational ICBM within a few years.[284]

Wilson took the issue to President Dwight D. Eisenhower in early 1954. A fiscal conservative, Eisenhower was concerned about the nation's military expenditure budget. He believed that military spending diverted funds and resources from domestic priorities. He also worried that the United States was on the path of becoming a garrison state and that militarization threatened democratic processes, private enterprises, and individual freedoms. For Eisenhower, national security was a question of reining-in military spending while simultaneously strengthening American might vis-à-vis the Soviet Union. This could be accomplished, Secretary of State John Foster Dulles argued, by relying on the "deterrent of

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[284] The Teapot Committee, "Recommendations of the Teapot Committee," 1 February 1954, in *The Development of Ballistic Missiles in the United States Air Force, 1945-1960*, by Jacob Neufeld (Washington, D.C.: U.S. Government Printing Office, 1990), 254-61; Chapman, *Atlas*, 73-4; Hughes, *Rescuing Prometheus*, 89-90.

massive retaliatory power." The doctrine of massive retaliation, part of what Eisenhower called the "New Look," was based on the principle of "getting maximum protection at bearable cost." The idea was simple: the federal government would place a greater emphasis on airborne strategic nuclear deterrent, which was comparatively cheap to procure, at the expense of conventional weapons of war.[285] Threatening total annihilation, Eisenhower argued, would make war so terrible that it would no longer be an option and would facilitate a long, uneasy peace between the United States and the Soviet Union. In other words, by manufacturing nuclear weapons and their delivery systems, and earnestly threatening to use them, the United States could deter Soviet aggression—even deter nuclear war. Eisenhower initially believed this could be accomplished by pouring funds into Strategic Air Command bombers. However, ICBMs, as outlined in the Teapot Report, seemed to better fit the doctrine of massive retaliation because of their sheer speed. Furthermore, Eisenhower reasoned that if the Soviet Union procured ICBMs before the United States, it would compromise the calculus of mutual assured destruction. After reviewing the Teapot Report, Eisenhower made the ICBM program the Air Force's highest priority.[286]

Before the Air Force could move forward with the program, it needed to create a division to oversee the project. Following the Manhattan Engineer District model, Gardner recommended that a single general head the program. He reasoned that a single director with an exceptional degree of authority could procure an ICBM as quickly as possible by cutting out review and approval channels and other forms of bureaucratic red tape. The Air Force brass agreed and

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[285] John Lewis Gaddis, *Strategies of Containment: A Critical Appraisal of American National Security Policy During the Cold War* (New York: Oxford University Press, 2005), 131, 133, 145-6.
[286] Campbell Craig, *Destroying the Village: Eisenhower and Thermonuclear War* (New York: Columbia University Press, 1998), 55; Gaddis, *Strategies of Containment*, 147, 173; Ramo, *The Business of Science*, 91; Bernard A. Schriever, interview by Carol Butler, 15 April 1999, 4, NASA Oral History Project (hereafter Schriever Interview).

selected Brigadier General Bernard Schriever for the job. Schriever had served as the assistant to the Air Force Deputy Chief of Staff for Development and worked for the Teapot Committee as an administrative aid. In these roles, Schriever proved his competency as a bridge between aerospace scientists and military officials. Under Schriever's leadership, in July 1954, Air Research and Development Command established the Western Development Division (WDD), an organization to oversee ICBM construction. After assuming command of WDD, Schriever needed to select a location to house the new organization and serve as the Air Force's headquarters for missile development.[287]

Los Angeles was the obvious choice. The city had a long history of aerospace development. Los Angeles first pursued airplane manufacturing in the early 1900s, hoping that the nascent industry would grant the struggling metropolis an industrial identity. Between 1910 and 1940, city boosters, such as Harry Chandler, William Randolph Hearst, and Henry E. Huntington, convinced dozens of airplane pioneers to set-up shop in Los Angeles by claiming that the city's weather patterns were ideal for flying airplanes. Additionally, the boosters agreed to provide low-interest loans to aerospace entrepreneurs if they based their operations in Los Angeles. Thanks to the boosters, dozens of airplane firms congregated in Los Angeles. Notable companies included Glenn L. Martin Company, Bell Aircraft Company, Douglas Aircraft Company, Hughes Aircraft Company, North American Aviation, and Lockheed Aircraft Company. During World War II, Los Angeles's aerospace industry provided thousands of airplanes and bombers to the Allied forces in exchange for federal payouts. The scale of the wartime aerospace industry attracted 500,000 migrants to the city looking for work. For example,

[287] Ramo, *The Business of Science*, 91; U.S. Congress, House of Representatives, Subcommittee of the Committee on Government Operations, *Organization and Management of Missile Programs: Hearings before a Subcommittee of the Committee on Government Operations*, 86th Cong., 1st sess., 1959, 7; Hughes, *Rescuing Prometheus*, 104, 93.

in 1941 alone, Lockheed sold $145 million worth of aerospace products to the military. To accommodate these orders, Lockheed hired 35,000 women to work as rivet workers, stress analysts, expediters, production engineers, tool planners, inspectors, and office workers.[288]

The city's universities also bought into the early aerospace craze. Caltech first began promoting aeronautical research during World War I. In 1926, the Daniel Guggenheim Fund for the Promotion of Aeronautics endowed Caltech with a grant to construct an aeronautical laboratory on campus, named the Guggenheim Aeronautical Laboratory. The laboratory helped local firms test airplane prototypes and, in 1944, gave rise to the Jet Propulsion Laboratory, an organization which developed guided and unguided rocket missiles for the military. Thanks to the Caltech laboratory, Los Angeles's aerospace industry overshadowed Boeing's efforts to transform Seattle into the nation's aerospace capital.[289] The University of California, Los

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[288] Peter J. Westwick, "Photoessay: An Album of Early Southern California Aviation," in *Blue Sky Metropolis: The Aerospace Century in Southern California*, ed. Peter J. Westwick (Berkeley: University of California Press and The Huntington Library, 2012), 16; Roger W. Lotchin, *Fortress California, 1910-1961: From Warfare to Welfare* (New York: Oxford University Press, 1992), 70, 106-9; Simon Ramo, interview by Peter Westwick, 4 December 2010, 2, Aerospace Oral History Project, The Huntington Library, San Marino, California (hereafter Ramo Interview); Hise, *Magnetic Los Angeles*, 121, 127-8; William A. Schoneberger with Paul Sonnenburg, *California Wings: A History of Aviation in the Golden State* (Woodland Hills: Windsor Publications, 1984), 24, 33-5, 55, 65, 56; "Noted Designer of Planes Here," *Los Angeles Times*, 2 April 1920; "Aviation News," *Los Angeles Times*, 1 April 1928; Edwin Clapp, *Los Angeles Examiner*, 18 June 1926; "To Make City 'Air Detroit,'" *Los Angeles Times*, 11 February 1920; Gerald D. Nash, *The American West Transformed: The Impact of the Second World War* (Lincoln: University of Nebraska Press, 1990), 25-6, 62; Lockheed Corporation, "Of Men and Stars: A History of Lockheed Aircraft Corporation," July 1957, 2, in author's possession; Lockheed Corporation, "Of Men and Stars: A History of Lockheed Aircraft Corporation," August-September 1957, 16, in author's possession; Ed Ainsworth, "Southland Defense," *Los Angeles Times*, 17 February 1941. Readers interested in Los Angeles's longer history of settlement and development should consult William Deverell, *Whitewashed Adobe: The Rise of Los Angeles and the Remaking of Its Mexican Past* (Berkeley: University of California Press, 2004).

[289] Judith R. Goodstein, *Millikan's School: A History of The California Institute of Technology* (New York: W.W. Norton & Company, 1991), 156, 159-60, 175, 165-6, 264; George Pendle, *Strange Angel: The Otherworldly Life of Rocket Scientist John Whiteside Parsons* (Orlando: Harcourt, Inc., 2005), 81, 76-7; Theodore von Kármán with Lee Edson, *The Wind and Beyond: Theodore von Kármán, Pioneer in Aviation and Pathfinder in Space* (Boston: Little, Brown and Company, 1967), 169, 243, 206-1, 263; Frank J. Malina, "Memoir on the GALCIT Rocket Research Project, 1936-38," 6 June 1967,

Angeles (UCLA) also entered the aerospace field. In 1945, UCLA opened a new engineering college, which provided an aircraft engineering course free of charge to female students to prepare them to work in the city's aircraft industries. In addition, UCLA paid some students to enroll in classes focused on aircraft drafting and tool engineering. In short, while Caltech trained engineers and physicists to become aerospace innovators, UCLA trained Angelenos to fill jobs in the city's aerospace firms.[290]

By the 1950s, Los Angeles contained numerous airframe firms and two universities with strong aerospace programs. No other city was better suited to house WDD. Consequently, in the summer of 1954, WDD established its offices in Los Angeles. At first, WDD occupied a vacated building, formerly Saint John's Catholic School for Boys, in Inglewood. However, WDD soon outgrew these humble facilities and moved into a large facility near the Los Angeles International Airport, the Arbor Vitae Complex.[291]

After establishing WDD, Schriever had to decide whether to leave the Atlas solely in Convair's hands or to follow the recommendations of the Teapot Committee and place the ICBM program under the control of a systems engineer. Schriever proposed a compromise: Convair would keep the Atlas project but would be aided and monitored by Ramo-Wooldridge's technical staff. The former members of the Teapot Committee criticized this compromise and

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http://www.olats.org/OLATS/pionniers/memoir1.shtml; Clayton R. Koppes, *JPL and the American Space Program: A History of the Jet Propulsion Laboratory* (New Haven: Yale University Press, 1982), ix.

[290] "U.C.L.A. Engineering School Assured as Governor Warren Signs Bill," *The U.C.L.A. Magazine*, June 1943; Flora Lewis, "A Man's World?," *Daily Bruin*, 5 August 1941; "War Has Blacked Out Life For 'Joe College,'" *Los Angeles Times*, 21 July 1943; Lucy Guild Quirk, "Our Campus Goes to War," *The U.C.L.A Magazine*, February 1943; John B. Jackson, "A School of Aeronautical Engineering for U.C.L.A," *The U.C.L.A Magazine*, March 1943; Marina Dundjerski, *UCLA: The First Century* (London: Third Millennium Publishing, 2012), 93-5.

[291] Markusen, Hall, Campbell, and Deitrick, *The Rise of the Gunbelt*, 94-5; Sheehan, *A Fiery Peace in a Cold War*, 231-2; History Office, Space and Missile Systems Center, "Historical Overview of the Space and Missile Systems Center, 1954-2003," February 2003, 7, 2, Los Angeles Air Force Base, California.

demanded Schriever grant a contract to Ramo-Wooldridge Corporation to serve as the systems engineer of the Atlas missile. Under this system, Ramo-Wooldridge would prepare an overarching design for the Atlas system and direct a gaggle of aerospace, electronics, and instrumentation firms to develop individual missile components. In short, the Teapot Committee recommended that the Air Force revolutionize its relationship with the aviation industry and abandon the prime-contractor system in favor of the innovative systems engineering scheme. After discussing the proposal with Leslie Groves, Schriever assigned Ramo-Wooldridge full responsibility for Atlas systems engineering and technical direction in the fall of 1954. Simon Ramo would, in effect, become chief engineer and chief scientist of the operation. Except for the nuclear bombs, themselves, Ramo and his engineers would oversee the design of virtually everything else and task contractors to manufacture subsystems. To accommodate this new arrangement, Ramo-Wooldridge created its Guided Missile Research Division to serve as the ICBM systems engineer.[292]

In 1955, the Air Force granted a formal cost-plus-fixed-fee contract to Ramo-Wooldridge to provide systems engineering and technical direction to the missile program. The contract barred Ramo-Wooldridge's Guided Missile Research Division from manufacturing its own ICBM hardware in order to keep it from profiteering from its privileged role. In return for its services, Ramo-Wooldridge received a fee of 14 percent, a rate higher than usual for aerospace work. After agreeing to the contract, the firm examined ICBM strategic requirements, appraised current missile technologies, investigated new aerospace theories, and created a research and development plan. Following WDD's trail, Ramo-Wooldridge purchased 40 acres of land blocks

[292] Hughes, *Rescuing Prometheus*, 96-7, 99-101; U.S. Congress, House of Representatives, Subcommittee, *Organization and Management of Missile Programs: Hearings before a Subcommittee of the Committee on Government Operations*, 6; Sheehan, *A Fiery Peace in a Cold War*, 234.

away from the Arbor Vitae Complex and erected the Research and Development Center in Inglewood. Together, the Arbor Vitae Complex and the Research and Development Center constituted the nerve center of the nation's ICBM program. While engineers at the Research and Development Center planned and managed the ICBM program, officers at the Arbor Vitae Complex monitored the program and collected finished missile components.[293]

Figure 11: WDD and Ramo-Wooldridge Corporation dedicating the Arbor Vitae Complex. Major General Bernard Schriever is standing in the center with Simon Ramo to his left. 1956. Image VIRIN: 150918-F-YF873. Photograph courtesy of the U.S. Air Force.

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[293] Hughes, *Rescuing Prometheus*, 117; Raymond Puffer, "The History of ICBM Development," 2, Air Force Systems Command, Norton Air Force Base, California; Jacobson, *TRW 1901-2001*, 64; Ball, Burge & Kraus, "Thompson Products, Inc.," 24 August 1956, 2, 5, folder 7, box 82, Simon Ramo Papers, J. Willard Marriott Library Special Collections, University of Utah, Salt Lake City, Utah; Simon Ramo, "The ICBM Program," 1 June 1957, 13, 10, folder 11, box 44, Simon Ramo Papers, J. Willard Marriott Library Special Collections, University of Utah, Salt Lake City, Utah; Ramo, *The Business of Science*, 93; Simon Ramo FBI Files, Part I, 44, FOIA; Schriever Interview, 17.

From the outset, Ramo-Wooldridge embraced parallel development. This meant that Ramo-Wooldridge tasked firms to produce competing models of missile components. Take experimental rocket engines, for example. To ensure that WDD received at least one workable model, Ramo-Wooldridge tasked two independent contractors to manufacture "a substantial number of engines even before the final design of the engine could be determined." This led contractors to develop several promising approaches to engine construction simultaneously. While parallel development might appear to be an exercise in government waste and excess, this system had proven effective during World War II when the Manhattan Engineering District developed uranium and plutonium bombs simultaneously. Ramo argued that duplicating the ICBM program would create competition between contractors, foster innovative solutions, and help keep the project on track in the event that one component model failed. As contractors delivered competing parts to WDD, Ramo and Schriever decided to assemble a second ICBM model using the second set of parts. Following Ramo-Wooldridge's guidance, WDD granted Convair a contract to use the first set of parts to assemble the Atlas and hired the Glenn L. Martin Company to use the second set of parts to assemble the Titan I ICBM.[294]

In order to acquire an ICBM as quickly as possible, Ramo took advantage of what he called "the previous art." Ramo and his engineers brought electronics, radar, computer, and instrumentation firms into the ICBM program. Notable firms included Litton Industries, General Electric, Bell Telephone Laboratories, Western Electric, and the AC Spark Plug Division of General Motors. In some cases, these companies simply furnished technical direction for ICBM

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[294] U.S. Congress, House of Representatives, Subcommittee, *Organization and Management of Missile Programs: Hearings before a Subcommittee of the Committee on Government Operations*, 7; Ramo, *The Business of Science*, 94; Simon Ramo, "The ICBM Program," 1 June 1957, 3-5, 10, folder 11, box 44, Simon Ramo Papers, J. Willard Marriott Library Special Collections, University of Utah, Salt Lake City, Utah; Hughes, *Rescuing Prometheus*, 108-9.

components. In other cases, they worked with Ramo-Wooldridge to design and manufacture the subsystems.[295]

To ensure that the city could supply his firm with workers competent in "high technology," Ramo forged connections with the city's universities. He tasked his leading engineers and scientists to teach courses at UCLA and the University of Southern California (USC). However, he quickly learned that USC was "stinko profundo as to engineering," and told his men to focus on UCLA. While Ramo-Wooldridge engineers and scientists taught "the damnedest evening courses" at the university, Ramo partnered with Dean Boelter, the chair of UCLA's engineering department, to bring nationally renowned engineers and scientists to campus for an annual lecture series. Meanwhile, Ramo-Wooldridge endowed a fellowship at Caltech to attract promising students to its engineering doctoral program.[296]

Utilizing its university connections, Ramo-Wooldridge brought together academics and industrialists to troubleshoot theoretical problems that had bearing on component design. Take, for example, the reentry problem. An ICBM needed to be able to travel into the upper atmosphere and reenter the lower atmosphere over its target without pulling apart or combusting in air. To troubleshoot this problem, Ramo recruited the head of the Caltech Physics Department, Robert Bacher, as well as six other university scientists and three aerospace engineers from private industry. The group met over the course of six weeks to discuss the reentry problem and craft theoretical solutions. Following the Bacher Group's recommendations, Ramo-Wooldridge guided its contractors to fabricate reentry technologies within a year.[297]

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[295] Simon Ramo, "The ICBM Program," 1 June 1957, 14-5, 20-1, folder 11, box 44, Simon Ramo Papers, J. Willard Marriott Library Special Collections, University of Utah, Salt Lake City, Utah.
[296] Ramo Interview, 33-4.
[297] Ramo, *The Business of Science*, 106-7.

Along with coordinating and managing the Atlas and Titan I programs, Ramo-Wooldridge became responsible for managing the development of the Thor missile. Unlike the Atlas and the Titan I, the Thor was an intermediate-range ballistic missile that could only travel 1,500 miles—one-quarter of the distance of an ICBM. Ramo selected Ruben F. Mettler, a 31-year-old Caltech alumnus, to direct the Thor program. Ramo selected the former Nazi aeronautical engineer Adolf Thiel to serve as Mettler's deputy. A veteran of Germany's V-2 program, Thiel came to the United States in 1946 with the original group of German scientists under Operation Paperclip. After working in Wernher von Braun's rocket development team at the Redstone Arsenal in Alabama, Thiel joined Ramo-Wooldridge. Although Thiel was technically Mettler's second, the German led the program. Thiel designed the Thor missile using copies of von Braun's papers he brought with him to Los Angeles. Like it did with the Atlas and the Titan I, Ramo-Wooldridge tasked multiple electronics and instrumentation firms in Los Angeles to build Thor components and issued the final assembly contract to Douglas Aircraft Company of Santa Monica.[298]

Although hundreds of contractors, scientists, and Air Force personnel worked together on the ICBM program, Ramo-Wooldridge made most of the key decisions. In 1957, Secretary Wilson asked Ramo how his firm documented decisions related to ICBM development. Ramo explained that "the big decisions were highly documented." However, Ramo later elaborated that if his firm documented "each and every item, we would have time to do little else." "There was a seeming infinite number of technical decisions for which I had prime responsibility," he continued. "We often had to choose between two things: completeness in setting down why we

[298] U.S. Congress, House of Representatives, Subcommittee of the Committee on Government Operations, *Organization and Management of Missile Programs: Hearings before a Subcommittee of the Committee on Government Operations*, 7; Hughes, *Rescuing Prometheus*, 109; Jacobson, *TRW 1901-2001*, 64; Sheehan, *A Fiery Peace in a Cold War*, 321-3.

were doing what we were doing, and getting on with doing it." After gathering information from experts, the Ramo-Wooldridge engineers, and often Ramo himself, forged conclusions and issued orders to contractors on their own accord. In other words, the systems engineers did not deliberate with Air Force officials or explain their reasoning before committing to a course of action. The program was never accused of incompetent management, nor was Ramo ever asked to testify to Congress to defend his decisions. Although the Air Force relied on Ramo-Wooldridge to manage the ICBM program, the military imposed few checks and balances on the firm and was often kept in the dark about why its systems engineer ordered its contractors to produce certain products. As Ramo put it, Schriever was "in charge of little administrative details. I'm really running this."[299]

While Ramo-Wooldridge coordinated the ICBM program, it directed the Air Force to empty defense dollars into Los Angeles's aerospace, electronics, and instrumentation firms. Some of the beneficiaries of this system included General Electric, which designed the Atlas's nose cone, North American Aviation, which designed the Atlas's rocket engines, American Electronics, Inc., which designed the Atlas's power converter, Wyle Laboratories, which tested the reliability of the Atlas's electrical and hydraulic components, AVCO Manufacturing Corporation, which developed the Titan I's nose cone, and Aerojet, which designed the Titan I's liquid rocket engines. Additionally, Lockheed Aircraft Corporation conducted research on the Atlas's reentry system. In one year alone, the Air Force divided $1.75 billion between these

[299] Ramo, *The Business of Science*, 111; Simon Ramo, interview by Carol Butler, 6 April 1999, 33-4, NASA Oral History Project.

firms, 11 other principal contractors, and 200 subcontractors. This totaled more than 75,000 jobs. Almost all of these producers were located in Los Angeles County.[300]

Recognizing that the federal defense budget was flowing to the city and its missile program, airframe, electronics, and instrumentation firms located outside of Los Angeles flocked to the metropolis. Raytheon's move to Los Angeles illustrates this process. Under the leadership of Charles Francis Adams IV, Raytheon had designed and manufactured surface-to-air and air-to-air missiles for the military out of its Massachusetts laboratories during the Korean War. After learning about the Los Angeles ICBM program, Raytheon executives understood that to get in on the ICBM work they would have to open a facility in the Southland. Consequently, in 1957, Raytheon purchased 16 acres in Santa Barbara and began building the West Coast Laboratory. While construction workers broke ground, the Air Force granted Raytheon a contract to engineer and develop infrared detection and radar systems for the ICBM program. By the end of 1957, 150 Raytheon scientists, engineers, and employees had relocated to Santa Barbara and enlisted in the ICBM program. Within three years, the West Coast Laboratory obtained $3.6 million in defense contracts, most of which stemmed from the ICBM program.[301]

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[300] Mark C. Cleary, *The 6555th: Missile and Space Launches Through 1970* (Patrick AFB: 45th Space Wing History Office, 1991), chapter 3, section 5; Tom Compere, ed., *The Air Force Blue Book, Volume I* (New York: Military Publishing Institute, Inc., 1959), 343-4; American Electronics, Inc., "Another American Electronics First," advertisement, circa 1957, in author's possession; William W. Holbrook, "Component Testing Makes Atlas Reliable," *Aircraft & Missiles*, February 1960, 56; U.S. Congress, House of Representatives, Committee on Science and Astronautics, *Progress of Atlas and Polaris Missiles*, 86th Cong, 1st sess., 1959, 164-77; TRW, "Annual Report of Thompson Ramo Wooldridge Inc., For the Year Ended December 31, 1958," 6, folder 3, box 82, Simon Ramo Papers, J. Willard Marriott Library Special Collections, University of Utah, Salt Lake City, Utah; Hughes, *Rescuing Prometheus*, 70; "Air Force Says Missile Program Has 75,000 People Working on It," *Wall Street Journal*, 30 January 1957; Richard P. Cooke, "Billions for Missiles," *Barron's National Business and Financial Weekly*, 30 April 1956; Roger E. Bolton, *Defense Purchases and Regional Growth* (Washington, D.C.: The Brookings Institution, 1966), 152-3; Scott, *Technopolis*, 77.

[301] "Raytheon Plans Facility," *Los Angeles Times*, 19 November 1957; "New Raytheon Lab Dedicated," *Los Angeles Times*, 1 December 1957; "New Raytheon Laboratory," *Wall Street Journal*, 18 November 1957; "Raytheon Unit Gets Contracts," *Wall Street Journal*, 13 April 1960.

While outsider firms moved into the region, the old Los Angeles aerospace, electronics, and instrumentation companies built new facilities across the metropolitan area to accommodate their new mission. Many of these new developments took place alongside Interstate 405, stretching from the Los Angeles International Airport through Inglewood, Torrance, Long Beach, and Orange County. Yet, the ICBM firms did not limit themselves to the I-405 corridor. They reached into nearly every neighborhood in the metropolitan area and extended into the city's hinterlands. Take, for example, Lockheed Aircraft Company. In 1954, Lockheed launched its Missile Systems Division, a program focused on two Air Force projects: the X-7 unmanned test bed and the X-17 hypersonic ballistic missile. These technologies were not designed to deliver nuclear warheads. Rather, they were experimental tools used to test ICBM components, including ramjet engines, guidance technologies, and atmospheric reentry machinery. Faced with this new program, Lockheed hired an additional 1,250 people and expanded onto a 77-acre site in Los Angeles's Van Nuys neighborhood.[302] North American Aviation provides another example of how ICBM firms reached outside the city. In 1956, North American Aviation's Rocketdyne Division began designing and manufacturing components for the ICBM program. To accommodate this new project, and its 17,000 missile workers, North American Aviation built a new plant in the Simi Hills. Litton Industries also pushed outward. Headquartered in Beverly Hills, the electronics firm moved into ICBM instrumentation work in 1960. Searching for space for its new mission, the company first erected a new facility in Woodland Hills and

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[302] Lockheed Corporation, "Of Men and Stars: A History of Lockheed Aircraft Corporation," January 1958, 14-6, in author's possession; Lockheed Aircraft Corporation, Missile Systems Division, "A Terminal Report on Advanced Telemetering Development for X-17," LMSD-2179, 31 July 1957, Sunnyvale, California, in author's possession; Roy Blay, ed., *Lockheed Horizons*, June 1983, 75-7, 80-3; "Lockheed Will Continue Use of Van Nuys Plant," *Los Angeles Times*, 1 May 1956.

incrementally moved farther into the San Fernando Valley, constructing new facilities in Canoga Park, Calabasas, Agoura Hills, and Moorpark.[303]

Spreading out was not solely a product of increasing scale. In 1951, the *Bulletin of the Atomic Scientists* maintained that the United States could better navigate a nuclear attack if its existing cities dispersed into smaller settlements. That same year, the National Security Resources Board and the U.S. Department of Commerce created a program to offer financial incentives for defense industries to build in suburban or rural locations. Although this program was designed to protect American defense installations by diffusing them across the nation, in practice it encouraged Los Angeles's ICBM firms to locate new production factories just outside of the city.[304] To some, this dispersal suggests that the corporations were not committed to place.[305] Yet, time and time again aircraft, electronics, and instrumentation companies chose to situate their offices, plants, and machine shops in or around the City of Angels. By trekking into nearby valleys and deserts, the manufacturers were not fleeing the city. Rather, they were expanding the city's reach and enlisting its hinterlands in the ICBM program.

The new Interstate Highway System made this dispersal possible. On June 29, 1956, Eisenhower signed the National Interstate and Defense Highway Act into law. The bill appropriated $25 billion to construct 41,000 miles of roads. It was the largest public works

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303 Markusen, Hall, Campbell, and Deitrick, *The Rise of the Gunbelt*, 82; Lockheed Corporation, "Of Men and Stars: A History of Lockheed Aircraft Corporation," January 1958, 4; Cooke, "Billions for Missiles"; Markusen, Hall, Campbell, and Deitrick, *The Rise of the Gunbelt*, 106-7; Litton Industries, Inc., "A Report of Financial Condition and Review of Operations for the Fiscal Year which Ended July the Thirty-First Nineteen Hundred Sixty," 1960, 7.

304 Kenneth T. Jackson, *Crabgrass Frontier: The Suburbanization of the United States* (New York: Oxford University Press, 1985), 249-50; David Monteyne, *Fallout Shelter: Designing for Civil Defense in the Cold War* (Minneapolis: University of Minnesota Press, 2011), 11.

305 See Wade Graham, "Blueprinting the Regional City: The Urban and Environmental Legacies of the Air Industry in Southern California," in *Blue Sky Metropolis: The Aerospace Century in Southern California*, ed. Peter J. Westwick (Berkeley: University of California Press and The Huntington Library, 2012), 268.

project in American history. Eisenhower justified this massive project to the American public by arguing that the nation's current highways were unsafe and prone to traffic jams. He also maintained that poor roads raised transportation costs, which hurt American businesses. Additionally, Eisenhower contended that new highways were needed in order to evacuate the nation's cities in the event of an atomic attack. Members of the administration echoed and expanded on these points. One official wrote that "national interests, in transportation, in the development of agriculture, commerce, and industry, in civil and military defense, in the general welfare, are bound up in every mile of [the Interstate Highway System]." Importantly, the new road network connected the majority of the nation's Air Force bases. This allowed the military to transport servicemen, jet fighters, bombers, missiles, and munitions with relative ease. The new roads also cut through the centers of American cities to facilitate the transportation of goods and people from city centers to hinterlands. Urban highway construction did not benefit everyone, however. Highways often eviscerated inner-city neighborhoods and downtowns, separating poor urban neighborhoods into disjointed communities.[306] Nevertheless, the new roads allowed ICBM firms to expand into Los Angeles's hinterlands.

As the ICBM companies collected defense dollars and erected new facilities, they expanded their payrolls and attracted thousands of Americans to the greater Los Angeles area. During the 1950s, aerospace and electronics companies created 292,000 new jobs in Los Angeles County and drew in over 900,000 migrants. Meanwhile, the Department of Defense paid out a total of $43.4 billion in wages to private defense employees, military, and civilian workers in

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[306] *The Federal-Aid Highway Act of 1956*, Public Law 84-627, *U.S. Statutes at Large* 70 (1956): 374-402; Jackson, *Crabgrass Frontier*, 249-50; U.S. Department of Commerce, Bureau of Public Roads, Office of Research, "A Perspective on the Federal Highway Program," September 1959, 21, Roads folder 2, box 4, John Stewart Bragon Papers, Dwight D. Eisenhower Library, Abilene, Kansas; Andres Duany, Elizabeth Plater-Zyberk, and Jeff Speck, *Suburban Nation: The Rise of Sprawl and the Decline of the American Dream* (New York: North Point Press, 2000), 87.

California. The growth of Lockheed's Missile System Division encapsulates this spending and employment trend. In 1955, the Missile Systems Division recorded sales of $24 million and employed 2,800 Angelenos in Van Nuys. One year later, the division more than doubled its sales—posting receipts of $53 million—and employed 4,800 people. By the early 1960s, the Los Angeles area contained 220,050 private defense employees and more active-duty military and civilian defense personnel than any other region. In all, defense spending accounted for 17.2 percent of personal income in the state.[307]

As Americans packed into the Los Angeles metropolitan area, real estate developers created new suburban tracts and expanded old neighborhoods to accommodate the growing ICBM labor pool. Developers flattened agricultural fields and felled trees to erect homes, shopping plazas, and municipal centers near the new defense offices and factories. Suburban construction necessitated the expansion, or sometimes wholesale creation, of roads and water, sewer, and electrical grids. By expanding livable space, developers soaked up ICBM wages and facilitated the continual growth of the ICBM program.[308]

Suburban development was made possible by the federal government, particularly the Federal Housing Administration (FHA). The FHA lowered risk for developers and provided them with a means to borrow funding for new projects. Under Title VI of the National Housing Act of 1934, developers could insure up to 90 percent of a $9,000 housing mortgage through the

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[307] Doris Ikle, *Southern California's Economy in the Sixties, Report no. P-2077* (Santa Monica: RAND Corporation, 1960); Nash, *The Federal Landscape*, 95, 98; James L. Clayton, "Defense Spending: Key to California's Growth," *The Western Political Quarterly* 15, no. 2 (June 1962): 281; James L. Clayton, "The Impact of the Cold War on the Economies of California and Utah, 1946-1965," *Pacific Historical Review* 36, no. 4 (November 1967): 461, 457-8, 455; Lockheed Corporation, "Of Men and Stars: A History of Lockheed Aircraft Corporation," January 1958, 14-6; Roy Blay, ed., *Lockheed Horizons*, June 1983, 75-7, 80-3; Markusen, Hall, Campbell, and Deitrick, *The Rise of the Gunbelt*, 98; "Lockheed Will Continue Use of Van Nuys Plant," *Los Angeles Times*, 1 May 1956.
[308] Hise, *Magnetic Los Angeles*, 124-5; Markusen, Hall, Campbell, and Deitrick, *The Rise of the Gunbelt*, 107.

FHA. After securing an FHA "commitment" to insure the mortgage, the developers could obtain "production advances" from banks to construct the house. This meant that developers did not need to risk their own cash to build new homes and communities. Developers could simply obtain federal insurance on the project, receive a private loan, and construct and sell the home for a profit.[309]

Although the FHA allowed developers to easily launch new projects, it established minimum standards for home construction that developers needed to follow. These standards included requirements for the home's size, lot space, setback from the street, and separation from adjacent structures. Additionally, the FHA tasked its underwriters to appraise neighborhoods with the following factors in mind: Relative economic stability, protection from adverse influences, freedom from special hazards, adequacy of civic, social and commercial centers, adequacy of transportation, sufficiency of utilities and conveniences, level of taxes and special assessments, and appeal. Underwriters also investigated neighborhoods for crowding. The FHA maintained, according to its 1938 *Underwriting Manual*, that "crowded neighborhoods lessen desirability" and "older properties in a neighborhood have a tendency to accelerate the transition to lower class occupancy." If an underwriter found that a neighborhood was too crowded, or contained a high degree of risk, the FHA would not insure developments in the area. Together the FHA's minimum standards and its emphasis on low population density guided developers to construct single-family homes on new suburban tracts.[310]

The FHA also suggested that these new neighborhoods become segregated spaces. The *Underwriting Manual* recommended that developers and communities adopt "subdivision

[309] *National Housing Act of 1934*, Public Law 73-479, *U.S. Statutes at Large* 48 (1934): 1246-1265; Jackson, *Crabgrass Frontier*, 238, 203-5.
[310] Jackson, *Crabgrass Frontier*, 206-8; Federal Housing Administration, *Underwriting Manual* (Washington, D.C.: U.S. Government Printing Office, 1938), section 1314, 909.

regulations and suitable restrictive covenants" to ensure that neighborhoods were "occupied by the same social and racial classes." This, according to the FHA, would "retain stability" in the neighborhoods and lessen the federal government's risk when it came to insuring projects. Following this guidance, several Los Angeles communities crafted restrictive covenants that discriminated against African Americans, Mexican Americans, and other minority groups. Long Beach, for instance, adopted a restrictive covenant that discriminated against Jews. Yet, the FHA did not leave the racial complexion of these communities solely in the hands of the developers and the communities. It allowed underwriters to use their own personal judgment when it came to insuring projects. Consequently, individual underwriters exercised their own personal bias in favor of insuring all-white subdivisions.[311]

In addition to insuring and guiding developments, the FHA worked with the Veterans Administration (VA) to empower homebuyers. The Servicemen's Readjustment Act of 1944, also known as the GI Bill, created a VA program to help sixteen million World War II veterans purchase homes. This program allowed veterans to receive a federal loan up to 50 percent of their home's purchase price. As the suburban historian Kenneth Jackson noted, "the VA very largely followed FHA procedures and attitudes" and thus "the programs can be considered as a single effort."[312] Together, the FHA and the VA insured long-term mortgage loans, collected

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[311] Federal Housing Administration, *Underwriting Manual*, section 937; Jackson, *Crabgrass Frontier*, 207-8; D.J. Waldie, *Holy Land: A Suburban Memoir* (New York: W.W. Norton & Company, 1996), 73-4; For more on how homeowners associations attempted to create "ideal" communities by excluding African Americans, Mexican Americans, and other ethnic groups, see Robert Fishman, *Bourgeois Utopias: The Rise and Fall of Suburbia* (New York: Basic Books, 1987); Michael Jones-Correa, "The Origins and Diffusion of Racial Restrictive Covenants," *Political Science Quarterly* 115, no. 4 (Winter 2000-2001): 541-568; John Kimble, "Insuring Inequality: The Role of the Federal Housing Administration in the Urban Ghettoization of African Americans," *Law & Social Inquiry* 32, no. 2 (Spring 2007): 399-434.
[312] *An Act to Provide Federal Government Aid for the Readjustment in Civilian Life of Returning World War II Veterans*, Public Law 78-346, *U.S. Statutes at Large* 58 (1944): 284-301; Jackson, *Crabgrass Frontier*, 204.

premiums, set up reserves for losses, and indemnified lenders in the event of default. Before the FHA, first-time mortgages were limited to one-half or two-thirds of the appraised value of the property. This meant that homebuyers needed a down payment of at least 30 percent to purchase a home. After the establishment of the FHA and the GI Bill, homebuyers could receive a 93 percent loan on their prospective property, lowering their down payments to 7 percent. The FHA also extended the repayment period for its guarantee mortgages to twenty-five or thirty years, reducing the average monthly payment for homeowners. Consequently, it became cheaper for many Americans to buy a home rather than rent.[313]

As aerospace, electronics, and instrumentation companies erected new facilities in the suburbs, their employees followed. Each defense corporation dominated at least one Los Angeles neighborhood. Ramo-Wooldridge employees primarily lived in Long Beach. Raytheon employees lived in Santa Barbara. Northrop employees lived in Hawthorne and Torrance. Hughes employees lived in Long Beach and Playa del Rey. Rockwell employees lived in Anaheim. Lockheed employees lived in Burbank, Toluca Wood, Van Nuys, and Panorama City. Douglas employees lived in Santa Monica Carson, Dominguez, Huntington Beach, Downey, Long Beach, Westside Village, and Lakewood. North American Aviation workers lived in Simi Valley and Westchester. Some of these neighborhoods had long histories. Others, such as Lakewood, Panorama City, Toluca Wood, Westside Village, and Westchester were specifically built to accommodate defense workers.[314] Several of the new developments followed the

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[313] Jackson, *Crabgrass Frontier*, 204-5; Lawrence Culver, *The Frontier of Leisure: Southern California and the Shaping of Modern America* (New York: Oxford University Press, 2002), 201.
[314] Markusen, Hall, Campbell, and Deitrick, *The Rise of the Gunbelt*, 104, 107; Waldie, *Holy Land*, 25, 45; Davis, *City of Quartz*, 132; The developers of Panorama City purposefully planted the project near Lockheed's Van Nuys facility. Burns and Marlow created Toluca Wood for Lockheed employees. Developers created Westside Village for Douglas employees and Westchester for North American Aviation workers. See Hise, *Magnetic Los Angeles*, 191, 187; Becky M. Nicolaides, *My Blue Heaven:*

Levittown model. The homes often contained two bedrooms and one bath. They sat on cookie-cutter lots with modest yards and were a short drive away from municipal parks and large shopping centers. Panorama City, for example, contained a one-hundred-acre shopping district, which held forty-two retailers, five restaurants, a bowling alley, a movie theater, and a 216,000-square-foot department store.[315]

The construction and subsequent purchases of suburban homes provided ICBM workers with a treasured space to protect. For over a hundred years, Americans were taught that that private home could become their personal heaven on earth. But homeownership proved elusive for many Angelenos until the postwar boom and the dawn of the ICBM program. Between 1950 and 1960, Los Angeles's total housing units grew by 34.1 percent. In sum, 65 percent of housing units in Los Angeles were detached homes in 1960. Americans valued their private homes for myriad reasons. Ideologically, many believed that homeownership was the key to their independence.[316] Others recognized the immense material value that their homes held. Along with being precious investments, homes collected consumer goods including televisions, hi-fis, appliances, and furniture. As Angelenos purchased and filled suburban homes with luxury goods, they transformed their dwellings into material temples worthy of worship.[317]

Like other Americans, ICBM workers participated in what the historian Lizabeth Cohen calls "the consumers' republic." At the heart of the consumers' republic was mass consumption.

Life and Politics in the Working-Class Suburbs of Los Angeles, 1920-1965 (Chicago: University of Chicago Press, 2002), 191.

[315] Jackson, *Crabgrass Frontier*, 236; Herb Lightfoot, "Panorama City: Sweet Song of Success," *San Fernando Valley Realtor*, December 1960, 18-20; "Shop Center Work Starts," *Los Angeles Examiner*, 8 December 1957; Hise, *Magnetic Los Angeles*, 205-6.

[316] Jackson, *Crabgrass Frontier*, 50, 49, 250; U.S. Bureau of Census, *Census of Housing, 1960, Volume I* (Washington D.C.: U.S. Government Printing Office, 1963), xxii, table 17, 1-107; Nicolaides, *My Blue Heaven*, 17.

[317] Adam Rome, *The Bulldozer in the Countryside: Suburban Sprawl and the Rise of American Environmentalism* (New York: Cambridge University Press, 2001), 42; Waldie, *Holy Land*, 12-3.

To Cohen, new house construction "provided the bedrock of the postwar mass consumption economy, both through turning 'home' into an expensive commodity for purchase by many more consumers than ever before and by stimulating demand for related commodities." This demand for luxury goods spurred the construction of large shopping centers. After purchasing homes, families rushed to stores to gather new appliances, furnishings, and other goods. Collecting these products served as a marker of status. As the historian Elaine May explains, "the family home would be the place where a man could display his success through the accumulation of consumer goods." In turn, "women would reap rewards for domesticity by surrounding themselves with commodities."[318]

Unlike other Americans, Angeleno ICBM workers had a higher than average purchasing power thanks to lucrative government contracts. By the 1960s, more than 40 percent of Los Angeles County's industrial laborers worked in ICBM aerospace plants.[319] Some worked in white-collar jobs, such as engineering, mechanical drawing, and technical advisement. Others worked in blue-collar positions, serving as mechanics and manual laborers.[320] Aerospace workers received comparatively higher wages than other industrial employees. For example, Douglas employees in 1950 earned an average of $5,100 per year, $2,000 higher than the national average. One lowly Douglas worker in Santa Monica, R.V. Lloyd, earned $3,224 after

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[318] Lizabeth Cohen, *A Consumers' Republic: The Politics of Mass Consumption in Postwar America* (New York: Vintage Books, 2003), 121-2, 6-8; Robert L. Griswold, *Fatherhood in America*: *A History* (New York: Basic Books, 1993), 197; Elaine Tyler May, *Homeward Bound: American Families in the Cold War Era* (New York: Basic Books, 2008), 156, 172.
[319] Culver, *The Frontier of Leisure*, 201.
[320] Douglas Aircraft Corporation, "A Career for You at Douglas," December 1956, in author's possession.

taxes in 1955, not including bonuses and overtime pay. Consequently, Lloyd and other working-class Douglas employees could afford to consume more goods than the average American.[321]

Real estate developers understood that their customers could afford to purchase luxury goods and consequently provided them with pamphlets directing them to the closest shopping malls and swimming pool vendors. When ICBM workers spent their dollars on goods, they were not only filling their new homes with luxuries. As workers gathered television sets, furniture, kitchen appliances, sporting goods, and designer suits, they sent ICBM wages into the hands of store owners and product manufacturers. In this indirect way, ICBM dollars contributed to overall growth of the city's economy.[322] A few statistics illustrate this phenomenon. Before the advent of the ICBM program, in 1947, Los Angeles County's industrial workers took home combined total of $785 million in wages. The next year, the city's retail stores reported $4.5 billion in sales. When the ICBM program began in 1954, industrial workers took home $1.87 billion while retail establishments logged $6.7 billion in sales. After the ICBM had taken hold of the city, in 1958, the workers claimed $2.3 billion in wages and retail establishments sold $8.3 billion worth of goods.[323] The above wage statistics do not account for the salaries enjoyed by the ICBM program's white-collar workers, including its engineers, scientists, and administrators.

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[321] Waldie, *Holy Land*, 37; Douglas Aircraft Company, Inc., "Douglas Aircraft Company, Inc. Application for Employment," circa 1956, in author's possession; R.V. Lloyd, Douglas Aircraft Company paystubs, Santa Monica, California, 1955-1957, in author's possession.

[322] Burns and Kaiser, "Keeping Up with the Joneses," "Housing" folder, carton 311, Henry Kaiser Papers, Bancroft Library, University of California, Berkeley, Berkeley, California; "Panorama City Shopping Center: The Center of the San Fernando Valley," "KCH Assoc. with Fritz Burns" folder, carton 348, Henry Kaiser Papers, Bancroft Library, University of California, Berkeley, Berkeley, California.

[323] U.S. Department of Commerce, *County and City Data Book, 1952* (Washington, D.C.: U.S. Government Printing Office, 1953), 47, 46; U.S. Department of Commerce, *County and City Data Book, 1956* (Washington, D.C.: U.S. Government Printing Office, 1957), 30, 27; U.S. Department of Commerce, *County and City Data Book, 1962* (Washington, D.C.: U.S. Government Printing Office, 1962), 37, 38.

However, they help reveal how ICBM work provided new economic opportunities for blue-collar workers and how retail sales increased accordingly.

Mass consumption not only transformed homes into showcases of wealth and galvanized the local economy, it also served as a Cold War weapon. American spending served as a testimony of the benefits of American capitalism. American leaders compared the mass consumption of goods in the United States with the material deprivations of the Soviet Union. By doing so, they undercut Marxist claims that capitalism led to working-class material deprivation. Eisenhower himself juxtaposed American purchasing power and quality of life with Soviet communism. “An American working man can own his own comfortable home and a car and send his children to well-equipped elementary and high schools and to colleges as well. They [the Soviets] fail to realize that he is not the downtrodden, impoverished vassal of whom Karl Marx wrote. He is a self-sustaining, thriving individual, living in dignity and in freedom,” he said. Vice President Richard Nixon echoed this point in his famous Kitchen Debate with Soviet Premier Nikita Khrushchev in 1959. At the American Exhibition in Moscow, Nixon argued that the United States came “closest to the ideal of prosperity for all in a classless society” by pointing to an American model home, priced at $14,000 and filled with appliances and other goods on display. Notably, Nixon associated the luxurious goods with his home state, California. In his memoirs, Nixon reported that the Soviet press was impressed by the model American home. They dubbed it the “Taj Mahal” and “insisted that it did not represent the way that an average American family really lived.” Nixon corrected them and related to Khrushchev that the home was “the kind of home that might be owned by an American steelworker.” Khrushchev was incredulous. “Either he did not believe me or he was unwilling to admit that it was true,” Nixon reported.[324]

While some Angelenos valued their homes as temples of wealth, others treasured their homes simply because they were the places where their families lived. During the first few decades of the Cold War, the nation experienced a dramatic increase in births. The baby boom touched nearly every American community but was particularly potent in Los Angeles. For example, the Lakewood average family size was 4.2 persons while the national the average family size was of 3.2. In addition to providing shelter for families, suburban homes were places where families could play. Suburban backyards provided the primary venue for leisure in Los Angeles. There, families gathered on patios to eat, drink, play games, and socialize with neighbors. Although backyard leisure was not distinctive to the city, Angelenos pursued barbecues, yard games, and other backyard activities with more intensity than other Americans.[325] *Harper’s* magazine noted this phenomenon, writing that “today’s dream looks westward to California” and “envisions a happy family in Technicolor slacks and Hawaiian shirts having a barbecue feast on the terrace, all smiling.”[326]

ICBM construction once made these homes possible and threatened their very existence. While ICBM spending produced new suburban tracts and empowered homebuyers to enjoy luxurious lifestyles, nuclear war threatened to destroy the tracts in a fiery inferno. Because Los

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[324] Cohen, *A Consumers’ Republic*, 7-9, 124-6; Dwight D. Eisenhower, “Address in Detroit at the National Automobile Show Industry Dinner,” 17 October 1960, in *Public Papers of the Presidents of the United States: Dwight D. Eisenhower, 1960-1* (Washington, D.C.: U.S. Government Printing Office, 1961), 769; Kitchen Debate Transcript, 24 July 1959, U.S. Embassy, Moscow, Soviet Union, https://www.cia.gov/library/readingroom/docs/1959-07-24.pdf; Richard Nixon, *The Memoirs of Richard Nixon* (New York: Grosset & Dunlap, 1978), 208.
[325] Waldie, *Holy Land*, 89; Culver, *The Frontier of Leisure*, 238, 232; “A Big Fast-Growing Market: The Leisured Masses, Part 1,” *Business Week*, 12 September 1953, 142; Kevin Starr, *The Dream Endures: California Enters the 1940s* (New York: Oxford University Press, 1997), 4.
[326] Frederick Lewis Allen, “The Big Change in Suburbia,” *Harper’s*, June 1954, 26.

Angeles was America's ICBM capital, the Soviet Union marked it as a primary nuclear target.[327] As aerospace experts, Angelenos knew this well. They also understood that if the Soviets dropped a single nuclear warhead on a local aerospace plant their suburban utopias would be destroyed. As a result, some stoked fears of the coming nuclear holocaust. "Using metropolitan Los Angeles as a target," one Lakewood engineer wrote, "I envision one or more bombs of 20 to 50-megaton yield exploding at 10,000 to 15,000 ft. above the ground. Under these conditions, a 20-megaton bomb would flatten every ordinary residence within 12-mile radius, render uninhabitable every house within 20 miles, start fires up to 50 miles and shatter windows more than 100 miles from ground zero."[328]

The city's aerospace experts disseminated this fear to less-knowledgeable Angelenos. Speaking to a local forum at Pasadena City College, local aerospace researcher Albert Hibbs wailed: "I'm frightened!" Hibbs recounted recent Soviet ICBM and satellite launches. From there, he spoke of suburban consumerism and leisure, including televisions, new cars, "and the most prosperous Christmas in our prosperous history." "We may not have too long to enjoy it," Hibbs explained. "There is a very real possibility that half-an-hour ago three Russian ICBM's were launched from Siberia, and right now—this instant—are high above the earth, their guidance systems fastened on Los Angeles, and hydrogen death in their warheads! In fifteen minutes, Los Angeles and all of the surrounding communities will be charred ruins." He continued: "How much more time will the Russians give us? How many months? How many

[327] Clayton, "Defense Spending," 291.
[328] "Engineer Blasts Government Booklet on Fallout Shelters," *Los Angeles Times*, 9 January 1962.

minutes?" "We've run out of future. There's no more future left. The only time we have is the present. And the present is now."[329]

Faced with the prospect of nuclear destruction, Angelenos worked for the ICBM program to earn money, purchase homes, fill them with goods, and produce the weapons that would keep the Soviet Union in check. In other words, suburbia gave Angelenos a vested interested in manufacturing nuclear deterrent. Clarence "Kelly" Johnson articulated this point in his 1961 Christmas address to his Lockheed employees. Referring to a nondescript nuclear weapon delivery system, Johnson remarked, "Our nation needs it for many things—as you do for yourself and your children. In its defensive role, it can save our lives and our country. When things get tough and you are tired…just think this— 'I'm not building this for Lockheed or Art Viereck or Kelly Johnson—this is for me!'"[330]

Although ICBM workers embraced suburbia, Ramo feared that sprawl would prove hazardous to Angelenos. He was particularly concerned about smog stemming from commuter vehicles. Smog first collared Los Angeles in the early 1940s when aerospace manufacturers attracted migrants and their motor vehicles to the region. The advent of the ICBM program and its acceleration of sprawl in the 1950s further flooded the city's air with hydrocarbons.[331] Recognizing that his firm had contributed to the problem by attracting migrants to the city and fueling its suburbanization, Ramo began developing a new muffler to eliminate smog fumes from automobiles. As Ramo put it, he attempted to curtail smog as act of "public service to the

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329 Albert Hibbs, "Talk presented at the Tuesday Forum, Pasadena, California, January 14, 1958," 1, 9, folder 3, box 67, Presentations and Speeches, Albert R. Hibbs Papers, The Huntington Library, San Marino, California.
330 Clarence L. Johnson, "Christmas Speech," 21 December 1961, folder 7, box 7, Speeches, 1958-1977, Clarence L. Johnson Papers, The Huntington Library, San Marino, California.
331 Chip Jacobs and William J. Kelly, *Smogtown: The Lung-Burning History of Pollution in Los Angeles* (Woodstock: The Overlook Press, 2008), 15.

Southern California community." Understanding that the technology would be more widely implemented if it was cheap to purchase, Ramo attempted to drive the prototype cost down to $100 per unit. After revising the muffler's design several times, Ramo procured a workable $200 model that used a direct flame to burn up pollutants in the exhaust system before they reached the tail pipe. However, the model was complicated to build, bulky, and gave off too much heat. As Ramo attempted to fix these problems, Kenneth Hahn, a member of the Los Angeles County Board of Supervisors, called on the State Legislature to defend the health of Angelenos by passing legislation to force the automobile industry to adopt the technology. Although the legislature refused to heed Hahn's call to action, it did order the California Department of Public Health to develop statewide air quality standards, including maximum-allowable levels for hydrocarbons and carbon monoxide. However, throughout the 1950s and the 1960s state officials and car manufacturers did little to curtail smog in the city. Discouraged by the lack of state and corporate action, Ramo stepped-away from his anti-smog pet project. "When the smog really begins to kill people, not just one but every day, [California] will do something about it," he said. Smog continued to plagued Los Angeles throughout the remainder of the twentieth century. Hundreds of thousands of people died from it, mostly from slow acting diseases.[332]

While the ICBM program transformed Los Angeles, the Soviet Union moved towards the militarization of space. On October 4, 1957, the U.S.S.R. sent Sputnik into space. The launch not only signified that the Soviet Union reached into the space frontier first, it also demonstrated that

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[332] Ramo-Wooldridge Corporation, "Background Data Sheet on the Ramo-Wooldridge Anti-Smog Device," 17 October 1958, in author's possession; "Missile Firm Working on Smog Muffler," *Los Angeles Times*, 17 January 1958; "Caltech Scientist Discloses Anti-Smog Device for Cars," *Los Angeles Times*, 22 October 1958; "Four Anti-Smog Devices Picked for Car Tests Here," *Los Angeles Times*, 9 January 1959; "The Search Now Begins," *Los Angeles Times*, 28 May 1960; Gene Blake, "Griswold Auto Smog Device Given Support," *Los Angeles Times*, 31 October 1959; Ken Fermoyle, "Smog Relief? Next Year, Maybe," *Popular Science*, February 1960, 62; Jacobs and Kelly, *Smogtown*, 167, 10; E.J. Stanley, "Smog Problems Answers Sought," *Los Angeles Times*, 25 June 1966.

the Soviets had the power to launch rockets across the earth. Thus, the battle of space was not solely a competition based on mastering the space frontier. It was also a means for the two superpowers to flex their rocket technologies and demonstrate their control of the heavens. Senate majority leader Lyndon Johnson said that whoever controlled "the high ground" of space would control the world. Others maintained that the moon, itself, was the high ground and warned that whoever controlled the moon would control the Earth. *The New York Times* framed the control of space as a "race for survival."[333]

In response to Sputnik, Ramo-Wooldridge began pursuing space technologies alongside the ICBM. Two days after Sputnik's launch, Ramo changed the name of the Guided Missile Research Division, the branch of Ramo-Wooldridge that managed the ICBM program, to Space Technology Laboratories (STL).[334] In January 1958, Ramo went before the board of directors of Thompson Products, the financial backer of Ramo-Wooldridge, and asked them for $25 million to construct a new complex in Los Angeles metropolitan area to serve as a laboratory, manufacturing center, and testing facility for spacecraft technologies. The board approved the plan, purchased one hundred acres in Redondo Beach, and provided funding to construct the new complex, Space Park. Later that year, Thompson Products formally merged with Ramo-Wooldridge under the name Thompson-Ramo-Wooldridge (TRW). Thanks to Ramo's history with WDD, and the newfound fears of Soviet space conquest, the National Aeronautics and Space Administration (NASA) granted STL the nation's first contract to build a spacecraft. Within a few months, STL produced an orbiter, Pioneer I. It launched into space on October 11, 1958.[335]

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[333] Johnson and the *New York Times* quoted Tom Wolfe, *The Right Stuff* (New York: Farrar, Straus, Grioux, 1979), 71; Ramo, *The Business of Science*, 120.
[334] Ramo, *The Business of Science*, 120-1.
[335] Ramo, *The Business of Science*, 123, 125; Simon Ramo FBI Files, Part II, 151, FOIA.

Following STL's lead, WDD also pursued space technologies alongside the ICBM. The Air Force redesignated WDD the Air Force Ballistic Missile Division (AFBMD) and expanded its mission to include the production of reconnaissance and surveillance satellites. Additionally, the Air Force tasked TRW to procure another ICBM model, the Minuteman I, and issued STL dozens of contracts to manufacture space equipment at Space Park. At first glance, this new arrangement contradicted the firm's initial systems engineer contract, which barred the company from manufacturing products for the Air Force. However, TRW claimed that its new manufacturing role only applied to space technologies and that the firm was not acting out of order because it was not manufacturing and selling ICBM components to the Air Force. After crafting the new deal, TRW and AFBMD expanded their operations, packing thousands of military officers, engineers, and technical advisers into the Arbor Vitae Complex, the Research and Development Center, and Space Park. Offices spilled out into trailers in the parking lots and rental spaces in southwest Los Angeles, Inglewood, Hawthorne, Lawndale, and Torrance.[336]

While TRW and AFBMD procured ICBM and space equipment in Los Angeles, Air Research and Development Command established a new base in the city's hinterlands to accommodate the ICBM program. In April 1957, Air Research and Development Command hired the P.J. Walker Company of Los Angeles to construct an Atlas ICBM guidance station at Camp Cooke, an old army training facility 63 miles northwest of Santa Barbara along the California coast. The facility included missile assembly buildings, tracking stations, and operation centers. In June the Air Force transformed the camp into Cooke Air Force Base while

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[336] Nash, *The Federal Landscape*, 94-5; History Office, Space and Missile Systems Center, "Historical Overview of the Space and Missile Systems Center," 7, 1, 8; Jacobson, *TRW 1901-2001*, 72; TRW, "Annual Report of Thompson Ramo Wooldridge Inc., For the Year Ended December 31, 1958," 3, folder 3, box 82, Simon Ramo Papers, J. Willard Marriott Library Special Collections, University of Utah, Salt Lake City, Utah; Jacob Neufeld, *The Development of Ballistic Missiles in the United States Air Force, 1945-1960* (Washington, D.C.: U.S. Government Printing Office, 1990), 211.

the Fredericksen, Kasler, and Stolte firm built an Atlas launch facility there. The vast acreage between the missile complexes and the sea was peppered with wildlife, including deer and wild hogs. To operate the missile base, Air Research and Development Command turned to Headquarters, 392nd Air Base Group, and the 1st Missile Division at AFBMD in Inglewood. In the fall of 1957, the Air Force transferred the management responsibilities for Cooke from AFBMD to Strategic Air Command. On January 1, 1958, Strategic Air Command established the nation's first ballistic missile division at the site.[337]

In short order, Cooke became the Air Force's leading missile testing facility. On October 4, 1958, Cooke Air Force Base was renamed Vandenberg Air Force Base. Encompassing 84,000 acres of Santa Barbara County, and housing over 20,000 people, Vandenberg was the third largest Air Force base in the world. The Air Force relied on Vandenberg for missile testing because of the base's environmental factors. Hugging the Pacific Coast, Vandenberg could launch missiles into the sea without them having to travel over populated American lands. In December 1958, Vandenberg launched its first missile, an inert Thor intermediate range ballistic missile, 1,268 miles into the Pacific Ocean. Launching missiles was an expensive endeavor. After all, unlike the Air Force's jet fighters and bombers, the missiles never came back. In September 1959, Vandenberg launched an Atlas ICBM 3,899 miles into the sea. After the launch, Strategic Air Command declared the Atlas system operational and integrated the missile in its Emergency War Order plan. A month later, Vandenberg became the first American launch site to hold an Atlas missile equipped with a nuclear warhead on strategic alert.[338]

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[337] Thomas Riedinger, "Vandenberg, USA," *Boeing Magazine*, November 1962, 3-5; Jeffrey E. Geiger, *Camp Cooke and Vandenberg Air Force Base, 1941-1966: From Armor and Infantry Training to Space and Missile Launches* (Jefferson: McFarland & Company, Inc., 2014), 154, 157; Chapman, *Atlas*, 146.
[338] Geiger, *Camp Cooke and Vandenberg Air Force Base*, 167, 156-7, 12-3, 163-5, 7.

Figure 12: Atlas ICBMs on strategic alert at Vandenberg Air Force Base. 1960. Photograph courtesy of the U.S. Air Force.

Over the next five years, Vandenberg sent dozens of ICBMs—including Titan and Minuteman models—into the Pacific. To accomplish this feat, the Air Force worked closely with over 300 private firms. To provide one example, the Boeing Company came to Vandenberg in 1960. There, it employed 1,350 people to install Minuteman I facilities and train Air Force instructors on how to operate and maintain the equipment. From 1960 through 1963, Air Force officers from missile complexes in Montana, Wyoming, the Dakotas, and Missouri traveled to Vandenberg to train using the new Minuteman I technology. This training consisted of manning launch control centers on 24 hour shifts and participating in alert drills. At the conclusion of their 30-day course, the trainees each launched a Minuteman I missile into the Pacific Ocean. Thanks to Boeing's guidance, the Air Force sent 65 Minuteman I missiles from Vandenberg into the Pacific by the end of 1963.[339]

Along with testing ICBMs, Vandenberg helped propel American satellites into space. On February 28, 1959, Vandenberg launched a modified Thor missile, the Thor-Agena A, to send the Discoverer I spacecraft into near polar orbit. Codenamed Corona, Discoverer I was a CIA space reconnaissance program. Outfitted with cameras, Corona satellites orbited the earth, photographed the Soviets, and ejected canisters of exposed film into the lower atmosphere for American planes to retrieve. Vandenberg sent dozens of Discoverer satellites into orbit in the late 1950s and early 1960s. The fourteenth Discoverer mission, on August 18, 1960, yielded fantastic results. It provided more photographs of the Soviet Union than all previous U-2 missions combined. In 1962 the CIA issued Corona a new codename, Keyhole. Vandenberg continued to support the program throughout the 1960s and sent modified Thor and Atlas missiles with Keyhole satellites into orbit.[340]

Camp Cooke's transformation into the nation's leading ICBM military base necessitated the creation of more livable spaces. In the late 1950s, the Air Force calculated that pouring money into Vandenberg base living would help prevent turnover of highly-trained missilemen and would be cheaper than training new recruits. To this end, Vandenberg constructed modern homes based on the suburban model. By 1960 it contained 1,405 modern homes filled with luxurious appliances, such as garbage disposals and dishwashers. Each house measured at least 1,000 square feet. In short order, Vandenberg became renown in the Air Force for its quality housing. However, as Vandenberg grew in importance, it quickly ran short on livable space. In

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[339] Geiger, *Camp Cooke and Vandenberg Air Force Base*, 167, 156-7, 12-3, 163-5, 7; Boeing Company, *Boeing/Vandenberg*, brochure, circa 1965, 1,7, 3, 16, in author's possession; Riedinger, "Vandenberg, USA."
[340] Geiger, *Camp Cooke and Vandenberg Air Force Base*, 165, 167, 172.

1962 Vandenberg employed 11,000 people. Less than one year later, it employed 21,000. The Air Force hurried to construct more housing for these families. Meanwhile, savvy entrepreneurs eyed the nearby town of Lompoc for new housing projects.[341]

Almost overnight, Lompoc transformed from a sleepy farming community to a booming modern town. Before Vandenberg's ascent, Lompoc primarily produced flower seeds and diatomaceous earth. As Vandenberg's workforce grew, Lompoc hired a full-time city administrator, a planning engineer, and a consulting firm to change the village into a bustling bedroom community for the base. The planners took cues from suburbia and built new structures common to the Los Angeles suburban experience. Lompoc poured $3 million into the construction of a new sewer system, $3.5 million into a shopping complex, and $9.5 million into new school buildings. In less than five years, Lompoc developers built nearly 4,000 tract homes, five schools, and two parks. The *Los Angeles Times* opined on Lompoc's transformation, writing that Vandenberg "has flung a whole city into a new environment called Progress." The community branded itself as the "Gateway to the Stars," and issued promotional materials to attract Vandenberg workers. Their efforts paid off and the town's population swelled from 6,500 to 18,000. Lompoc leaders projected that the community would continue to grow with Vandenberg and hold 35,000 people in 1970 and 50,000 in 1980.

As Lompoc grew, developers created a new town just outside of the community to collect Vandenberg families. Named Vandenberg Village, the new tract contained 350 homes and 36 apartment units in 1962. One year later, Vandenberg Village took off and contained more than 1,000 homes, markets, churches, schools, and a golf course. Facing the future, the developers

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[341] Chapman, *Atlas*, 145; "Vandenberg Village, Missile Satellite City, Rises." *Los Angeles Times*, 21 March 1963.

planned to construct 10,000 homes, vast shopping centers, and seven schools within a few years.[342]

While developers erected new communities to service Vandenberg workers, back in Los Angeles aerospace companies began organizing against the systems engineer organizational scheme. Although the ICBM program had fattened hundreds of contractors, many bemoaned the system. Some contractors, such as Convair, argued that TRW's systems engineer division could pass on proprietary information from the aerospace firms it managed to its manufacturing division. Other aerospace companies claimed that the Air Force was favoring TRW for other projects because of the "intimate" relationship it enjoyed with the firm under the ICBM program. TRW's steady success, and the fact that it held over thirty military contracts, seemed to indicate that the firm had a "privileged position" with its primary customer, the Air Force.[343] A critical mass of these concerns prompted a series of congressional investigations in the summer of 1959. TRW refuted any impropriety but indicated it would divest its systems engineering arm, if necessary. While Congress examined the issue, the Secretary of the Air Force James H. Douglass, Jr. tasked Clark B. Millikan, the director of Caltech's Guggenheim Aeronautical Laboratory, to chair a special committee to study the systems engineering arrangement.[344]

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[342] Chapman, *Atlas*, 146; "Lompoc, Canaveral of West, Transformed by Missile Age," *Los Angeles Times*, 25 February 1962; "School Needs Outlined in Lompoc Area," *Los Angeles Times*, 29 January 1961; "Vandenberg Village, Missile Satellite City, Rises." *Los Angeles Times*, 21 March 1963.

[343] During 1958, the Ramo-Wooldridge Division of TRW experienced steady growth. By the end of the year, its monthly rate of sales nearly doubled what it was at the beginning on the year. See TRW, "Annual Report of Thompson Ramo Wooldridge Inc., For the Year Ended December 31, 1958," 11, folder 3, box 82, Simon Ramo Papers, J. Willard Marriott Library Special Collections, University of Utah, Salt Lake City, Utah.

[344] Hughes, *Rescuing Prometheus*, 137-8; Schriever Interview, 17; U.S. Congress, House of Representatives, Subcommittee of the Committee on Government Operations, *Organization and Management of Missile Programs, Part I—Department of Defense, Part II—Air Defense, Part III—Air Force: Hearings before a Subcommittee of the Committee on Government Operations*, 86th Cong., 2nd sess., 1960, 82-91; [Walter T. Bonney], *The Aerospace Corporation, 1960-1970: Serving America* (El

The Millikan Committee tendered its report on January 29, 1960. In it, the group concluded "that it would not be desirable at this time" to return to the prime-contractor model. It noted that "the current management approach had worked extremely well both in terms of technical quality of the results and the speed with which missile system development had taken place." Therefore, the Millikan group recommended that TRW continue to oversee the Atlas, Titan I, Thor, and Minuteman I programs "in order to avoid any possible disruption of the approved development plans." However, the committee maintained that the Air Force should establish a "basically noncompetitive" civilian organization to takeover systems engineering for future missile and space projects.[345]

After reviewing the Millikan report, Schriever partnered with Undersecretary of the Air Force Joseph Charyk to begin the process of forming a new "noncompetitive" corporation to assume TRW's role as systems engineer for future ICBM and space projects. On April 1, 1960, the Air Force formed an organizing committee for the new venture. The group included William O. Baker of Bell Telephone Laboratories, T.F. Walkowicz of Rockefeller Brothers Enterprises, and other industrial leaders. In April, the group crafted articles of incorporation and a mission statement and discussed prospective board members for the new firm. On May 24, Charyk—then

Segundo: The Aerospace Corporation, 1970), 6; Ramo, *The Business of Science*, 108; Neufeld, *The Development of Ballistic Missiles in the United States Air Force*, 211; William Leavitt, "Aerospace Corporation: USAF's Missile/Space Planning Partner," *Air Force/Space Digest*, October 1967, 75. For criticism of Ramo-Wooldridge's role in the ICBM program, see H.L. Nieburg, *In the Name of Science* (Chicago: Quadrangle Books, 1966). For another congressional hearing on the subject of Ramo-Wooldridge's ICBM program, see U.S. Congress, House of Representatives, Subcommittee for Special Investigations of the Committee on Armed Services, *Weapons System Management and Team System Concept in Government Contracting: Hearings before the Subcommittee for Special Investigations of the Committee on Armed Services*, 86th Cong., 1st sess., 1959. For "intimate and privileged position" see U.S. Congress, House of Representatives, Committee on Government Operations, *Organization and Management of Missile Programs: Eleventh Report by the Committee on Government Operations*, 86th Cong., 1st sess., 1959, 97.

[345] U.S. Congress, House of Representatives, Subcommittee, *Organization and Management of Missile Programs, Part I—Department of Defense, Part II—Air Defense, Part III—Air Force*, 83-92.

the acting secretary of the Air Force—approved the new corporation's articles, mission statement, and board members.[346]

On June 25, 1960, the AFBMD held a press conference at the Arbor Vitae Complex and announced the "formation of a new nonprofit organization, The Aerospace Corporation, to serve with the Air Force in scientific and technical planning and management of missile-space programs."[347] That summer, the Air Force granted The Aerospace Corporation a $1 million contract as well as an advance of $5 million to recruit workers.[348] Along with providing these funds, the Air Force purchased the Research and Development Center from TRW to house the new firm.[349] Led by the former Raytheon executive Ivan Getting, The Aerospace Corporation recruited 2,694 employees during its first year, garnering most of its technical staff and experts from STL.[350] Between 1960 and 1964, the Air Force granted The Aerospace Corporation $309 million in contracts to work on a variety of new programs, including the Discoverer space satellite, the Mercury launch vehicle, the Missile Defense Alarm System, and the Nike Zeus system—a defense complex that could intercept and down enemy ICBMs. In short order, The Aerospace Corporation became one of the nation's largest defense firms. Los Angles continued to grow thanks to The Aerospace Corporation's systems engineer model. By 1964, real estate

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[346] The Aerospace Corporation, *The Aerospace Corporation, Its Work: 1960-1980* (El Segundo: The Aerospace Corporation, 1980), 17.
[347] U.S. Congress, House of Representatives, Subcommittee, *Organization and Management of Missile Programs, Part I—Department of Defense, Part II—Air Defense, Part III—Air Force*, 83-92; [Bonney], *The Aerospace Corporation*, 6; History Office, Space and Missile Systems Center, "Historical Overview of the Space and Missile Systems Center," 1-2.
[348] U.S. Congress, Office of Technology Assessment, *A History of the Department of Defense Federally Funded Research and Development Centers* (Washington, D.C.: U.S. Government Printing Office, 1995), 25.
[349] The Aerospace Corporation, *The Aerospace Corporation, Its Work*, 17.
[350] Neufeld, *The Development of Ballistic Missiles in the United States Air Force*, 212; [Bonney], *The Aerospace Corporation*, 6, 8, 23, 7; History Office, Space and Missile Systems Center, "Historical Overview of the Space and Missile Systems Center," 8.

developers had created new suburban tracts across Orange County to service ICBM and other aerospace workers. 60 percent of Orange County's manufacturing jobs were created by the aerospace industry. The county produced 90 percent of all advance communication equipment for the United States.[351]

On January 17, 1961, Eisenhower gave his farewell address to the nation. During the speech, the president invoked Ramo-Wooldridge, The Aerospace Corporation, and the nation's ICBM program. He warned the American people about the growing influence of the "scientific-technological elite," those engineers and planners that had their fingers on military development and the American economy. He cautioned the nation that these people, and the system they constructed, held "the potential for the disastrous rise of misplaced power." He advised families about the dangers of a growing "military-industrial complex," painting the arrangement as a mysterious cabal with "unwarranted influence" in American government.[352]

Yet, as exemplified by Ramo-Wooldridge's quest for the ICBM, the military-industrial complex had worked for Los Angeles. Under Ramo-Wooldridge's system, the ICBM program disbursed federal dollars into dozens of contractors and hundreds of subcontractors. From there, the money flowed into employee paychecks, suburban construction, and shopping centers. As the money weaved its way through Los Angeles, it underwrote a new era of prosperity for families, communities, and businesses. Angelenos embraced this system, recognizing that it made their

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[351] U.S. Congress, House of Representatives, Subcommittee for Special Investigations of the Committee on Armed Services, *The Aerospace Corporation, A Study of Fiscal and Management Policy and Control: Hearings before the Subcommittee for Special Investigations of the Committee on Armed Services*, 89th Cong., 1st sess., 1965, 1; Aerospace Corporation, "Annual Progress Report, 1 July 1960 through 20 June 1961," El Segundo, California, n.d., viii, x, FOIA; The Aerospace Corporation, "Fact Sheet: The Aerospace Corporation," December 1983, Los Angeles, California, in author's possession; María E. Montoya, "Landscapes of the Cold War West," in *The Cold War American West, 1945-1989,* ed. Kevin J. Fernlund (Albuquerque: University of New Mexico Press, 1998), 16.
[352] Dwight D. Eisenhower, "Farewell Address," "Final TV 1" folder, box 38, Speech Series, Dwight D. Eisenhower's Papers as President, Dwight D. Eisenhower Library, Abilene, Kansas.

new lives possible. They understood that their prosperity was a product of weapons work. They also knew that the city's ICBM industry made their suburban utopia a primary target for destruction and therefore poured their labor into the ICBM program in hopes of keeping the Soviet Union in check. In other words, Angelenos enlisted in the military-industrial complex because it worked for them.

The military-industrial complex not only proved beneficial to Angelenos, it also fulfilled Eisenhower's national security strategy. During the 1960s presidential election, John F. Kennedy claimed that the United States had fallen behind the Soviet Union in missile procurement. However, when Kennedy took office in 1961, he learned that his appraisal was unsound. As Secretary of Defense Robert McNamara put it, "there is a missile gap, but it's in the opposite direction of what we thought." Thanks to TRW and the Los Angeles firms, the Atlas and the Thor became operational in 1959. The Titan I and the Minuteman I followed in 1961 and 1962, respectively. Paradoxically, the creation of nuclear weapon delivery systems at once risked nuclear war and provided international stability. Because ICBMs could deliver nuclear weapons to enemy targets within minutes, the United States and the Soviet Union refrained from waging direct warfare on each other and engulfing the world in nuclear flames. World War III did not occur.[353] Nuclear deterrence worked. Angelenos did, indeed, safeguard their new homes and lifestyle by pouring their lifeblood into constructing ICBMs.

In the end, Ramo-Wooldridge's ICBM program was a success. The program not only produced ICBMs, it also made modern Los Angeles. The history of ICBM manufacturing is a story about organizational innovations, technological achievement, and local economic, social,

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[353] Simon Ramo, interview by Carol Butler, 6 April 1999, 41, NASA Oral History Project; Hughes, *Rescuing Prometheus*, 137; Neufeld, *The Development of Ballistic Missiles in the United States Air Force*, 186; Ramo, *The Business of Science*, 100; John Lewis Gaddis, *The Long Peace: Inquiries into the History of the Cold War* (New York: Oxford University Press, 1987), 216, 232.

and environmental change. With the completion of the Atlas, Titan I, Thor, and Minuteman I programs in the early 1960s, TRW lost its position as ICBM systems engineer. While TRW produced space technologies under Ramo and Thiel's leadership at Space Park, The Aerospace Corporation assumed the mantel of ICBM systems engineer and continued to disperse defense contracts across Los Angeles throughout the remainder of the Cold War. This system would ultimately make the city dependent on Cold War defense spending and led Angelenos to champion the hawkish rhetoric of Barry Goldwater and Ronald Reagan. When global tensions cooled in the late 1980s, Los Angeles's economy plummeted, causing many to question what would happen to the city if the Cold War came to an end.[354]

[354] U.S. Congress, House of Representatives, Subcommittee, *The Aerospace Corporation, A Study of Fiscal and Management Policy and Control*, 1-4; Elaine Woo, "Adolf Thiel; Oversaw Early Space Programs," *Los Angeles Times*, 12 July 2001; Robert C. McFarlane, "Time Out on Defense," *Washington Post*, 3 January 1988; Joan Didion, *Where I Was From* (New York: Vintage International, 2004), 131-2.

Part Two

Contesting the Atomic West

Chapter Five

Seeking Justice in Uranium Country: Human Health, Environmental Justice, Decolonization, and the Uranium Industry, 1973-1987

Although uranium mining and milling enriched thousands of westerners, the uranium industry presented many hazards. Uranium is naturally radioactive. Its nucleus is unstable, leaving the element in a constant state of decay. Although people commonly assume that uranium's hazardous nature is connected to its radioactivity, according to the Agency for Toxic Substances & Disease Registry, uranium's human health effects are due to its chemical effects and not the radiation it emits. Inhaling uranium can lead to irritation of the respiratory tract and the accumulation of fluid in the lungs as a result of the hydrofluoric acid that accompanies the element. Ingesting uranium can produce kidney damage. Neither the National Toxicology Program, the International Agency for Research on Cancer, nor the Environmental Protection Agency have classified uranium "with respect to carcinogenicity." As of 2013, the Agency for Toxic Substances & Disease Registry did "not know whether uranium can harm an unborn child" and has not identified a "scientifically strong human study that has shown birth defects due to uranium exposure."[355]

The most dangerous health hazards associated with mining uranium are linked to radon. As uranium decays it produces radon, a colorless, odorless, and tasteless radioactive gas. Because pockets of uranium in the earth are constantly in a state of decay, cracking into a uranium deposit can release a sizable radon plume. Radon can also travel through groundwater. Radon and the various elements it decays into—commonly called radon daughters—are

[355] U.S. Department of Health and Human Services, Public Health Service, Agency for Toxic Substances & Disease Registry, "Public Health Statement: Uranium," February 2013, https://www.atsdr.cdc.gov/ToxProfiles/tp150-c1-b.pdf.

carcinogenic. Specifically, exposure to radon can result in lung cancer. Furthermore, some radon daughters can settle in human lungs. There, they undergo radioactive decay. The radiation released during this process passes into the lung tissue, damaging the organ.[356]

As workers extracted uranium from the earth, hauled it to the mills, and processed the ore, uranium dust, radon gas, and radon daughters flowed across their skin, eyes, and lungs. In 1963, miners and former miners living on the Navajo Reservation began succumbing to lung cancer. As cancer burned across Navajo Country, some Navajos noticed that many of the afflicted had worked in the region's uranium mines. Drawing connections between the lung cancer outbreak and uranium mining, hundreds of Navajo miners and widows called for justice. Some argued that the federal government was negligent for the cancer outbreak and should provide fiscal compensation and health services to the uranium miners and their families. Others took aim at the uranium mining firms and made similar demands. Over time, other Native Americans across the United States seized on the issue and formed new organizations to draw attention to the plight of the uranium workers and those Indigenous peoples whose lands were contaminated by uranium waste products.

This chapter examines how Native American peoples fought for environmental justice in uranium country beginning in the early 1970s. While rooted in the Navajo experience and in the Southwest, this chapter travels across the American West and outside of the Navajo experience to document how diverse Native American peoples partnered with other westerners to challenge the uranium industry, demand environmental justice, and fight for compensation for their uranium-borne illnesses. This revises a uranium historiography that has strained to investigate

[356] U.S. Department of Health and Human Services, Public Health Service, Agency for Toxic Substances & Disease Registry, "Public Health Statement: Radon," May 2012, https://www.atsdr.cdc.gov/ToxProfiles/tp145-c1-b.pdf.

anti-uranium activism outside of the Navajo experience and integrates uranium history with the scholarship surrounding of twentieth-century Native American activism, which emphasize pan-Indian networks and the shared struggles for environmental justice and decolonization.[357] This chapter highlights how Native American activists were not alone in their struggle for compensation and survival. Rather, those irradiated bodies that sought justice found powerful non-Native allies, including the press, members of Congress, and Stewart L. Udall, the former Secretary of the Interior. By recognizing that the fight for justice in uranium country was not confined to one sub-region, one reservation, one people, or one identity group, this chapter illuminates that the fight for justice in uranium country was shepherded by diverse westerners. Uranium activists were Native, non-Native, male, female, poor, rich, uneducated, educated, private citizens, state officials, and concerned Americans from across the West.

He did not feel right. Peter Yazzie, a Navajo man who had mined uranium for seventeen years in Cove, Arizona, complained of a pain on his left side. One day in 1967, Yazzie traveled to the Shiprock Public Health Center looking for answers. The doctors took X-ray photographs of his torso. After reviewing the film, the doctors informed Yazzie that cancer had taken hold of his lungs. The doctors gave him "some pills" and sent him on his way. In May 1970, Yazzie's

[357] Prevalent works on anti-uranium activism include Peter H. Eichstaedt, *If You Poison Us: Uranium and Native Americans* (Santa Fe: Red Crane Books, 1994); Valerie L. Kuletz, *The Tainted Desert: Environmental and Social Ruin in the American West* (New York: Routledge, 1998), 7. Although Traci Voyles analyzes uranium activism within the context of the 1970s Red Power movement, her work is preoccupied with the Navajo experience. See Traci Brynne Voyles, *Wastelanding: Legacies of Uranium Mining in Navajo Country* (Minneapolis: University of Minnesota Press, 2015), 8. For histories of twentieth-century Native American activism, see Nick Estes, *Our History is the Future: Standing Rock versus the Dakota Access Pipeline, and the Long Tradition of Indigenous Resistance* (New York: Verso, 2019); Dina Gilio-Whitaker, *As Long as Grass Grows: The Indigenous Fight for Environmental Justice, From Colonization to Standing Rock* (Boston: Beacon Press, 2019); Alvin M. Josephy Jr., Joane Nagel, and Troy Johnson, eds., *Red Power: The American Indians' Fight for Freedom* (Lincoln: University of Nebraska Press, 1999).

body began to break down. Fighting for his life, he traveled to Albuquerque for hospitalization. He died eight days later, leaving behind his wife and ten children. He was forty years old.[358]

Dirty Bedonie mined uranium in one of the most productive mines in Arizona. He worked 700 feet underground. To Bedonie, it was just another job. His supervisors never let on that interacting with uranium was hazardous. Perhaps they were kept in the dark, too. During lunch breaks, Bedonie and the other workers would stand in line to drink from the water dripping down the side of the exposed rock. When he went home, Bedonie did not change his clothes, wash his hands, or shower. He wore his work clothes to sleep. Bedonie eventually left the uranium business on good terms. He was grateful for the good pay he found in the industry. Then, illness slowly set in. Bedonie had trouble breathing. He suffered from chest pain. After hearing about his health problems, Bedonie's wife, Clara, knew he would die like the others. Concerned about his condition, Bedonie traveled to the Tuba City Hospital. The doctors gave him medication for the pain and sent him on his way. Before he died, he said he felt no anger, bitterness, or pain.[359]

Across the Navajo Reservation, uranium miners and former miners began succumbing to lung cancer in the 1960s. The illness slowly devoured its victims, rendering many miners too sick to work and provide for their families as they slowly wasted away. The lung cancer outbreak was particularly potent in Red Rock, Arizona. Later renamed Red Valley in the late 1970s, Red Rock was an area of the reservation nestled between the large mining operations in Cove, Shiprock, and the Lukachukai Mountains. Most Red Rock residents lived in small hogans, void of electricity and running water. Many hoped they could save up enough money to improve their

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[358] Urith Lucas, "Navajos Who Mined Uranium Dying from Lung Cancer, Relatives Seeking Federal Compensation," *Albuquerque Tribune*, 17 August 1973; Eichstaedt, *If You Poison Us*, 96.
[359] Jane Kay, "Long Dead Uranium Mines Still Haunt Navajo Miners, Families," *Navajo Times*, 19 January 1983.

condition by working in the mines. They dreamed that as the mines boomed, their communities would blossom with running water and electricity. While some struck it rich in the mines, most workers usually only made enough cash to purchase a car, make small improvements to their homes, and make ends meet. As lung cancer disabled and killed miners, it left families impoverished and crushed their dreams of a better life.[360]

As lung cancer festered across Red Rock, Harry Tome took notice. Tome was a member of the Navajo Tribal Council, a delegate representing the Red Valley Chapter. In 1963, Tome worked for the minerals department of the Navajo Nation. As he visited the uranium mines surrounding Red Rock, Tome heard miners complain that they constantly felt ill and had trouble breathing. At the time, it did not occur to Tome that the miners' complaints were linked to their work. While attending Native American Church prayer meetings, Tome heard many fellow worshippers also complain of lung problems. The religious leaders connected the dots, explaining that the sicknesses "had something to do with uranium." Concerned about his community, Tome asked physicians if uranium caused health problem. "They said, 'yes,' there are studies that show it is harmful," Tome recalled.[361] After speaking with several doctors, Tome attended a Red Valley Chapter meeting and told local tribal leaders that uranium was the source of the numerous illnesses in the community. The group was incensed. None of the miners had been warned of the dangers of mining uranium. Searching for help, the chapter council contacted

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360 Lucas, "Navajos Who Mined Uranium Dying from Lung Cancer, Relatives Seeking Federal Compensation."

361 Lucas, "Navajos Who Mined Uranium Dying from Lung Cancer, Relatives Seeking Federal Compensation"; Eichstaedt, *If You Poison Us*, 96-7. Although Tome spearheaded activism on behalf of the uranium miners, there are few primarily sources that document Tome's actions. Eichstaedt obtained key sources on Tome from Tome, himself. With the exception of the Joseph M. Montoya Papers at the University of New Mexico, the archival trail has yielded little documentation on Tome. Furthermore, Tome passed away before I could contact him to confirm details about his story. Consequently, this chapter relies on Eichstaedt to fill-in the archival gaps surrounding Tome's actions.

the tribal council in Window Rock, Arizona. The council, however, had little resources to alleviate the health problems in Red Rock. Furthermore, Tome and the other members of the Tribal Council argued that the federal government should have warned the miners about the dangers of the uranium industry and, therefore, the federal government should provide medical treatment and compensation to the sick miners. Tome knew that the best way to force the issue would be by getting the press involved. Utilizing his personal network, Tome contacted a reporter from the *Albuquerque Tribune*, Urith Lucas, and urged him to come to Red Rock and investigate.[362]

In the summer of 1973, Lucas journeyed into the Red Valley communities of Red Rock, Cove, and Oak Springs to interview dozens of families about their deceased loved ones. One woman Lucas interviewed was Dolores Yazzie, Peter's Yazzie's widow. The two sat in a one-room hogan, the home of Dolores and her ten children. Dolores shared photographs of her husband, weeping as she told his story. She shared her pain of losing Peter and the struggles of rearing ten children on her own. She feared that her children would struggle throughout their lives by not having a father's guidance and enough money to get an education. Lucas also interviewed those Navajo miners who were fighting to stay alive. They shared with them that since there was no drinking water available in the mines, they "often just drank the water seeping through" the rock. "We didn't know it could be contaminated," a miner said. On August 17, 1973, Lucas's story on the Red Rock miners appeared on the front page of the *Albuquerque Tribune*. "Navajo families are seeking compensation for husbands, fathers and sons who have died of lung cancer. The relatives claim that many have died from anaplastic carcinoma of the lung, a fatal disease which they say was brought on by exposure to radiation in uranium mines,"

[362] Lucas, "Navajos Who Mined Uranium Dying from Lung Cancer, Relatives Seeking Federal Compensation"; Eichstaedt, *If You Poison Us*, 98.

it read. Throughout the article, Lucas listed the names of the widows and the men still fighting for their lives. Lucy Wilson Benally lost her husband, Roy, on June 15, 1972. Cora Joe lost her husband, David, on October 12, 1972. Ann Mae Nelson lost Alfred in 1968. Clyde Dick lost her husband in March 1973. John Walter worked in the mines for ten years and was fighting through a disability. So was Hoscan Tsosie, who had mined for eight years. The list went on.[363]

While Lucas was researching his story, the leaders of the Red Valley Chapter wrote to two members of the New Mexico congressional delegation, Senator Joseph M. Montoya and Representative Manuel Lujan, about the lung cancer epidemic. They included a resolution requesting compensation for the uranium miners. Lujan understood that it would be difficult proving that mining uranium caused the disease. Causation, in the words of Lujan, was "a complex matter." Still, Lujan promised to "push hard for legislation" to protect the workers and their families. Montoya said his office would provide forms and information to the community on social security benefits. Both agreed that the miners and their families should "speak out" and be heard.[364]

In October 1973, Montoya announced that he would introduce legislation which, if passed, would provide federal compensation to Navajos and others who contracted lung cancer as a result of working in the nation's uranium mines. The bill promised benefits ranging between $169.80 per month for a single survivor up to $339.50 per month for a worker with three

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[363] Lucas, "Navajos Who Mined Uranium Dying from Lung Cancer, Relatives Seeking Federal Compensation."
[364] Elwood Tsosie, Harry V. Lee, Sarah M. Harvey, and Harry Tome to Joseph M. Montoya, 12 June 1973, folder 5, box 320, Joseph M. Montoya Papers, Center for Southwest Research, University Libraries, University of New Mexico, Albuquerque, New Mexico; "Resolution of the District #12 Council, Requesting Compensation for Uranium Miners," 3 March 1973, folder 5, box 320, Joseph M. Montoya Papers, Center for Southwest Research, University Libraries, University of New Mexico, Albuquerque, New Mexico; Lucas, "Navajos Who Mined Uranium Dying from Lung Cancer, Relatives Seeking Federal Compensation"; Eichstaedt, *If You Poison Us*, 98.

dependents. Montoya estimated that the bill would benefit more than 1,000 people. The bill required that the miner must have worked in an environment "where he was exposed to radon-daughters gas a minimum of six months and at least five years prior to the time the worker contracted cancer." Montoya said that the bill was based on medical data, which showed that the incidence of cancer among those who had worked ten years in a uranium mine was twelve times what it was for the normal population. At the same time, he recognized that "any exposure at all is sufficient to generate the disease." Importantly, the proposed bill prevented the government from rejecting claims unless the government, not the miner, proved that the cancer was not caused by radiation exposure. In other words, the burden of proof lay in refuting the relationship, not establishing it. Montoya introduced his bill as an amendment to Senate Bill 1029, the Respiratory Disease Benefits Act. Introduced by Robert Taft Jr. in February 1973, the Respiratory Disease Benefits Act was a comprehensive measure that promised government benefits to workers suffering from occupationally induced respiratory diseases, including asbestosis, silicosis, Shaver's disease, and lung cancer. In November, Lujan introduced a similar bill, H.R. 11567, in the House of Representatives. The Navajo Tribal Council endorsed Montoya's bill in January 1974.[365]

[365] "Aid for Navajo Miners Who Have Lung Cancer," *Navajo Times*, 11 October 1973; Amendment to S. 1029, 93d Congress (1973), folder 5, box 320, Joseph M. Montoya Papers, Center for Southwest Research, University Libraries, University of New Mexico, Albuquerque, New Mexico; "Lung Cancer Hearings for Workers in Uranium Mines Are Scheduled," *Navajo Times*, November 1973; Joseph M. Montoya, Address to the Senate manuscript, n.d., folder 5, box 320, Joseph M. Montoya Papers, Center for Southwest Research, University Libraries, University of New Mexico, Albuquerque, New Mexico; United Steelworkers of America, "Federal Workmen's Compensation for Respiratory Diseases," 27 April 1973, folder 5, box 320, Joseph M. Montoya Papers, Center for Southwest Research, University Libraries, University of New Mexico, Albuquerque, New Mexico; H.R. 11567, 93d Congress (1973), folder 5, box 320, Joseph M. Montoya Papers, Center for Southwest Research, University Libraries, University of New Mexico, Albuquerque, New Mexico; Red Rock Chapter to Joseph M. Montoya, 23 January 1974, folder 5, box 320, Joseph M. Montoya Papers, Center for Southwest Research, University Libraries, University of New Mexico, Albuquerque, New Mexico; "Resolution of the Navajo Tribal Council Strongly Recommending Support of Senate Bill S. 1029 Concerning Compensation for Uranium Miners," folder 5,

Although Montoya and Lujan's bills stalled in both chambers, the congressmen's actions drew the attention of the Bureau of Indian Affairs. In June 1974, the Bureau of Indian Affairs Commissioner Morris Thompson announced that his agency had begun investigating how it could provide "possible assistance," including income subsidies, for the uranium widows and their families. At the same time, Thompson denied that the bureau was culpable for safety conditions in the then-defunct reservation mines. He argued that the Mine Safety Enforcement Administration and the Bureau of Mines were charged with monitoring mine safety, not the Bureau of Indian Affairs. Nevertheless, Thompson ordered a check of the leases granted to Kerr-McGee Corporation, which operated the balance of the mines in Navajo Country during the 1950s and the 1960s. Thompson maintained that the "only real remedy" that the bureau could provide for the afflicted families would be through the Indian Social Services Budget. Such help, he went on, could include counseling services, financial assistance, job placement, and income subsidies. However, he added that direct financial subsidies would only be provided "to those families which are truly destitute." "Just because a woman's husband died of lung cancer, that doesn't mean she's destitute," he said. Thompson indicated that the bureau would "probably" interview and meet with the afflicted families "in the near future" to determine their needs.[366] This combination of cautious behavior, non-committal commentary, and gestures of austere aid, made it clear that the Bureau of Indian Affairs was attempting to distance itself from the issue and, at the same time, placate the bereaved families by doing little, if anything.

While the federal government appeared to be failing the Navajo Nation, Tome did not give up. He traveled to Washington D.C. and met with Congressman Harold Runnels, a man who

box 320, Joseph M. Montoya Papers, Center for Southwest Research, University Libraries, University of New Mexico, Albuquerque, New Mexico.

[366] Eichstaedt, *If You Poison Us*, 99; Gene Goldenberg, "BIA Uranium Probe Begins, Navajo Subsidies Sought," *Albuquerque Tribune*, 14 June 1974.

represented the Gallup area and most of southern New Mexico. After meeting with Tome, Runnels introduced H.R. 8107 in early 1974. The bill contained the same requests for compensation as Lujan and Montoya's earlier bills. This bill stalled, too. Concerned about uranium families, and struck by Tome's persistence, Runnels held a public hearing in Gallup on May 24, 1975. After listening to local residents shared their stories and health concerns, Runnels promised that he would reintroduce H.R. 8107. The bill stalled again. Still, Tome refused to give up. In 1976, he persuaded the Red Valley Chapter to pass a resolution asking that all congressional representatives in New Mexico and Arizona introduce bills similar to H.R. 8107. Furthermore, the chapter asked the director of the Navajo Area Indian Health Service to establish a special clinic to screen for lung carcinomas and to interview and examine all those who may have been exposed to unsafe radiation levels while working in the mines. Nothing happened. In 1977, Tome once again wrote to congressional representatives, asking them to do something. Finally, Runnels suggested that Tome contact Stewart L. Udall.[367]

Udall was a powerful westerner, to say the least. Born in 1920 in Saint Johns, Arizona, near the Navajo Reservation, Udall enrolled in the University of Arizona as a young man. After serving in the Army Air Corps in World War II, Udall returned to the university in 1946, obtained his law degree in 1948, opened a private practice in Tucson, and found himself representing Arizona in the U.S. House of Representatives in 1954. In 1961, President John F. Kennedy appointed Udall secretary of the interior. Under his leadership, the Department of the Interior added four national parks, six national monuments, nine national recreation sites, and

[367] Eichstaedt, *If You Poison Us*, 99-101; Red Rock Chapter of the Navajo Tribe, "Requesting the United States Congress, the Navajo Tribal Council and Indian Health Service to Take Appropriate Action to Assist Former Navajo Uranium Miners and Their Families," Resolution RRC-48-76, photocopy in author's possession; Scott Raymond Einberger, *With Distance in His Eyes: The Environmental Life and Legacy of Stewart Udall* (Reno & Las Vegas: University of Nevada Press, 2018), 245.

fifty-six national wildlife refuges. As secretary, Udall took a robust stance on environmentalism, too. He played a key role in enacting various environmental laws, including the Wilderness Act of 1964, the Endangered Species Preservation Act of 1966, and the Land and Water Conservation Fund Act of 1965. After serving presidents Kennedy and Johnson, Udall returned to private life and joined the Washington D.C. law firm Duncan, Weinberg, Miller & Pembroke.[368]

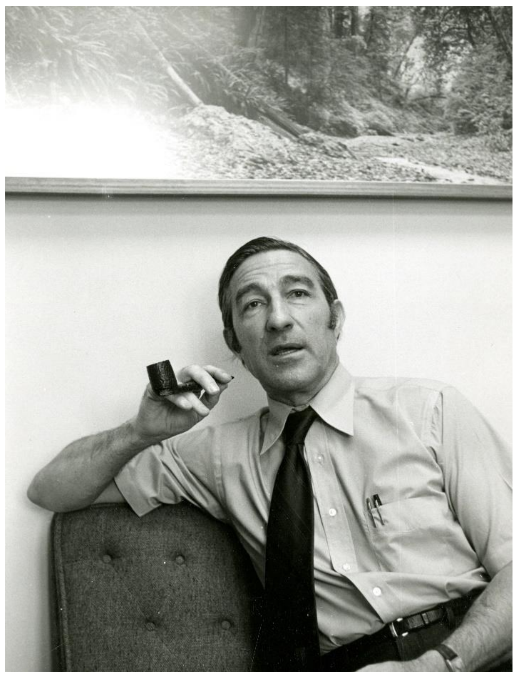

Figure 13: Stewart Udall. 1972. Image AZ 372, folder 7, box 245, Stewart L. Udall Papers, University of Arizona Special Collections, Tucson, Arizona.

Thinking that Udall might be able to help the uranium families, in 1978 Tome traveled to Washington D.C. to meet with Udall in his law office. At the time, Udall was thinking about returning to his native Southwest and was already working on a lawsuit involving the Nevada Test Site, a landscape where the federal government proved nuclear weapon designs by testing

[368] For more on Udall's personal history, see Einberger, *With Distance in His Eyes*; Thomas G. Smith, *Stewart L. Udall: Steward of the Land* (Albuquerque: University of New Mexico Press, 2017).

them in the open air. Udall worked for the families that lived downwind from the test site and complained of numerous illnesses and cancers which, they believed, were caused by the nuclear detonations. After speaking with Tome, Udall realized that the plight of the uranium miners was a case worth pursuing. The case addressed similar issues as the "downwinder" lawsuit and would give him good reason to relocate back to the Southwest. It looked like Tome and the uranium families had found a new, powerful ally.[369]

After meeting with Tome, Udall partnered with the Phoenix attorney Bill Mahoney to gather information and prepare a civil lawsuit on behalf of the mining families. The two contacted the Navajo General Counsel George Vlassis to confirm that Udall's planned lawsuit would not conflict with anything Vlassis or the tribe might have underway. After getting the go-ahead from Vlassis, Udall reached out to the uranium families and gathered information on their hardships. In January 1979, Udall and Mahoney drove to Red Rock to interview the widows of the Navajo uranium miners. With the help of Tome and other interpreters, Udall and Mahoney learned how lung cancer "settled like a plague over the families who lived in the vicinity of Cover and Red Rock and Lukachukai." The widows told the men that many of their husbands had worked for mines owned by Kerr-McGee and Vanadium Corporation. Additionally, they noted that very few of their husbands were smokers and that the lack of industrialization in Navajo Country indicated that the air they breathed outside of the mines was "some of the cleanest air in the United States." Most widows said that their husbands died in their thirties or forties, leaving their families with seven or eight children. None of the widows had received workmen's compensation benefits for the deaths of their husbands. The conversations between the widows, the interpreters, and the attorneys was difficult. The Navajo language had no words

[369] Eichstaedt, *If You Poison Us*, 102; Einberger, *With Distance in His Eyes*, 245.

to explain workers' compensation, lung cancer, radiation, or uranium. Gradually, the attorneys and the interpreters pieced together an "interesting pattern" of uranium mining, lung cancer, and death.[370]

After meeting with the widows, Udall wondered if non-Native miners also suffered from illnesses related to uranium mining. He had heard that there was a group of women in Marysvale, Utah, whose husbands had developed lung cancer after working in the nearby uranium mines owned by Vanadium Corporation. In the spring of 1979, Udall traveled to Marysvale to interview a handful of these widows. The women maintained that their husbands had developed lung cancer as a result of working in poorly ventilated uranium mines. After speaking with Udall, the widows took him to a local cemetery they had nicknamed "Cancer Hill." There, the women pointed to thirty-one graves that contained the remains of Marysvale uranium miners. Indeed, the uranium industry's human health horrors were not limited to the Navajo Reservation.[371]

While Udall gathered evidence for the lawsuit, his brother, the Arizona Congressman Morris "Mo" Udall, introduced legislation that addressed the environmental legacy of uranium mining and milling. On July 28, 1978, Mo Udall introduced the Uranium Mill Tailing Radiation Control Act, H.R. 13650, in the House of Representatives. The act promised to amend the Atomic Energy Act of 1954 and authorize the Environmental Protection Agency (EPA) to establish health and environmental standards for the stabilization, restoration, and disposal of uranium mill waste. Additionally, the act tasked the Department of Energy (DOE), the successor to the Atomic Energy Commission (AEC), to stabilize, dispose of, and control uranium mill

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[370] Eichstaedt, *If You Poison Us*, 103; Einberger, *With Distance in His Eyes*, 245-6; Stewart L. Udall, *The Myths of August: A Personal Exploration of Our Tragic Cold War Affair with the Atom* (New York: Pantheon Books, 1994), 183-4.
[371] Udall, *Myths of August*, 186-7.

tailings and other contaminated materials at uranium mills across the American West. Although Congress had so far failed the uranium miners and their families, remarkably, it recognized the environmental merits of Udall's legislation and passed the act in October 1978. President Jimmy Carter signed the act into law in November.[372]

Although the Uranium Mill Tailings Radiation Control Act seemed promising, it contained numerous problems. One problem was that it perpetuated the "Agreement State" program. Established in 1959, this program allowed the AEC to give regulatory authority of certain nuclear materials to states. However, the program did not make clear how much regulatory power the states held when it came to tending to nuclear materials. Consequently, the states took little action. Further complicating the issue was the fact that the Uranium Mill Tailings Radiation Control Act did not cover sites that were owned by the federal government, the Nuclear Regulatory Commission, or the Agreement States. This meant that the responsibility for remediating those sites fell to the government agencies or the states which owned them. In the end, those agencies responsible for implementing the act spent a considerable effort in determining just what exactly their statutory mandate was, instead of cleaning up the landscape.[373]

Although the Uranium Mill Tailings Radiation Control Act was imperfect, it did prompt an effort to clean up the mill tailings that had plagued Grand Junction, Colorado. For twenty years, Climax Uranium Company operated a uranium mill on a site adjacent to the Colorado River near downtown Grand Junction. From 1952 to 1964, the uranium oxide produced by the mill was used by the AEC for the nation's nuclear weapons program. As Climax milled uranium,

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[372] Elisa J. Grammer, "The Uranium Mill Tailings Radiation Control Act of 1978 and NRC's Agreement State Program," *Natural Resources Lawyer* 13, no. 3 (1981): 478, 480.
[373] Ibid., 478, 480-1.

it removed uranium oxide from the raw ore. In most cases, uranium oxide represented less than one percent of the ore processed. The remaining tailings contained uranium, radon, and more than eighty-five percent of the raw ore's radioactivity. Having no fiscal use for the tailings, the Big Uranium firm donated approximately 300,000 tons of radioactive uranium tailings to the city of Grand Junction for use as construction materials in sewer and road construction. The city also used the tailings to break up shale in farmlands and as foundation materials for office buildings, homes, and businesses. But Climax did not donate all its tailings to the city. It left approximately two million tons of tailings near the mill in large, unguarded, open-air piles. Consequently, from 1951 through 1966, local residents and contractors used the tailings as free building materials in homes, schools, and businesses. By the 1970s, local experts estimated that construction workers had used approximately 50,000 tons of the tailings to build homes and that over 3,800 buildings in Grand Junction and Mesa County were contaminated by the tailings. Meanwhile, local physicians noted an increased number of birth defects and congenital abnormalities in Grand Junction patients, although they stopped short of claiming that these ailments were caused by uranium pollution.[374]

The Uranium Mill Tailing Radiation Control Act prompted the DOE to tend to Grand Junction's tailings problem. To do so, the DOE created the Uranium Mill Tailings Remedial Action Project. Under this program, the DOE partnered with the Colorado Department of Health. The Department surveyed nearly 29,000 sites in Grand Junction and Mesa County for tailings. It identified over 6,100 locations with tailings on their property, 3,800 of which had tailings in their structures. After identifying the sites, clean-up began. The federal government provided 75% of

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[374] Two Rivers Citizen Association, "Grand Junction's Nuclear Legacy," folder 9, box 3, Two Rivers Citizen Association Collection, University of Colorado Boulder Libraries, Special Collections and Archives, Boulder, Colorado.

the remediation funding. Colorado footed the rest of the bill. The average cost for the clean-up ran $16,000 for residences and over $75,000 for schools and commercial structures. Seeking justice for the taxpayers, the State of Colorado attempted to force Climax to pay for the stabilization of the pile and cough-up cash for willful radiation control violations. Although its license required it to post a surety bond, Climax failed to do so and filed for bankruptcy, leaving the taxpayers and the Colorado Department of Health responsible for the radioactive waste site. Big Uranium had gotten away with polluting Grand Junction.[375]

Although the Uranium Mill Tailings Remediation Act seemed to lead to a promising future in Grand Junction, Native Country continued to suffer from lung cancer and other burdens associated with uranium mining. As Stewart Udall gathered information for the lawsuit, thousands of Native Americans organized against the uranium industry. Most of these groups weaved anti-uranium advocacy into larger programs of decolonization, Native sovereignty, and women's health. For example, in late 1977, a group of Navajo women began meeting in Shiprock, New Mexico, to discuss domestic violence on the Navajo Reservation. In 1977, domestic violence had grown in frequency and intensity across the reservation, sending at least one raped or battered woman to the Shiprock Indian Hospital emergency room every night. Responding to this crisis, Navajo women created *Asdzani Doo Alchini Dabaghan* (Women and Children's House) Association, a women and children's advocacy group. While discussing domestic violence in the reservation, *Asdzani Doo Alchini Dabaghan* began regarding the

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[375] Two Rivers Citizen Association, "Grand Junction's Nuclear Legacy," folder 9, box 3, Two Rivers Citizen Association Collection, University of Colorado Boulder Libraries, Special Collections and Archives, Boulder, Colorado; Joseph Pierce to Al Hazle, 12 November 1980, folder 4, box 4, Two Rivers Citizen Association Collection, University of Colorado Boulder Libraries, Special Collections and Archives, Boulder, Colorado; Albert J. Hazle to Joseph Pierce, 17 December 1980, folder 4, box 4, Two Rivers Citizen Association Collection, University of Colorado Boulder Libraries, Special Collections and Archives, Boulder, Colorado.

problem as a result of colonialism. The women maintained that aspects of colonialism worked in synergy to produce domestic abuse. They argued that the white-owned businesses that sold liquor, clothing, and groceries at exorbitant prices, combined with televisions that transmitted "American propaganda" to stress Navajo men and lead them to violence. While attempting to uncover the various aspects of colonialism that contributed to domestic violence, the women turned to uranium mining. They argued that the uranium industry subjected Navajo men to white supervisors, substandard conditions, and pollution. These conditions wore away at their spirits, minds, and bodies, leading to what one Shiprock woman called "pressure cooker syndrome." *Asdzani Doo Alchini Dabaghan* believed that this syndrome manifested itself via rape, battery, and child abuse. To rectify this deleterious situation, *Asdzani Doo Alchini Dabaghan* spoke out against the uranium industry, planned workshops on battered women and children, and attempted to establish a shelter for victims of domestic violence. Those seeking justice for uranium country had found new allies in these women and children advocates.[376]

As *Asdzani Doo Alchini Dabaghan* worked to better life on Navajo land, other Native American women organized to better the lives of Native Americans across multiple reservations. In the mid-1970s, Lorelei DeCora Means, a Minneconjou Lakota, Madonna Thunderhawk and Phyllis Young, two Hunkpapa Lakotas, and Janet McCloud, a member of the Tulalip Tribes, joined with other Native American women to form Women of All Red Nations (WARN). Conceptualized as a response to the arrests of Native American men after the 1973 Wounded Knee occupation, WARN held its first meeting in September 1978 in the Black Hills of South Dakota. Over 200 Native women activists, representing thirty different nations, attended the

[376] "Navajo Battered Women," *Off Our Backs*, August-September 1978, 5.

gathering.[377] Some of the women had participated in the American Indian Movement and the Wounded Knee incident. Others had participated in the Longest Walk or had traveled to Geneva for the NGO Conference of Discrimination Against Indigenous Populations. By gathering a diverse indigenous body together, the organizers of WARN hoped to spur real change across Native America.[378]

In the beginning, WARN styled itself as an organization focused on decolonization and the end of the continual destruction of Native lives and land. "We are *American Indian* Women, in that order," WARN's manifesto read. "We are oppressed, first and foremost, as American Indians, as peoples colonized by the United States of America, *not* as women…..Decolonization is the agenda, the whole agenda, and until it is accomplished it is the *only* agenda that counts for American Indians."[379] With its eyes set on decolonization, WARN recognized that colonialism created distinctive gendered experiences among Native men and women. As a result, during its inaugural meeting, WARN morphed its objective to center around Native women's health issues. The group maintained that Native American women and children faced distinctive health burdens as a result of colonialism.[380] In Native Country, Native women and children disproportionally suffered from poor nutrition, inadequate healthcare, and involuntary sterilization programs. They also navigated higher levels of domestic violence resulting from

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[377] Lorelei DeCora Means, "Let this be a WARNing," *Off Our Backs*, December 1978, 9; Lorelei DeCora Means, "Women of All Red Nations," in *Red Power: The American Indians' Fight for Freedom*, ed. Alvin M. Josephy Jr., Joane Nagel, and Troy Johnson (Lincoln: University of Nebraska Press, 1999), 51. Sources differ on the precise date that Native women officially organized WARN. Some sources state that WARN began in 1974. Others maintain that WARN was officially organized during its first conference in 1978.

[378] Lorelei Means and Janet McCloud, "Who We Are," in *National Indian Civil Rights Issues Hearing Held in Washington, D.C., March 19-20, 1979, Volume II: Exhibits*, ed. United States Commission on Civil Rights (Washington, D.C.: U.S. Government Printing Office, 1979), 14; Means, "Women of All Red Nations," 51.

[379] Means, "Women of All Red Nations," 52. Emphasis in the original.

[380] Estes, *Our History is the Future*, 170, 181.

poverty, joblessness, substance abuse, and hopelessness. WARN also linked environmental issues to women's reproductive health.[381] While discussing how environmental contamination posed reproductive hazards to Native women, WARN set its sights on uranium mining and milling in and near Native American reservations across the United States. The members believed that the uranium industry—an aspect of a colonial economy and colonial militarism—was "destroying our future, for our grandchildren and for the unborn," by irradiating Native reproductive systems and generating birth defects. WARN, a coalition of diverse Indigenous women, had joined the fight for justice in uranium country.[382]

With a new emphasis on women's health, several members of WARN traveled to Des Moines, Iowa, for the Women and Global Corporations conference. The women hoped to forge connections with women of other identity groups in order to further their goals of decolonization and safeguarding Indigenous reproductive health. Shortly after arriving at the conference, however, the women of WARN realized that their decolonization goal was at odds with the objectives held by the white attendees. "It was obvious to us the major difference between Native American Women and the daughters of immigrants," wrote Means and McCloud. "We remember our sacred duty to Mother Earth, our relationship to Grandma Moon, and our unborn generations, while they [white Americans] talk in Band-aid terminology— 'How can we get OSHA to use non-carcinogenic chemicals in our production plants?' 'How can we get cheap energy to the poor people,' 'How can we increase our wages and improve our working conditions?'" Means and McCloud were struck by the comments of the white attendees. They and the other members of WARN argued that the comments offered by the white participants did

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381 Means, "Women of All Red Nations," 51-2; Gilio-Whitaker, *As Long as Grass Grows*, 117-8.
382 Voyles, *Wastelanding*, 141; quoting Pat Bellanger, "On the Edge of Extinction," *Off Our Backs*, May 1979, 8.

not address the underlying structural issue, or as she put it, the “real problem,” that led to the pollution of Native bodies. WARN maintained that their members’ eyes saw “further ahead than next week’s paycheck” and that human beings needed to end their exploitation of “Mother Earth for the sake of better wages.” In other words, WARN argued that American capitalism was to blame for the environmental conditions on Native lands and struggled finding white allies that were willing to advocate for systemic change. Although WARN did not find white allies at the Des Moines conference, it did make important connections with other minority attendees, including Puerto Ricans, African Americans, Hawaiians, and Filipinos. WARN regarded these women as kindred spirits. Like Native women, these identity groups also navigated the burdens of colonialism, critiqued capitalism, and sought to better their health by adopting decolonization discourses and politics.[383]

Primarily, WARN combated colonization and attempted to improve the health of Native women by spreading information. WARN recognized that “truth and communication were among our most valuable tools in the liberation of our lands, people, and four-legged and winged relations.” The members of WARN framed the communication of truth as a “a basic survival tactic.” This meant that WARN members believed their success was based on “getting accurate information on specific concerns to a broad base of support.”[384] The fight for decolonization and the safety of women’s health, then, was a battle that WARN would wage by spreading information on the hazards of colonial industries and other colonial systems.

The information war started at home. WARN emphasized that the best way to spread information was to pass it on to family members. To this end, WARN encouraged its members to

[383] Means and McCloud, “Who We Are.”
[384] Ibid.

incorporate political discussions into home life. Members argued that women wasted time gossiping with each other at home and could better utilize that time by discussing local Indian issues or international issues similar to those of Indian people. WARN believed that over time this tactic would recruit new members to their cause and ultimately put pressure on colonial structures of oppression, including the uranium industry. Additionally, WARN encouraged mothers to teach their children about local issues, including poverty, domestic abuse, and environmental contamination. By doing so, WARN hoped to raise a new generation of activists that would carry on their cause as adults.[385]

WARN also drew public attention to scientific studies on the dangers of uranium and radiation on the Pine Ridge Oglala Lakota Reservation in South Dakota. Using *Akwesasne Notes*, one of the largest Native newspapers in the world, as a platform, WARN shared details on J. Haworth Jonte's study of Pine Ridge's water supply. Jonte, a biochemist and the head of the Chemistry Department at the South Dakota School of Mines, had examined Pine Ridge's water for radiation in the 1970s. While studying the water, Jonte discovered that it contained dangerous amounts of radioactivity. According to the U.S. Public Health Service, five picocuries of radiation per liter of water was dangerous for human use. Jonte's study found nineteen picocuries of radiation per liter in the surface water flowing into the reservation from the subsidiaries of the White River and fifteen picocuries per liter in the groundwater from the Lakota Aquifer under Red Shirt Table, a reservation community. Jonte's study connected this radioactivity to the Susquehanna-Western uranium mill in Edgemont, located approximately thirty miles west of the reservation. On June 11, 1962, an accident at the mill sent 200 tons of radioactive tailings into Cottonwood Creek. The balance of the radioactive material washed 25 miles downstream until it

[385] Ibid.

sank into the Angostura Reservoir. From there, the Cheyenne River—which flowed through Angostura Reservoir—carried radioactive material into the Red Shirt Table surface water. No cleanup was ever conducted.[386]

In 1980, WARN conducted and published its own study on the effects of radiation contamination in water from uranium mining on human reproductive health. The study, "Radiation: Dangerous to Pine Ridge Women," appeared in *Akwesasne Notes*. The article revealed that in one month alone in 1979, 38% of the pregnancies reported to the Pine Ridge Public Health Service hospital ended in miscarriages. Sixty to seventy percent of the children that were born suffered from underdeveloped lungs or jaundice. The study also noted that numerous children were born with clef palate and club foot—conditions that were uncommon to the Lakota people. Although the study could not conclude what caused these ailments, WARN pointed to "local and national studies" that linked these abnormal rates of disease and death "to increased contamination of air and water by chemical toxics and nuclear development in the same geographic area." WARN named the uranium mining and milling in the nearby Black Hills as the source of these mutations and ailments. By the 1970s, Edgemont—the uranium hub of the Black Hills—contained over thirty abandoned uranium tailing piles. According to the WARN study, as high winds and rains swept across the plains, they pushed radioactive dust off the piles and carried them across the landscape. Consequently, the region's crops and water sources gathered uranium, radon, and radon daughters. From there, radioactive elements accumulated in Lakota bodies, subjecting them to illness, mutation, and death.[387]

[386] "Radiation: 'Dangerous to Pine Ridge Women,' W.A.R.N. Study Says," *Akwesasne Notes,* Early Spring 1980, 22-3.
[387] Ibid.

As WARN spread information on the hazards associated with the uranium industry, the national magazine *The Progressive* partnered with Tom Barry, a reporter for the *Navajo Times* in Window Rock, to publish perhaps the most notorious exposé on the uranium problem in the Southwest. In February 1979, *The Progressive* published "Bury My Lungs at Red Rock," an article bearing a title which compared the deaths of Navajo miners to the infamous Wounded Knee Massacre of 1890. Throughout the article, Barry chronicled the deaths and devastation caused by uranium mining in Navajo Country.[388]

Along with interviewing Navajo widows, Barry took care to probe how uranium mining affected other Native American nations in the Southwest, namely the Laguna Pueblo. In the early 1950s, Anaconda established the Jackpile Mine in Laguna Pueblo. It was the largest open-pit mine in the United States. While investigating the mine, Barry met with Ben Lorenzo, a former governor of the Laguna Pueblo. Lorenzo told Barry that each time workers detonated a charge at the mine, "sometimes two or three times a day, the dust goes all over the village." Then Lorenzo turned irate. "We have lived here for many years, and a lot has changed. I used to be able to breathe here, but I now can breathe better when I'm somewhere else. My son works in the mines and he doesn't look so good. And there is no doctor to check up on the miners." While Lorenzo's commentary suggested that the mine had poisoned Laguna bodies, other members of the nation criticized the mine for undermining native sovereignty. Lucy Lorenzo complained that Anaconda brought in "outsiders—non-Indians—into the mines as bosses even though our men have worked in the mines longer." "More and more non-Indians are around the Pueblo, and now I think the

[388] Tom Barry, "Bury My Lung at Red Rock: Uranium Mining Brings a New Peril," *The Progressive*, February 1979, 25-8. In 1970, Dee Brown published the *Bury My Heart at Wounded Knee: An Indian History of the American West*. The book detailed the history of Native American displacement and death at the hands of the United States federal government in the late 1800s. It became well-known for its depiction of the 1890 Wounded Knee Massacre. See Dee Brown, *Bury My Heart at Wounded Knee: An Indian History of the American West* (New York: Holt, Rinehart & Winston, 1970).

uranium companies and the outsiders are ruling this place," she said.[389] By highlighting how uranium mining harmed both Laguna and Navajo bodies and undermined the Laguna's sense of sovereignty, Barry helped position the uranium industry as a force that stressed multiple Native nations in the Southwest. In other words, Barry's work helped American readers understand that the uranium industry was not a problem distinctive to the Navajo people. The industry had created environmental and political hardships for Native America writ large. Taken together, Barry's publication, WARN's initiatives, the Udall brothers' efforts, Lujan and Montoya's failed bills, and the Tome's persistence illustrates how the struggle for justice in uranium country was a diverse effort not exclusive to the Navajo Reservation and the Navajo experience.

While "Bury My Lungs at Red Rock," drew public attention to the hazards of the uranium industry in the Southwest, New Mexico and Arizona suffered through the largest release of radioactive material in American history. On July 16, 1979, around 6:00AM, a worker at the United Nuclear Corporation's Church Rock Mill in northwest New Mexico noticed a breach in its 18-acre earthen pond dam. Constructed in 1977, the dam stored radioactive mill waste. The breach was approximately six meters wide. Reacting quickly, United Nuclear Corporation (UNC) shut down the mill and constructed a temporary dike in front of the breach to stop the flow of waste products. Workers had finished positioning the dike in front of the breach by 8:00AM. The company contacted the New Mexico Environmental Improvement Division, the Nuclear Regulatory Commission, and the Mine Safety and Health Administration. UNC also reached out to the local community, informing city officials in nearby Gallup and local radio stations about the disaster. Recognizing that the release threatened the health and safety of

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[389] Barry, "Bury My Lung at Red Rock."

Navajos living nearby, UNC dispatched Navajo employees to personally notify Navajo-speaking residents about the incident.[390]

Figure 14: The breach at the Church Rock Uranium Dam. n.d. Photograph courtesy of the U.S. Environmental Protection Agency.

But the damage had already been done. In just a few short hours, the breach sent approximately 1,100 tons of radioactive waste and 95 million gallons of hazardous mine process effluent across the landscape. As it flowed across the earth, the waste entered Pipeline Arroyo and the Northern Fork of the Rio Puerco.[391] The flowing waste traveled across state lines, backed

[390] U.S. Congress, House Committee on Interior and Insular Affairs, Subcommittee on Energy and the Environment. *Mill Tailings Dam Break at Church Rock, New Mexico: Oversight Hearing before the Subcommittee on Energy and the Environment of the Committee on Interior and Insular Affairs*, 96th Cong, 1st sess., 1979, 19-24; Doug Brugge, Jamie L. deLemos, and Cat Bui, "The Sequoyah Fuels Release and the Church Rock Spill: Unpublicized Nuclear Releases in American Indian Communities," *American Journal of Public Health* 97, no. 9 (September 2007): 1595-8.

[391] A.J. Ruttenber, Jr., K. Kreiss, R.L. Douglas, T.E. Buhl, and J. Millard, "The Assessment of Human Exposure to Radionuclides from a Uranium Mill Tailings Release and Mine Dewatering Effluent," *Health Physics* 47, no. 1 (July 1984): 21-35; Brugge, deLemos, and Bui, "The Sequoyah Fuels Release and the Church Rock Spill," 1598.

up local sewers, contaminated two aquifers, and sent hazardous materials as far as Navajo, Arizona, eighty miles downstream.[392]

From the onset, UNC, the State of New Mexico, and the State of Arizona attempted to guide residents to avoid contaminated materials but did little to remove the contaminants from the environment. UNC posted signs in New Mexico and Arizona warning residents to not use local water and provided bottled water to nearby communities. New Mexico and Arizona health officials took to local newspapers to tell residents to stay away from the Puerco. Yet, these advisories were often accompanied with remarks that downplayed the disaster. For example, James Scanlon, a water quality technician with the Arizona Department of Health Services, told readers of the *Navajo Times* to "stay away from the water" while noting that he did not think the situation was "serious" and that residents were not in any immediate "danger." Meanwhile, the New Mexico Environmental Improvement Division closed some of the contaminated wells and told Navajo ranchers to not slaughter and consume their livestock.[393]

The ensuing cleanup was cursory, at best. Recognizing that most local residents and animals relied on the Rio Puerco for survival, UNC used manual laborers to remove 3,500 tons of sediment from the river. However, this only removed approximately one percent of the spill materials. Subsequently, as humans and herds imbibed on the Puerco's water, their bodies accumulated radiation. Local veterinarians and the Centers for Disease Control and Prevention noted that the sheep and goats that had ingested water from the Puerco had elevated levels of radiation in their tissues. Worried that humans might have consumed radioactive materials, the

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[392] Brugge, deLemos, and Bui, "The Sequoyah Fuels Release and the Church Rock Spill," 1598.
[393] U.S. Congress, House of Representatives, Committee, *Mill Tailings Dam Break at Church Rock, New Mexico*, 19- 24; Dan Liefgreen, "Church Rock Uranium Pond Spills: Residents Near Rio Puerco Warned Not to Use Contaminated Water," *Navajo Times*, 19 July 1979; Brugge, deLemos, and Bui, "The Sequoyah Fuels Release and the Church Rock Spill," 1598.

Centers for Disease Control selected five Navajo children and one Navajo adult for examination. One of the children had dropped a toy truck in the Puerco after the spill and waded in after it. The adult, a middle-aged man, had splashed in the Puerco to keep his herd of sheep from drinking the water. The tests indicated that there were "no acute effects in these individuals." All the while, local newspapers maintained that the spill engendered no severe health effects in the community.[394]

The Navajo Nation was incensed. Just as Native Americans were bringing the hazards of mining uranium into the public eye, Navajo Country became ground-zero for the largest uranium-waste spill in human history. The Navajo Tribal Council was further agitated by the lackadaisical cleanup effort. Seeking justice, in August 1979, the chairman of the Navajo Tribal Council's Emergency Services Coordinating Committee asked New Mexico Governor Bruce King to declare a state of emergency and mark McKinley County as a disaster area. The General Counsel of the Navajo Tribe George Vlassis argued that King should treat the situation as an emergency to allow federal and state aid to Navajo families who were told to not slaughter their livestock for food. King denied the request. On September 4, King clarified he saw "no reason to issue a disaster declaration for the area" because "the danger to area residents was not immediately identifiable."[395] It looked like UNC, the press, and the State of New Mexico had turned their backs on those downstream from Church Rock.

Local Navajos refused to sit idly by while the spill devastated their nation. In September, Navajo Tribal Chairman Peter MacDonald petitioned the federal government to investigate the

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[394] U.S. Congress, House of Representatives, Committee, *Mill Tailings Dam Break at Church Rock, New Mexico*, 19-24; "United Nuclear Defends N-Spill Cleanup Effort," *Santa Fe New Mexican*, 22 September 1979; "LASL N-Contamination Test Results Expected Next Week," *Santa Fe New Mexican*, 24 August 1979; Brugge, deLemos, and Bui, "The Sequoyah Fuels Release and the Church Rock Spill," 1598.
[395] "Governor Says 'No' to Disaster Status," *Alamogordo Daily News*, 5 September 1979.

Church Rock spill. In response, Mo Udall announced that he would chair a one-day hearing on the incident to uncover why the dam failed, who was to blame, and to "consider the effects of the spill on Navajo area residents."[396]

The Church Rock hearing took place on October 22, 1979, in Washington D.C. Udall, the chair of the Committee on Interior and Insular Affair's Subcommittee on Energy and the Environment, presided over the affair. Udall started the hearing by outlining why the dam collapsed and who was to blame. He chastised all levels of government charged with overseeing the mill and its tailings reservoir, arguing that "at least three and possibly more Federal and State regulatory agencies had ample opportunity to conclude that such an accident was likely to occur." "Before the dam was licensed," he explained, "the company's own consultant predicted that the soil under this dam was susceptible to extreme settling which was likely to cause the cracking and subsequent failure of the structure. This information was incorporated in the company's license application materials, which were reviewed by the State of New Mexico's dam safety engineer, by the State environmental improvement division and by the U.S. Nuclear Regulatory Commission….Yet there is indication that none of the regulatory authorities required detailed independent assessments of the company's construction practices." According to Udall, UNC knew that the landscape would likely cause the dam the fail and that every regulatory agency involved failed to do their due diligence to ensure the structure was sound. After making these points, Udall revealed that the cracks which led to the failure of the dam "began to appear in December 1977," the year UNC contractors constructed the earthen reservoir. It appeared that both the state and UNC were to blame.[397]

[396] "Udall to Hold Spill Hearing," *Navajo Times*, 18 October 1979; "Udall to Hold Spill Hearings," *Navajo Times*, 27 September 1979.
[397] U.S. Congress, House of Representatives, Committee, *Mill Tailings Dam Break at Church Rock, New Mexico*, 2.

Udall brought in experts to assess the engineering and licensing materials of the failed structure. The hearing's star expert was Dr. Bruce Tschantz, a dam safety specialist and a professor of civil engineering at the University of Tennessee. Tschantz pointed out that the building materials used in the dam raised serious question regarding why the specific dam design was approved, as well as whether the dam was constructed as originally planned. Tschantz also indicated that "the quality assurance procedures available to prevent the Church Rock accident were probably not applied." The Army Corps of Engineers also assessed the structure. Its report echoed Tschantz's conclusions and made three key points. First, the design of dam included a "zone of tailings" laid against the upstream face of the dam. These tailings were to help buttress the structure in light on structural settlement. However, the constructed dam did not feature this design feature. Second, UNC knew that the dam had cracked in 1977, and again in 1978, but failed to report these structural problems to state regulatory agencies. Third, the design of the dam did not incorporate "all the necessary protective measures recommended by the company's engineering consultant." Had the dam been constructed according to its approved design, the Army Corps of Engineers surmised, "it is possible that the failure would not have occurred."[398]

After reviewing these points, Udall called on the Vice Chairman of the Navajo Tribal Council Frank E. Paul to offer a statement. Paul outlined a list of demands "to deal with this incident and the uranium industry in general." Paul called for an environmental restoration of Navajo Country. "We want the lands and water and people and livestock who have been contaminated by the UNC spill decontaminated," he began. "We want our land, our people, our livestock, and our way of life restored as nearly as possible as it was before UNC and Kerr-McGee and their friends came to our land." After articulating this large-scale project, Paul turned

[398] Ibid., 2-3.

to more attainable, but nevertheless difficult, desires. He asked for Congress to ensure that the Church Rock mill remained closed "until such time as a safe and sane method of dealing with uranium tailings is devised, tested, and implemented." He asked that Congress allow "no more mills to be constructed on or near the Navajo Nation unless such mills are completely safe and have completely safe waste disposal systems." He asked for the creation of a single agency to "have responsibility" over all aspects of the radiation hazards associated with the nuclear industry. He also asked for "sufficient resources" to be readily available in the event of a similar emergency "so that our people, our land, our livestock and our livelihood will not once again be abused as it has been so often in the past."[399]

After articulating his people's demands, Paul connected the Church Rock spill to the long legacy of uranium mining in Navajo Country. He noted that in the 1940s, "Navajos railed in yet another way to aid America's defense effort" by working in nearly 160 uranium mines and their nearby mills. Although Navajos labored on behalf of national security, Paul pointed out that the federal government failed to do right by these patriots by never advising them of the potential dangers associated with mining and milling uranium. "As a result," he continued, "hundreds if not thousands of Navajo uranium miners are contaminated from the dust and air in the mines." By recounting this story, Paul maintained that it was inappropriate for the federal government to treat the spill as an isolated episode. Rather, the spill was one manifestation of the general disregard that the uranium industry and its state regulators had for the health and safety of the Navajo people.[400]

[399] Ibid., 5-6.
[400] Ibid., 7.

Next, Paul focused on the Church Rock spill. Seconding Udall's commentary, Paul indicted a litany of state and federal government agencies. He noted that numerous federal and state agencies all had "some finger in the pie of regulation of the uranium industry," but had "shown themselves incompetent and unable to do the job of protecting the people from the industry." Despite the existence of several bloated regulatory bureaucracies, not one agency made a difference at Church Rock. "Somehow United Nuclear Corp. was permitted to locate a tailings pond and dam on an unstable geologic formation," Paul said. "Somehow UNC was allowed to design an unsafe tailings dam not in conformity to its own design criteria. Somehow UNC was permitted to inadequately deal with warning cracks that had appeared over 2 years prior to the date the dam failed…. Somehow UNC was permitted to deal with the spill by doing almost nothing."[401]

Near the end of the hearing, the Executive Vice President and Chief Operating Officer of United Nuclear Corporation, J. David Hann, issued a statement to the Subcommittee on Energy and the Environment. Hann pointed out the economic benefits that UNC provided to New Mexico. He noted that UNC employed more than 2,300 people in the state and featured an annual payroll of nearly $45 million. He also recorded that the company's total expenditures in the state were more than $140 million annually. From there, Hann noted that the Church Rock mine and mill employed more than 950 people, 200 of which were Navajos. Additionally, he said that the Church Rock operation, when at full production, "contributes more than one half million dollars per year in royalties to the Navajo tribe."[402]

[401] Ibid., 8.
[402] Ibid., 120.

After reminding the group how UNC and its mill economically benefitted both the state and the Navajo people, Hann moved on and attempted to absolve his company from fault. He started by discussing the structural integrity of the dam. Hann maintained that the impoundment "was designed and constructed by experienced engineering and construction firms with extensive use of independent experts." He further reminded the committee that the design conformed to NRC design guidelines.[403] Next, Hann noted that both private engineering firms and all state and federal agencies agreed that the breach was caused by differential settling of the dam. Workers had originally constructed the portion of the dam that eventually broke on a landscape consisting of both "shallow and deeper bedrock." Over time, these two formations settled at different rates, resulting in "transverse cracking" of the structure. Importantly, Hann noted that private engineers, UNC employees, and government regulators all only uncovered "this unusual configuration" during the investigation of the breach after the spill. In other words, no one knew that the Church Rock mill had been built on this distinctive geologic formation until it was too late.[404] Taken together, Hann's statement made clear that the spill was a freak accident caused by a freak landscape. While this argument is compelling, and seemingly factually sound, it did not appear to offer many avenues for compensation or justice for the residents downstream. Hann went on to declare that the spill "did not and does not represent a significant hazard to local residents or to downstream communities," and that UNC "acted with responsibility and dispatch" in cleaning up the spill and informing local residents.[405]

Hann concluded his remarks by announcing that the Church Rock mill would reopen shortly after the hearing. Two independent engineering firms, as well as state and federal

[403] Ibid., 122.
[404] Ibid., 124.
[405] Ibid., 127.

agencies, had determined that the mill's facilities were fit for operations days before the hearing commenced.[406] Indeed, it appeared that despite Udall's fervor and Paul's demands, there would be no justice for those downstream from Church Rock. The day after the hearing concluded, the New Mexico Environmental Improvement Division issued the final order allowing UNC to reopen the mill. Big Uranium had survived the Church Rock spill.[407]

While Mo Udall failed to rectify the Church Rock tragedy by way of his hearing, his brother, Stewart, moved forward with his lawsuits to compensate the uranium miner families. Four days after the breach at Church Rock Mill, Stewart Udall filed suit against the federal government on behalf of eighty-five Navajo plaintiffs. Udall and his legal partners, Mahoney and Albert Hale from the Navajo Nation, selected eleven claimants as representative of the group. The suit, *John M. Begay v. the United States of America*, sought compensation for the claimants under the 1946 Federal Tort Claims Act (FTCA). Congress passed the act in 1946 as Title IV of the Legislative Reorganization Act in an effort to negate the doctrine of sovereign immunity. Before the FTCA, private citizens could take no legal civil action against the United States government unless the government gave its permission to be sued. The FTCA cut against the doctrine of sovereign immunity by removing the government permission proviso. It permitted private citizens to seek monetary compensation for injuries or death resulting from government neglect.[408]

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[406] Ibid., 127.
[407] "Udall Holds Hearing, Church Rock Mill Can Reopen," *Navajo Times*, 25 October 1979; "State Approves Reopening of Church Rock Mill," *Santa Fe New Mexican*, 27 October 1979.
[408] Einberger, *With Distance in His Eyes*, 245-6; Eichstaedt, *If You Poison Us*, 109; "Cancer Suit by Uranium Miners Heard in Arizona," *New York Times*, 31 August 1983; Smith, *Stewart L. Udall*, 315-6; Kathleen Stanton, "Uranium Perils Ignored, Suit Claims," *Arizona Republic*, 3 August 1983; Howard Ball, *Justice Downwind: America's Atomic Testing Program in the 1950s* (New York: Oxford University Press, 1986), 133-5.

Recognizing that his case against the federal government would proceed slowly, on December 15, 1979, Udall filed another lawsuit on behalf on eighty-five Navajo miners, widows, and their descendants against seven uranium mining companies, including Kerr-McGee Corporation, Vanadium Corporation of America, and Climax Uranium Company. In the suit, Udall argued that the firms knew of the dangers in the mines but did nothing to warn or protect the miners. Udall called it a "breach of duty" on the part of the defendants and asked $30 million in damages. Specifically, he asked that each person listed in the complaint receive $500,000, that each widow receive an additional $500,000, and that each widower and child receive an additional $150,000.[409]

The justice system failed the Navajos. In the fall of 1980, the federal district court judge threw Udall's suits against the mining companies out, ruling that the mining families should seek workers' compensation through their individual states. While state workers' compensation laws might seem like a promising avenue for aid, the uranium families complained that the process of filing and waiting to receive workers' compensation benefits was too slow. People were dying. They needed aid as quickly as possible. Udall immediately filed with the federal appeals court in San Francisco. During the appeals trial, the mining companies successfully argued that the Navajo miners were covered by Arizona workmen's compensation laws and because of that could not file separate lawsuits for additional compensation. Udall argued that because the mines were on the Navajo Reservation, which was under the jurisdiction of the federal not the state government, the miners were not covered by Arizona laws. The judge agreed with the mining firms. Later, Udall recalled that the mining company lawyers had been able to get some Navajo workers who were part of the suit to admit that they might have seen a workmen's compensation

[409] Grant E. Smith, "Navajo Families Sue Uranium Firms for Work Hazards," *Arizona Republic*, 15 December 1979; Eichstaedt, *If You Poison Us*, 115.

notice posted somewhere on the mining company property. Udall said that the element of doubt introduced into the miners' minds was enough to prompt dismissal of the suit.[410]

Although Udall's Navajo lawsuit against the private firms failed, he nevertheless moved forward with a similar case. In 1982, Udall filed a $19 million lawsuit against Foote Mineral Company on behalf of the families of 26 deceased miners. These non-Native miners had worked in Vanadium Corporation of America's uranium mines near Marysvale between 1949 and 1968. In 1967, Vanadium Corporation merged with Foote Mineral, leaving Foote responsible for Vanadium Corporation's previous operations. Udall argued in *Barnson v. Foote Mineral Co.* that Vanadium Corporation understood the health risks associated with uranium and did not install adequate ventilation in the mines, nor inform the miners of the health risks. Furthermore, Udall noted that the Marysvale mine was particularly "poisonous" to workers because "the ores there were of very high grades." The Marysvale mine contained seven times the amount of triuranium octoxide found in typical uranium formations. As a result, the miners developed lung cancer, ostensibly due to radon and radon daughter exposure. To support his claim, Udall procured a series of documents from the 1950s. These papers documented that Vanadium Corporation knew of the dangers associated with radon gas and did little to improve ventilation in the mines.[411]

One document that Udall showcased in the Marysvale case was a letter from the U.S. Public Health Service Senior Sanitary Engineer Duncan A. Holaday to the Vice President of

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[410] Al Senia, "Navajo N-Miners, Kin File Contamination Suit," *Albuquerque Journal*, 15 December 1979; *Esther Lee Begay, et al. v. The Kerr-McGee Corporation*, No. 80-6059, Appellants' Opening Brief, (9th Cir. 1982), folder 9, box 244, Stewart L. Udall Papers, University of Arizona Special Collections, Tucson, Arizona; Eichstaedt, *If You Poison Us*, 118-9; "Court Dismisses Navajo Suit Claiming Radiation Ailments," *United Press International*, 12 June 1982.

[411] "Marysvale Miners File $19 Million Lawsuit," *Richfield Reaper*, 3 November 1982; *Barnson v. Foote Mineral Co.*, Nos. C-80-0119A, C-81-0719W, C-81-0045W & C-81-0715J (D. Utah 1985); Stewart Udall, "Memorandum of Telephone Conversation with Duncan Holaday," 4 March 1980, folder 5, box 244, Stewart L. Udall Papers, University of Arizona Special Collections, Tucson, Arizona; "Cancer-Stricken Miners Settle Suit Against Mine," *Yuma Daily Sun*, 7 February 1985.

Vanadium Corporation, D.C. Viles. In the letter, Holaday reported on air radon samples taken at the Marysvale Prospector No. 1 mine in July 1950. Holaday noted that these samples were obtained after the ventilation shafts had been drilled, but before a blower had been installed. According to the data gathered by Holaday, the longest drift on the 150-foot level of the mine showed "a concentration of radon of 26,900 micromicrocuries per liter." The other sample, taken at the foot of the entrance incline, "contained 14,000 micromicrocuries of radon per liter." Holaday noted that "the presently accepted maximum allowable concentration of radon for an 8-hour daily exposure for a working lifetime is ten micromicrocuries per liter." Holaday advised Viles that it was "absolutely essential that the ventilating fan be kept operating during the entire period that men are working in the mine" and said that the last time his investigators visited the mine "the main working drift did not appear to have much air moving in it." "We do not have sufficient data to be able to tell you how long individuals could work in concentrations such as were found in Prospector No. 1 mine without becoming liable to the development of lung cancer," Holaday wrote. It was clear that Prospector No. 1 mine was not safe for workers.[412]

Udall also presented a second letter from Holaday to Viles. In this document, Holaday reported on air radon samples taken at the Marysvale Prospector No. 1 mine after the force ventilation fan had been installed. The samples showed that the radon concentrations in the mine air "had been reduced by a factor of about 500." The samplers documented radon readings of "about 500 micromicrocuries per liter." Although ventilation had reduced the atmospheric radon, as noted in his previous correspondence, 500 micromicrocuries per liter of radon exceeded the maximum allowable concentration for human exposure by a factor of fifty.[413]

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[412] Duncan A. Holiday to D.C. Viles, 20 October 1950, folder 1, box 244, Stewart L. Udall Papers, University of Arizona Special Collections, Tucson, Arizona.
[413] Duncan A. Holiday to D.C. Viles, 30 October 1950, folder 1, box 244, Stewart L. Udall Papers, University of Arizona Special Collections, Tucson, Arizona.

Holaday testified in the court proceedings, as well. He noted that in order to gain access to the mines, he made an oral agreement with Vanadium Corporation to not directly inform those most affected by their findings, the miners.[414] This practice was, as Holaday put it, "routine procedure that was followed in every industrial survey I was aware of…this went back for many decades." In order to enter the mines, Holaday agreed that his researchers would not "alarm the miners" by warning them of the hazardous conditions they worked in. "[T]here would be no overt publicity," Holaday continued, "and when we reported the information that we found, it would be done in such a way that the facilities where a particular set of samples were taken would not be identified and that we would not inform the individual workers of what data we found."[415] When pressed by Udall as to why he did not try to "go public" with the information, Holaday replied, "Stewart, I never thought a little Utah tweet from me would have been heard in Washington."[416]

In the end, Foote Mineral decided to settle the case with the Marysvale families. The firm agreed to provide $1.19 million in compensation to the twenty-six plaintiffs. The money was distributed based on the relative legal strengths of each of the families' claims. Five families received $1,500 each in the settlement. The remaining 19 families received settlements ranging from $30,000 to $137,000.[417]

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[414] *Barnson v. Foote Mineral Co.*, Nos. C-80-0119A, C-81-0719W, C-81-0045W & C-81-0715J, deposition taken upon oral examination of Duncan Holaday, 9 October 1985 (ACHRE No. DOJ-051795-A), 12.
[415] Deposition of Duncan Holaday, *Barnson v. Foote Mineral Co.*, 12.
[416] Udall, *The Myths of August*, 199.
[417] "Marysvale Miners File $19 Million Lawsuit," *Richfield Reaper*, 3 November 1982; "Cancer-Stricken Miners Settle Suit Against Mine," *Yuma Daily Sun*, 7 February 1985; Smith, *Stewart L. Udall*, 318; *Begay v. United States*, 768 F.2d 1059 (9th Cir. 1985); *Barnson v. United States*, 630 F. Supp. 418 (D. Utah 1985).

Udall's case against the federal government on behalf of the Navajo families, *Begay v. United States*, finally convened in August 1983. During the trial, Udall, Mahony, and Hale argued that the AEC "oligarchs" failed to warn miners of the health hazards associated with working in unventilated uranium mines.[418] The lawyers maintained that the U.S. Public Health Service provided the AEC with a series of medical studies linking radon gas to lung cancer, yet the AEC failed to share this information with the miners. The failure of federal agencies to provide warnings of the lethal health hazards, Udall asserted, was an unconscionable betrayal of the miners in the name of national security. Furthermore, Udall unearthed evidence that the AEC failed to create safety guidelines and took no precautions before allowing Navajos to work in the mines. He noted that the AEC could have mandated the installation of low-cost ventilation systems in the mines "in a matter of weeks." The mining companies could have easily paid for these improvements had the AEC raised its purchasing price of uranium by a few cents per ton. By not attempting to implement this low-cost system, Udall argued that the AEC decided to "put the flow of ore ahead of human health." This reckless act, Udall maintained, "sacrificed the lives of hundreds of miners." To compensate for this neglect, Udall's clients were asking for $30 million.[419]

Most of the courtroom drama centered around a single clause. Defense attorneys argued that the discretionary function clause of the FTCA shielded the government from liability. This clause prohibited injury awards resulting from the discretion or judgement of government

[418] Udall, *Myths of August*, 178; Einberger, *With Distance in His Eyes*, 247.
[419] *John N. Begay, et al. v. United States of America*, 591 F. Supp. 991 (D. Arizona 1984); Udall, *Myths of August*, 174-6, 183-202; Einberger, *With Distance in His Eyes*, 248. Cancer Suit by Uranium Miners Heard in Arizona," *New York Times*, 31 August 1983.

employees carrying out their responsibilities.[420] In 1984, the U.S. District Court Judge William P. Copple found for the defense, ruling that the decision of the federal government not to warn the miners of potential health risks fell within the discretionary clause. Copple suggested that only Congress could rectify the situation by passing a compensation bill. Udall appealed. In August 1985, the U.S. Circuit Court of Appeals in San Francisco upheld the discretionary principle of the FTCA and directed Udall and the bereaved to turn to Congress for compensation. Unsatisfied, Udall requested that the U.S. Supreme Court review the case. On October 13, 1987, the Supreme Court refused Udall's petition.[421] The court system had failed the Navajos.

Udall was devastated. He could not bring himself to explain the failed suit to his Navajo clients. "I tried but I could not write that letter," he said. When the Navajo families asked him to come to the Red Valley Chapter and discuss the outcome of the lawsuit, Udall sent Hale to go in his stead. "I did not go because I was humiliated and sick at heart," he later explained. "I did not go because for so many years, and on so many occasions, I had urged the Navajos to be patient and to have faith in their country's system of justice." Udall was ashamed that the federal government had "betrayed" its people. He was ashamed that bureaucrats had "needlessly sacrificed the lives of their husbands in the name of national security." As depression set in,

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[420] Smith, *Stewart L. Udall*, 315-6; Ball, *Justice Downwind*, 133-5. The defense also pointed out that mine safety was the responsibility of the individual states between the late 1940s and the mid-1960s, the period in which the miners claimed they were exposed to harmful levels of radon in the mines. Udall countered this point, arguing that state officials did not believe they had authority over the mines because they procured national defense materials and were located on Indian reservations. See "Closing Arguments Heard in Uranium Case," *Navajo Times*, 21 March 1984.

[421] Smith, *Stewart L. Udall*, 318; *Begay v. United States*, 768 F.2d 1059 (9th Cir. 1985); "No Health Warning Was Required for Navajo Uranium Miners, Court Rules," *Navajo Times Today*, 14 August 1985.

Udall came to terms with the fact that justice could only be obtained by an act of Congress. The state had to make things right.[422]

Although intimately tied to the Navajo experience, the fight for justice in uranium country was not confined to the Navajo people or the Navajo landscape. Throughout the latter-half of the twentieth century, diverse westerners organized to demand compensation for the illnesses borne by the uranium industry. Irradiated bodies joined with decolonization movements, women and children advocates, members of the press, politicians, and the former secretary of the interior to call for environmental and human health justice. Although their efforts helped remove the tailing piles in Grand Junction and provided some compensation for the Marysvale families, much still needed to be done. By the end of the 1980s, the fate of uranium country was still up for grabs.

[422] Udall, *Myths of August*, 202; Cynthia Gorney, "Stewart Udall's War of the West," *Washington Post*, 18 April 1990; Smith, *Stewart L. Udall*, 318.

Chapter Six

The Struggle Over the West's Nuclear Weapons Factories: Environmental Fears and Grassroots Activism at Rocky Flats Plant, Pantex, and Hanford, 1974-1987

During the 1970s and the 1980s, thousands of westerners organized against the West's nuclear weapons factories. These Americans argued that Rocky Flats Plant, Pantex, and Hanford were immoral factories of death. They believed that these facilities provoked a catastrophic war with the Soviet Union by manufacturing nuclear material. Furthermore, they maintained that these plants saddled their respective local communities with radioactive pollution and cancers. Some of the activists called on workers to resign from the factories. Others, namely regional journalists, wrote newspaper and magazine articles outlining the hazards of the facilities. Still other activists organized pilgrimages, protests, and sit-ins to make their discontent visible.

While the activists called for Rocky Flats Plant, Pantex, and Hanford to close, those westerners working at the plants rallied behind the factories. These members of the atomic workforce charged that the activists and the media were overplaying the environmental hazards associated with the facilities. They argued that the plants helped secure the peace between the United States and the Soviet Union because nuclear weapons served as forces of deterrent. Finally, the workers defended their plants because of the economic benefits they provided to their local communities. To challenge the protesters, some workers formed counter-protest organizations and held pro-nuclear rallies. Others harassed and intimidated the activists, hoping that fear would divert their critical eyes away from the factories. This chapter brings these two histories together. It examines how westerners organized to attack and defend the nation's nuclear weapons factories.

Although Rocky Flats Plant, Pantex, and Hanford historians recognize that local communities did not unify behind the anti-nuclear protest movements, they have spent little time exploring how workers and other residents organized grassroots movements to defend their factories and the military-industrial complex.[423] By bringing these histories of protest and counter-protest together, this chapter complicates how we think about western support for the nuclear weapons factories and the military-industrial complex in the 1970s and the 1980s. The westerners protesting Rocky Flats Plant, Pantex, and Hanford were not just waging a political war against the nuclear firms. Rather, they were also participating in a struggle on the grassroots level, fighting against local, blue- and white-collar people. By probing the grassroots divide over Rocky Flats Plant, Pantex, and Hanford, we come closer to understanding how the military-industrial complex was not a top-down, monolithic entity, but a participatory structure comprised of average westerners.

In order to best chronicle the diverse grassroots movements surrounding Rocky Flats Plant, Pantex, and Hanford, this chapter is organized into three sections. While each section explores the grassroots contestations surrounding Rocky Flats Plant, Pantex, and Hanford,

[423] See Len Ackland, *Making a Real Killing: Rocky Flats and the Nuclear West* (Albuquerque: University of New Mexico Press, 1999); LeRoy Moore, *Plutonium and People Don't Mix: A Guide to Rocky Flats, Colorado's Defunct Nuclear Bomb Factory* (Boulder: Rocky Flats Nuclear Guardianship and Rocky Mountain Peace & Justice Center, 2017); Alex Hunt, "'Host and Hostage': Pantex and the Texas Panhandle," *Southwestern Historical Quarterly* 118, no. 4 (April 2015): 339-363; Kate Brown, *Plutopia: Nuclear Families, Atomic Cities, and the Great Soviet and American Plutonium Disasters* (New York: Oxford University Press, 2013); John M. Findlay and Bruce Hevly, *Atomic Frontier Days: Hanford and the American West* (Seattle: University of Washington Press, 2011); Michele Stenehjem Gerber, *On the Home Front: The Cold War Legacy of the Hanford Nuclear Site* (Lincoln: University of Nebraska Press, 2007); Michael D'Antonio, *Atomic Harvest: Hanford and the Lethal Toll of America's Nuclear Arsenal* (New York: Crown, 1993); Patricia Nelson Limerick, "The Significance of Hanford in American History," in *Washington Comes of Age: The State in the National Experience*, ed. David H. Stratton (Pullman: Washington State University Press, 1993). For a general history of nuclear activism in the United States see, Kyle Harvey, *American Anti-Nuclear Activism, 1975-1990: The Challenge of Peace* (New York: Palgrave Macmillan, 2014).

respectively, there is not enough space here to provide a comprehensive history of the factories during the last few decades of the Cold War. This chapter does not attempt to detail every instance of protest and counter-protest surrounding the facilities, nor every radiological event and instance of pollution. Rather, it illustrates the grassroots divide over the factories by exploring salient instances of pollution, explaining why the protest and counter-protest movements formed, and documenting the tactics that westerners used to attack and defend the plants. To do this, this chapter uses new sources, including oral histories. Each section stops short of explaining how its grassroots contestation turned out. The fate of Rocky Flats Plant, Pantex, and Hanford is documented in the epilogue of this dissertation. For now, we focus on the grassroots struggle.

The Struggle Over Rocky Flats Plant

During the 1970s and the 1980s, peace advocates, environmentalists, and college students in Colorado turned their attention to Rocky Flats Plant. Spurred by a series of radiological accidents at the factory, these activists demanded that the federal government close Rocky Flats Plant and abandon nuclear weapons manufacturing altogether. To challenge Rocky Flats Plant's existence, activists rallied college students to their cause and organized an annual protest outside its gates.

In response to the protesters, Rocky Flats Plant workers formed Citizens for Energy and Freedom, an organization dedicated to defending the factory. The group maintained that Rocky Flats Plant posed no health hazards to its workers, nor other Coloradans. Echoing the doctrine of nuclear deterrent, Citizens for Energy and Freedom argued that Rocky Flats Plant helped safeguard the American people by making war with the Soviets too terrible to be an option. To defend Rocky Flats Plant's existence, workers partnered with local and national union leadership to organize a pro-nuclear rally outside its gates.

The roots of the struggle over Rocky Flats Plant began on May 11, 1969. That morning, plutonium shavings in a glove box spontaneously ignited in Rocky Flats Plant Building 776/777, the warehouse where workers shaped plutonium into nuclear triggers. As the shavings burned, the glove box ventilation fans sucked heat from the fire into the larger glove box system, sparking new fires across the building. Few people were working at Rocky Flats Plant that Sunday. Consequently, the fire was detected four hours after it began, when the building's heat detectors triggered an alarm at the plant's fire station. Firefighters fought with the fire for nearly four hours, dousing it with water. The blaze did not injure or contaminate anyone in the building. The Atomic Energy Commission (AEC) estimated that the fire released a small amount of radiation, 210 picocuries. Major General Edward B. Giller, the director of the division of military application for the AEC, reassured Colorado Governor John Love that "no dangerous accumulation of contamination left the building at Rocky Flats" and that "no one was endangered."[424]

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[424] U.S. Department of Energy, Office of Public Affairs, "Declassification of the Amount of Weapon-Grade Plutonium Involved in Fires at the Rocky Flats Plant, near Denver, Colorado, in 1957 and 1969," June 27, 1994, NNSA/NSO Nuclear Testing Archive, Las Vegas, Nevada; Len Ackland, "The Day They Almost Lost Denver," *Bulletin of the Atomic Scientists* 55, no. 4 (1999): 61-2; U.S. Atomic Energy Commission, "Report on the May 11, 1969 Fire at the Rocky Flats Plant Near Boulder, Colorado," 18 November 1969, NV0911740, NNSA/NSO Nuclear Testing Archive, Las Vegas, Nevada; Pat Buffer, "Rocky Flats Site History," 2002, Office of Legacy Management, Department of Energy, https://www.lm.doe.gov/land/sites/co/rocky_flats/closure/references/199-Rocky%20Flats%20History%20Thru%201-2002.pdf; Jack Shepherd, "The Nuclear Threat Inside America," *Look*,15 December 1970, 22; Linda D. Vollan, "'To The Village Square:' Early Activism Against Rocky Flats Nuclear Weapons Plant," (Master's thesis, University of Colorado at Boulder, 1992), 2; "Rocky Flats Fire Effects Report is Given Gov. Love," *Greeley Daily Tribune*, 18 June 1969; "Flats Blaze Prompted Fire Protection Probe," *Colorado Springs Gazette*, 6 September 1969.

Still, the fire was costly. The fire was the most expensive industrial accident in the United States at the time. The destruction left the AEC with a $45 million bill to decontaminate and renovate the building. The fire yielded a national security cost, too. It took two years for Dow and the AEC to tend to Building 776/777. This bottlenecked all nuclear warhead manufacturing in the nation.[425]

As Dow and the AEC renovated the plant, Edward A. Martell investigated if the fire had contaminated the Front Range with radiological pollution. Martell was a radiochemist with Boulder's National Center for Atmospheric Research and a member of the Colorado Committee for Environmental Information, a group of scientists concerned with the environmental consequences of military projects. Fearing that the fire had poisoned the environment, in August 1969, Martell and his assistant, Stuart Poet, began collecting surface soil samples around Rocky Flats Plant and measuring them for two dangerous radioactive elements: plutonium-239 and strontium-90.The duo found plutonium-239 and strontium-90 in more than three-dozen areas around the plant, including in Denver, Aurora, Derby, and Golden.[426]

Plutonium-239 has a half-life of 24,100 years, meaning it takes over twenty-four thousand years for half of the element to decay. As it decays, it gives off alpha radiation, or alpha particles. Alpha particles are not very intrusive. They can be stopped by skin or a piece of paper.

[425] U.S. Atomic Energy Commission, "Report on the May 11, 1969 Fire at the Rocky Flats Plant Near Boulder, Colorado," 18 November 1969, NV0911740, NNSA/NSO Nuclear Testing Archive, Las Vegas, Nevada; Ackland, *Making a Real Killing*, 152-9; Moore, *Plutonium and People Don't Mix*, 29.
[426] Moore, *Plutonium and People Don't Mix*, 29; Shepherd, "The Nuclear Threat Inside America," 22; S.A. Poet and E.A. Martell, "Plutonium-239 and Americium-241 Contamination in the Denver Area," *Health Physics* 23, no. 4 (October 1972): 540; Ackland, *Making a Real Killing*, 161-2.

If ingested or inhaled, however, alpha particles can mutate the human body and cause lung, bone, and liver cancer.[427]

Strontium-90 has a half-life of about twenty-nine years. It decays to yttrium-90, which, in turn, decays by emitting beta particles. Although beta particles are stopped by thin pieces of aluminum, they can cause burns on exposed skin. If inhaled or ingested, beta particles can mutate the body. Furthermore, strontium-90 is a "bone seeker," that acts like calcium. After entering the body, mostly by contaminated food and water, strontium-90 deposits in bones and bone marrow. There, it can cause bone cancer, leukemia, and cancers of nearby tissues. Strontium-90 also has an affinity to the calcium-sensing receptor of parathyroid cells. This causes strontium-90 to accumulate in the thyroid and can led to hyperparathyroidism. Once strontium-90 enters the human body its half-life changes. Some reports indicate it obtains half-life of fourteen days. Other studies indicate forty-nine years.[428]

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[427] Agency for Toxic Substance and Disease Registry, "Public Health Statement: Plutonium" November 2010, https://www.atsdr.cdc.gov/ToxProfiles/tp143-c1-b.pdf. In her analysis of Rocky Flats Plant, the Linda Vollan mistakenly insists that plutonium-239 emits both alpha and gamma radiation. Gamma radiation is far more intrusive than alpha particles. It penetrates most substances including lead and concrete. By indicating that plutonium-239 emits gamma particle, Vollan's frames plutonium-239 pollution as much more hazardous than it actually is. See Vollan, "To the Village Square," 5-6.

[428] J.E. Pattison, R.P. Hugtenburg, M.W. Charles, and A.H. Beddoe, "Experimental Simulation of A-bomb Gamma-ray Spectra for Radiobiology Studies," *Radiation Protection Dosimetry* 95 no. 2 (May 2001): 125-136; Michael F. L'Annunziata, *Radioactivity: Introduction and History* (Amsterdam: Elsevier Science, 2007), 55-8; K. Rothkamm and M. Löbrich, "Evidence for a Lack of DNA Double-Strand Break Repair in Human Cells Exposed to very low X-ray Doses," *Proceedings of the National Academy of Sciences of the United States of America* 100, no. 9 (April 2003): 5057-62; Centers for Disease Control and Prevention, "What is Radiation? Properties of Radioactive Isotopes," 20 August 2015, https://www.cdc.gov/nceh/radiation/isotopes.html; Agency for Toxic Substance and Disease Registry, "Toxicological Profile for Strontium," April 2004, http://www.atsdr.cdc.gov/toxprofiles/tp159.pdf; U.S. Nuclear Regulatory Commission, "Bone Seeker," 21 March 2019, https://www.nrc.gov/reading-rm/basic-ref/glossary/bone-seeker.html; B.O. Boehm, S. Rosinger, D. Belyi, and J.W. Dietrich, "The Parathyroid as a Target for Radiation Damage," *New England Journal of Medicine* 365, no. 7 (August 2011): 676-678; Centers for Disease Control and Prevention, "Radioisotope Brief: Strontium-90," 4 April 2018, https://www.cdc.gov/nceh/radiation/emergencies/isotopes/strontium.htm.

To account for fallout stemming from the atmospheric tests at the Nevada Test Site, Martell and Poet also took soil samples from other sites along the Front Range and estimated the background concentration of radionuclides in the soil. By comparing these samples, the two could determine if Rocky Flats Plant sent radioactive pollution into the region.[429] After reviewing the samples, Martell and Poet noted that the contamination in Denver, Aurora, and Golden corresponded to atmospheric nuclear weapons tests in Nevada. However, they reasoned that "because Derby is only 17 miles east of Rocky Flats" it "appears to have received some ^{239}Pu from the plant." The plutonium-239 they found in the surface soil ranged from five to 300 times the levels of plutonium pollution created by nuclear tests.[430] After recording their findings, Martell and Poet submitted their report to the Colorado Committee for Environmental Information, which concluded that the 1969 fire was "the most likely source of the contamination."[431]

In January 1970, the Colorado Committee for Environmental Information passed along the Martell and Poet report to the AEC and Governor Love. In an attempt to get ahead of the story, in February, Dow officials admitted to the press that radioactive contamination had spread outside the factory. However, they maintained the contamination was not a result of the 1969 fire. Rather, they said that the pollution stemmed from the 1957 Rocky Flats Plant fire and leaking oil drums. In 1958, Dow began storing machine cutting oil contaminated with plutonium in 400, 55-gallon drums just outside of the factory. As the drums corroded, the oil seeped into the soil and the winds blew the plutonium particles across the Front Range. Although Dow

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[429] Poet and Martell, "Plutonium-239 and Americium-241 Contamination in the Denver Area," 537-48; Ackland, *Making a Real Killing*, 161-2.
[430] Poet and Martell, "Plutonium-239 and Americium-241 Contamination in the Denver Area," 541, 537.
[431] E.A. Martell, P.A. Goldan, J.J. Kraushaar, D.W. Shea, and R.H. Williams, "Fire Damage," *Environment: Science and Policy for Sustainable Development* 12, no. 4 (1970): 16.

discovered that some of the barrels were corroded and leaking in 1964, it did not remove them to the Idaho waste site until 1967. In July 1969, Dow poured a four-inch asphalt pad over the contaminated soil to keep the winds from spreading the contamination. Shortly after this announcement, the AEC reassured the public that "such trace amounts [of plutonium-239 and strontium-90] present no risk to the health of employees in the plant or to citizens in the surrounding area."[432]

In response to these statements, Martell and Poet collected more soil samples in the summer of 1970. This time, the duo operated within the theoretical framework that the pollution was linked to the leaking drums. In 1972, the scientists published their findings in *Health Physics*. They concluded that plutonium "from the spill area was the main source of contamination."[433]

In 1973, Rocky Flats Plant fell under scrutiny again when the Colorado Department of Health determined that the plant released tritium into Walnut Creek. The waterway flowed into Great Western Reservoir, which supplied the city of Broomfield with potable water. Tritium has a half-life of about twelve years. As it decays into helium, tritium emits beta particles. However, tritium's beta particles are so weak that they only travel about six millimeters in the air and cannot penetrate human skin. Consequently, health physicists do not consider small quantities of

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[432] Martell, Goldan, Kraushaar, Shea, and Williams, "Fire Damage," 20-1; Deborah Shapley, "Rocky Flats: Credibility Gap Widens on Plutonium Plant Safety," *Science* 174, no. 4009 (November 1971): 569-70; Shepherd, "The Nuclear Threat Inside America," 22; Vollan, "To the Village Square," 110; Poet and Martell, "Plutonium-239 and Americium-241 Contamination in the Denver Area," 537, 544; "Rocky Flats Plutonium Not Danger to Denver, AEC Says," *Greeley Daily Tribune*, 19 February 1970; Ackland, *Making a Real Killing*, 164.
[433] "Plutonium is Found at Rocky Flats Site," *Colorado Springs Gazette*, 7 August 1970; Poet and Martell, "Plutonium-239 and Americium-241 Contamination in the Denver Area," 544.

tritium hazardous.[434] On September 18, 1973, Colorado Governor John Vanderhoof announced the tritium contamination to the public. Dow officials were incredulous. They maintained that Rocky Flats Plant did not process nor produce any tritium and reasoned that the contamination could not possibly be linked to the facility. In response, the AEC investigated Rocky Flats Plant for tritium. It found that the Lawrence Livermore Laboratory had shipped plutonium scrap metal contaminated with tritium to Rocky Flats Plant. Factory workers had not monitored the scrap for tritium, processed the metal, and, consequently, sent tritium into the plant's waste disposal system, which flowed into Walnut Creek.[435]

The tritium release wore-away at Dow's standing with the AEC. In response to the debacle, the AEC investigated Rocky Flats Plant for other incidences of tritium pollution. In December 1973, the AEC chastised Dow for failing to report two releases of tritium at Rocky Flats Plant. The AEC alleged that Dow "accidentally" released 603 curies of tritium through a smokestack at Rocky Flats Plant in 1968 but failed to report the incident to the state. Additionally, the AEC reprimanded Dow for failing to document the 1973 tritium release into Walnut Creek.[436]

By 1974, newspaper articles on the tritium release and Martell and Poet reports had made their way around environmentalist circles in Boulder and Denver. Judy Danielson was just one

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[434] U.S. Atomic Energy Commission, Albuquerque Operations Office, *Investigation of the Tritium Release Occurrence at the Rocky Flats Plant,* 26 November 1973, 14-9, FOIA; "Scientists, Health Officials Examining Rocky Flats Plant," *Fort Collins Coloradoan,* 26 September 1973; Ackland, *Making a Real Killing*, 171; Health Physics Society, "Tritium Fact Sheet," March 2011, https://hps.org/documents/tritium_fact_sheet.pdf.

[435] "AEC to Investigate Tritium Contamination," *Greeley Daily Tribune*, 21 September 1973; U.S. Atomic Energy Commission, Albuquerque Operations Office, *Investigation of the Tritium Release Occurrence at the Rocky Flats Plant*, 59; "Broomfield Water Contaminant Traced to Rocky Flats Plant," *Fort Collins Coloradoan*, 25 September 1973.

[436] "Dow Charged with Failure to Report Radioactive Leaks," *Fort Collins Coloradoan*, 21 December 1973.

concerned Denverite who collected newspaper clippings and the Martell and Poet reports on Rocky Flats Plant. After reading these publications, Danielson came to believe that Rocky Flats Plant threatened the health and safety of Coloradans and the regional environment. In 1974, Danielson began working at the Denver office of the American Friends Service Committee (AFSC), a Quaker organization dedicated to working for peace and social justice. In the AFSC office, Danielson discussed her fears about Rocky Flats Plant with her friend, Pam Solo. Solo was a nun in the Sisters of Loretto Order and a critic of the Vietnam War. As the United States withdrew from Vietnam, Solo turned her attention to Rocky Flats Plant, believing that it was a manifestation of the same militarism that drove the United States towards Vietnam.[437]

Through the AFSC, Solo and Danielson organized a new grassroots movement dedicated to the closure of Rocky Flats Plant: Rocky Flats Action Group. The group brought together environmentalists concerned with Rocky Flats Plant's pollution and anti-war activists incensed by the nuclear arms race. As Solo put it, Rocky Flats Action Group "developed a unique marriage between environmental and peace activism." It blended environmentalism's popular appeal and focus on changing public policy with peace activism's expertise in community-organizing and campaigning.[438]

While Danielson and Solo organized Rocky Flats Action Group, the AEC announced that Dow was moving on from Rocky Flats Plant. The local press reported that the tritium incident motivated the AEC to ditch Dow. However, according to plant workers, Dow decided to not renew its contract because the AEC "wanted more say in management decisions" at Rocky Flats

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437 "AEC to Investigate Tritium Contamination," *Greeley Daily Tribune*, 21 September 1973; "Tritium in Reservoir Claimed Not Harmful," *Daily Sentinel*, 19 September 1973; Ackland, *Making a Real Killing*, 170.

438 Ackland, *Making a Real Killing*, 170; Pam Solo, *From Protest to Policy: Beyond the Freeze to Common Security* (Cambridge: Ballinger Publishing Co., 1988), 29-30.

Plant.[439] In November 1974, the AEC awarded a cost-plus fixed fee contract to Rockwell International Corporation. Less than two months later, in January 1975, the AEC gave way to two agencies. The Nuclear Regulatory Commission took over the AEC's responsibility for nuclear power. The Energy Research and Development Administration, later renamed the Department of Energy (DOE), became responsible for nuclear weapons.[440]

From the federal government's perspective, Rockwell was a safe choice for taking over Rocky Flats Plant. The firm was one of the Pentagon's top ten contractors in the early 1970s, having merged with the aerospace juggernauts North American Aviation and Rocketdyne in 1967 and the avionics firm Collins Radio in 1973. The firm produced a variety of high-tech products for the federal government, including the B-1 bomber, the third stage of the Minuteman ICBM, the AGM-53A Condor air-to-surface missile, the Space Shuttle Orbiter, and the Apollo Command and Service Module. By bringing Rockwell into Rocky Flats Plant, the federal government vested nuclear bomber development, ICBM manufacturing, space technology procurement, and nuclear trigger production within one company.[441]

Rockwell began managing Rocky Flats Plant on July 1, 1975. The company kept the balance of the plant's workforce and middle managers intact but made several changes at the factory. Rockwell recognized that the Martell and Poet studies and the tritium releases had worn away at the credibility of the factory. In an attempt to change the plant's image, Rockwell began giving limited public tours of the plant days after it took over the facility.[442] Rockwell

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439 Farrel D. Hobbs, *An Insider's View of Rocky Flats: Urban Myths Debunked* (Coppell: CreateSpace Independent Publishing Platform, 2010), 30, 19.
440 Ackland, *Making a Real Killing*, 176; Moore, *Plutonium and People Don't Mix*, 43.
441 Harry Weisberger, "Rockwell Collins Traces Its Spirit of Innovation to a Rich Heritage," *Aviation International News*, 18 June 2008.
442 Ackland, *Making a Real Killing*, 176, 180-1; Herrick Roth, *Local 8031: Its Struggles and Its Victories* (Denver: A.B. Hirschfeld Press, 1989), 62-5.

understood that the cost-plus fixed fee contract system gave the firm little incentive to increase productivity and efficiency. The federal government guaranteed all the paychecks, infrastructure, and provided Rockwell with no motivation to increase production for the sake of higher profit margins. In order to gain additional federal funding, Rockwell increased the size of the plant's bureaucracy. More specifically, Rockwell analyzed plant activities and processes and criticized "the adequacy of safety of the operations and/or written procedures." By identifying perceived problems in the factory, Rockwell could call on the federal government for more cash to tend to the problems it identified. Under the cover of "responsible management," Rockwell gouged the federal government and overhauled Rocky Flats Plant. As one worker noted, "operations with flawless safety records weren't immune. Auditors were continually finding things 'that might go wrong,' and requiring other people to respond and find a solution." Rockwell's auditors, investigators, and bureaucrats became "problem finders" who simply identified perceived problems and did not offer any solutions outside of asking for more federal funding. Ironically, Rockwell's new culture of critique made the plant notably less efficient. While Dow had relied on employee expertise to guide production, Rockwell established complex procedures, validation processes, and a bureaucratic maze. Rockwell hired hundreds of staffers to oversee all aspects of production and tasked them to criticize every facet of the operation in order to maximize federal funding. The anti-plant activists played into this system, providing democratic fuel which Rockwell mobilized to overhaul the plant and increase its profit margins. Each time Rockwell's inspectors released their findings to the federal government, activists galvanized around the reports, using them as evidence of the plant's problems. However, the activists failed to recognize that the balance of Rockwell's negative reports documented procedural violations that had little bearing on production and human and environmental health. In some cases, the negative reports simply documented that a worker had failed to date a checklist or check a box. When the activists took to the public arena and demanded that the federal government do something about the poor operations at Rocky Flats Plant, the federal government responded by increasing Rocky Flats Plant's operating budget to tend to the problem. By increasing the operating budget, the federal government then had to increase the amount it paid Rockwell for operating the plant because the terms of Rockwell's contract mandated that it receive a 2 percent fee of the overall operating budget.[443] In this way, the activists fed Rockwell.

Along with producing a litany of negative reports, Rockwell galvanized the activists by its mere presence at Rocky Flats Plant. Members of the Rocky Flats Action Group had worked with the AFSC to campaign against Rockwell throughout the 1970s, hoping to stop the firm from manufacturing the B-1 bomber. The activists argued that the firm and the aircraft were manifestations of the nation's "permanent war economy." The phrase "permanent war economy" was popularized by the industrial engineering professor Seymour Melman in 1974. In his numerous volumes on the military-industrial complex, including the *Permanent War Economy*, Melman argued that the military-industrial complex constituted a "new state-controlled economy" that was in the process of dismantling "the United States as an economic and industrial system." In other words, Melman framed the military-industrial complex as monolithic, top-down force that threatened the economic fabric of the nation.[444]

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[443] Hobbs, *An Insider's View of Rocky Flats*, 37-8, 41; Matthew L. Wald, "Rockwell is Giving Up Rocky Flats Plant," *New York Times*, 23 September 1989. By the end of the 1980s the annual budget for Rocky Flats Plant was $500 million. Rockwell received $10 million per year.

[444] Solo, *From Protest to Policy*, 29-30; Seymour Melman, *The Permanent War Economy: American Capitalism in Decline* (New York: Simon and Schuster, 1974), 11. See also, Seymour Melman, *Pentagon Capitalism: The Political Economy of War* (New York: McGraw-Hill Book Company, 1970).

Solo and the other AFSC activists shared Melman's appraisal of the military-industrial complex. In her memoir, Solo argued that Rockwell had established a "corporate influence over national security policy" and "needed to be exposed and opposed."[445] Yet, unlike Melman, Solo recognized that the military-industrial complex was a participatory structure that had purchase with Coloradans who found work at Rocky Flats Plant. Recognizing that many Denverites and Boulderites worked at Rocky Flats Plant, and therefore would lend little support to dismantling the factory, Solo and the other leaders of Rocky Flats Action Group reached out to students at Colorado State University (CSU) in Fort Collins, hoping to recruit young anti-war advocates to their cause. Rocky Flats Action Group also courted young environmentalists by giving speeches on the Rocky Flats Plant and the hazards of nuclear waste to CSU's green club, Environmental Corps. The outreach was so successful that in March 1978, CSU students formed a branch of the Rocky Flats Action Group in Fort Collins.[446]

In April 1978, Rocky Flats Action Group organized a two-day anti-war, pro-environment demonstration centered on Rocky Flats Plant. Its purpose, one activist explained, was "to call for the closing of the Rocky Flats Plant" and "send the message to political and corporate leaders all over the world that we are sick and tired of the arms race." Rocky Flats Action Group invited notable national activists to speak at the event, including Daniel Ellsberg, the former Rand Corporation employee who had leaked the Pentagon Papers to the press in 1971. The organizers planned to follow the speeches by bussing the attendees to Rocky Flats Plant and staging a sit-in on the Denver and Rio Grande Railroad spur. Trains used this spur to deliver Hanford plutonium

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[445] Solo, *From Protest to Policy*, 29-30; Pam Solo, interview by Dorothy D. Ciarlo, 2004, OH1272-V, Boulder Public Library, Boulder, Colorado.
[446] "Talk Planned by Rocky Flats Action Group," *Fort Collins Coloradoan*, 31 October 1977; "Rocky Flats Action Group," *Fort Collins Coloradoan*, 12 March 1978; "Rocky Flats Action Group," *Fort Collins Coloradoan*, 19 March 1978.

to Rocky Flats Plant. The planned sit-in was envisioned to be a “symbolic” act of civil disobedience. The sit-in was to occur on a day when no trains were on their way to the plant. To promote the event, members of the Rocky Flats Action Group passed out leaflets outside local post offices. To ensure a high turnout, the activists organized a motorcade to bring CSU students to the protest.[447]

Thanks to the mobilization of CSU’s student body, five thousand people attended the event. On April 28, activists gathered at the Denver Federal Building to listen to speakers decry the nuclear arms race, including Ellsberg, Colorado Representative Pat Schroeder, Winona LaDuke Westigard, Allen Ginsberg, and Stokeley Carmichael. After taking-in the speeches, some of the activists trained in nonviolent civil disobedience. On Saturday, April 29, the freshly-trained activists traveled to Rocky Flats Plant, sat on the spur, and refused to leave.[448]

The blockade continued for months. Ellsberg enticed this act of rebellion, telling the protesters not to leave the tracks “until the plant is converted to more productive peacetime uses.”[449] Danielson and Solo were furious. The two had promised Rockwell that the sit-in would end at sundown on April 29. Furthermore, the two had hoped that the protest and limited sit-in would help convince Rocky Flats Plant workers that the factory threatened local health and

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[447] “Nonviolent Demonstration to Call for Closing,” *Fort Collins Coloradoan*, 16 April 1978; Pam Solo, Chris Moore, Judy Danielson, and Mike Jendrzejczyk, “Rocky Flats National Action,” 1978, folder 2, box 3, Kathy Partridge Papers, University of Colorado Boulder Libraries, Special Collections and Archives, Boulder, Colorado; Ackland, *Making a Real Killing*, 186.
[448]“Nonviolent Demonstration to Call for Closing,” *Fort Collins Coloradoan*, 16 April 1978; Ackland, *Making a Real Killing*, 186; Paul Wehr, *Conflict Regulation* (Boulder: Westview, 1979), 111-22; “Legal Information—Nonviolent Direct Action/Rocky Flats,” 1978, folder 2, box 3, Kathy Partridge Papers, University of Colorado Boulder Libraries, Special Collections and Archives, Boulder, Colorado.; John J. Kennedy, Jr., “Annihilation Beckons: A Brief History of Colorado’s Nuclear Bomb-Trigger Factory,” *Colorado Heritage*, Spring 1994, 27; Solo, *From Protest to Policy*, 63.
[449] “Rocky Flats Protestors Vow to Keep Blockade,” *Daily Sentinel*, 31 May 1978; “15 Demonstrators Arrested,” *Colorado Springs Gazette Telegraph*, 15 June 1978.

international stability. They feared that the permanent blockade would alienate Rocky Flats Plant workers from their cause. In the weeks that followed, dozens of CSU students flocked to the blockade looking to defy the establishment. As the sit-in dragged on, Ellsberg came to believe that the group had a real shot at not only closing Rocky Flats Plant, but at ending the nuclear arms race altogether. As he later explained, "as long as we were there, the trains—which, after all, did not want to run over us—couldn't go. And, if the trains couldn't go, they choked in their own radioactive waste, in effect. They couldn't keep their operation going without moving those trains. So if the trains had to stop, the production would stop. And in effect, you would have stopped the arms race." Rockwell security and the local police hesitated to arrest the protesters, believing that such confrontations would only provide more publicity and public sympathy to the movement.[450]

Figure 15: Anti-nuclear protesters, including the poet Allen Ginsberg (left, farthest from camera) during the 1978 blockade. 13 June 1978. Photo by Steve Groer. Image RMN-045-3469. Rocky Mountain News Archives, Denver Public Library.

[450] Daniel Ellsberg, interview by LeRoy Moore, 24 April 1998, OH1530A-B, Boulder Public Library, Boulder, Colorado.

In early August, the blockaders changed their strategy. Branding their protest as a "die-in," the group took over two access roads at Rocky Flats Plant and refused to leave. The expansion of the protest prompted law enforcement to act. The police arrested the sixty-six protesters, including Ellsberg, for trespassing.[451]

After posting bond, in November 1978, Ellsberg looked to recruit more young Coloradans to his cause and traveled to Mesa College in Grand Junction. There, in front of a capacity crowd in the Walter Walker Auditorium, Ellsberg extended an invitation to the student body to join him on the tracks leading to Rocky Flats Plant next spring. "We'll probably go to jail, at least some of us," he said. Referring to those who took part in the blockade, Ellsberg said, "They're making better use of their lives…by being on those tracks instead of working in Rocky Flats." In perhaps his most controversial statement, Ellsberg likened Rocky Flats Plant to the Nazi death camps. "Rocky Flats is the Auschwitz of our time," he said. "No more."[452]

Although hundreds of university students subscribed to Ellsberg's rhetoric, many Coloradans rebuked the whistleblower for his "rabble-rousing." "Does he want us to surrender to Russia?" one critic asked. "I'd like to see the locomotive run over the S.O.B. Why doesn't he go to Russia and tell them to stop manufacturing nuclear bombs?" Another critic called Ellsberg an anti-nuclear "stormtrooper" and a pied piper of "mob action," that sought to "overwhelm and break down the system of law enforcement" by creating an "undemocratic force."[453]

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[451] "Nuclear Protesters Arrested," *Daily Sentinel*, 10 August 1978; George Orbanek, "Ellsberg—Not Always Dissenter," *Daily Sentinel*, 9 November 1978; Ackland, *Making a Real Killing*, 187; Solo, *From Protest to Policy*, 63.

[452] George Orbanek, "Ellsberg—Not Always Dissenter," *Daily Sentinel*, 9 November 1978.

[453] W.P.D., "Daniel Ellsberg's Talk," *Daily Sentinel*, 23 November 1978; Anthony Harrigan, "The Anti-Nuclear Stormtroopers," *Colorado Springs Gazette Telegraph*, 7 June 1978.

Fearing that the 1979 protest would follow the course of its predecessor, Solo and Danielson worked with the DOE, Rockwell, and law enforcement in planning the event. Solo promised the DOE that all protesters would leave the area by 6PM on April 29. In addition to training 236 protesters in civil disobedience, Rocky Flats Action Group also trained 300 of its own “peacekeepers” to work with U.S. Marshals and Rockwell security guards to “maintain order” at the demonstration.[454]

Nine thousand people attended the April 1979 protest. The event began on Saturday, April 28, at the University of Colorado campus in Boulder. There, two hundred activists walked, jogged, and bicycled to the plant. After arriving, they joined with hundreds of other activists from CSU and Mesa College to listen to speeches by Schroeder, Lorelei Means, Jackson Browne, Bonnie Raitt, and Danny O’Keefe. Then Ellsberg took the stage. The former analyst had purchased Rockwell stock. While standing in front of the crowd, he burned his dividend check, sending a clear message: environmental protection and world peace outweighed economic benefit. The crowd cheered. At noon, the activists released hundreds of balloons into the air as a symbolic act of peace. The next day, 284 activists, including Ellsberg, blockaded the roads leading to Rocky Flats Plant. All seemed to be going to plan. Then 6PM came. Led by Ellsberg, most of the cadre refused to quit the blockade. Reacting quickly, the peacekeepers, U.S.

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[454] “Critics of Rocky Flats to Protest,” *Daily Sentinel*, 28 April 1979; “Thousands Call for Rocky Flats Closure,” *Daily Sentinel*, 29 April 1979; “Road Blocks Bring Arrest of Protestors Near Rocky Flats,” *Daily World*, 30 April 1979; Ackland, *Making a Real Killing*, 187-8; Joe Seldner, “Ellsberg Trespass Nets $1,000 Fine,” *Denver Post*, 14 July 1979; Mike Patty, “Ellsberg Fined $1,000 for Flats Trespass,” *Rocky Mountain News*, 14 July 1979.

Marshals, and Rockwell guards apprehended the 254 remaining blockaders. Each had to pay a $1,000 fine for criminal trespassing.[455]

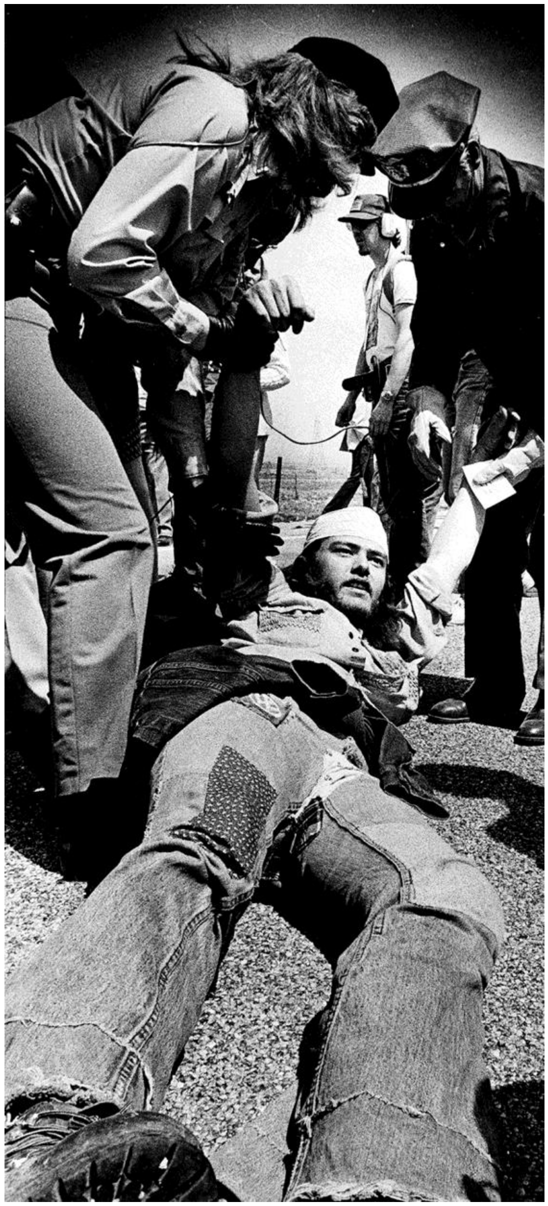

Figure 16: Police arresting a protester at Rocky Flats Plant. April 1979. Photo by Frank Murray. Image RMN-024-4392. Rocky Mountain News Photo Archives, Denver Public Library.

455 "Critics of Rocky Flats to Protest," *Daily Sentinel*, 28 April 1979; "Thousands Call for Rocky Flats Closure," *Daily Sentinel*, 29 April 1979; "Road Blocks Bring Arrest of Protestors Near Rocky Flats," *Daily World*, 30 April 1979; Ackland, *Making a Real Killing*, 187-8; Joe Seldner, "Ellsberg Trespass Nets $1,000 Fine," *Denver Post*, 14 July 1979; Mike Patty, "Ellsberg Fined $1,000 for Flats Trespass," *Rocky Mountain News*, 14 July 1979.

The demonstrations, particularly the blockades, troubled Rocky Flats Plant's workforce. While workers labored on the factory floor, they shared with one another their thoughts on the blockades, their anxieties about what would happen to them if the plant closed, and their dedication to the doctrine of nuclear deterrent. Following the 1979 blockade, more than 1,500 workers at the plant signed a petition to defend their plant. "Those who would undermine our national security by demanding the closure of our nuclear facilities have commanded national headlines too long," one worker wrote. "Those who are demanding the closure of Rocky Flats are, in reality, demanding unilateral disarmament. Any reasonable person knows that in this tension-filled world such a stance is unthinkable," he continued. In daily conversations, hundreds of workers argued that Rocky Flat Plant was fulfilling its intended purpose by providing nuclear deterrent. They maintained that the factory was not only a local economic necessity, but the keystone to keeping the Cold War from turning hot. Without nuclear deterrent, the workers reasoned, the United States could find itself in a real combat situation with the Soviet Union.[456]

Rocky Flats Plant workers also argued that the growing protest movement surrounding the factory was a product of ignorance and not valid scientific concerns. As nuclear physicists, chemists, and engineers, the workers maintained that they, and not the protesters, had the expertise to judge whether the plant posed environmental and human health hazards. Across the factory floor, workers attempted to square the protesters' claims that Rocky Flats Plant featured a disorganized workforce and was poisoning the Front Range with the plant's detailed training programs and "strict requirements about working with and around radioactive materials." Furthermore, workers took an active interest in ensuring that the plant did not harm the local community. As local Coloradans, workers carefully monitored the plant's effluent into the region

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[456] Art Benjamin, "Pro-Nuclear Rally is Scheduled," *Daily Sentinel*, 20 August 1979.

to make sure it did not harm their families. For example, Farrel Hobbs kept track of the tritium released into Great Western Reservoir because his family lived in Broomfield and relied on the reservoir's water for drinking, showering, and watering their garden. Workers also pointed out that the protesters and the media consistently critiqued the plant's "cloak of secrecy" and alleged that both Dow and Rockwell did not inform the public about the plant's environmental footprint. However, the plant's environmental monitoring reports were never hidden behind a "cloak of secrecy." Rockwell's managers distributed the reports to the media, scientific bodies, Colorado universities, and community meetings in an attempt to gain additional federal funding. According to Hobbs, a member of the plant's environmental monitoring team, these reports were comprehensive and did not exclude nor ignore inconvenient truths. Identifying problems, after all, provided Rockwell with more federal cash.[457]

The pro-nuclear conversations on the factory floor were so ubiquitous that they drew the attention of the labor union at Rocky Flats Plant, United Steelworkers of America Local 8031. In 1979, the union began planning and sponsoring a "pro-nuclear rally" at Rocky Flats Plant. Within days it allocated $20,000 from union coffers for a rally fund and established an organizing committee. With the blessing of the union, workers launched a new grassroots organization: Citizens for Energy and Freedom. The group argued that union workers were nearest to the "supposed dangers" of Rocky Flats Plant and, yet, union members reported good health. From their first-hand experience, they believed that their facility was safe and posed no dangers to the regional community. Kathy Erickson, a spokesperson for the group, told the press that she and other supporters of the plant wanted to dispel the fears about nuclear trigger manufacturing. "We aren't dying of cancer and our children aren't deformed," she said. "And

[457] Hobbs, *An Insider's View of Rocky Flats,* 22, 6, 20.

we're not murderers." Along with championing the safety of Rocky Flats Plant, the group believed that by manufacturing nuclear deterrent they were keeping people safe. In addition to organizing behind Rocky Flats Plant, Citizens for Energy and Freedom promoted the development of nuclear power for energy purposes. In June 1979, 200 members of Citizens for Energy and Freedom traveled to Fort St. Vrain Nuclear Power Plant near Platteville, Colorado, to show their support for its nuclear energy mission.[458]

After the Fort St. Vrain gathering, Citizens for Energy and Freedom refocused on planning its Rocky Flats Plant rally. The group believed that the event "must be a resounding success or else the result would simply play into the hands of anti-nuclear proponents in a way that even the latter could not have better planned for itself." If not enough people attended the rally, it could signal that worker support for the plant was low and further invigorate the anti-Rocky Flats Plant movement. Citizens for Energy and Freedom used the factory floor as a fundraising ground, passing around envelopes for donations. Meanwhile, Steelworkers Local 8031 reached out to Labor leadership across the country for support. Thanks to its efforts, the Colorado AFL-CIO contributed to the rally fund and passed a resolution endorsing Citizens for Energy and Freedom and the planned rally. Rockwell helped support the event, too. The firm solicited donations from local businesses where workers shopped.[459]

On August 26, 1979, Citizens for Energy and Freedom held its pro-nuclear rally, "Power for the People," outside of Rocky Flats Plant. Workers showed up with their friends and family. The Steelworkers' community in Pueblo gathered their loved ones into buses and made their way

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[458] Roth, *Local 8031*, 66; Kristen Iversen, *Full Body Burden: Growing Up in the Nuclear Shadow of Rocky Flats* (New York: Broadway Books, 2013), 185; "St. Vrain Shutdown Urged by Antinuclear Protestors," *Daily Sentinel*, 3 June 1979; "Anti-Nuclear Demonstrators Calmly Protest Worldwide," *Daily Sentinel*, 4 June 1979.
[459] Roth, *Local 8031*, 66-7; Ackland, *Making a Real Killing*, 188.

to Rocky Flats Plant. Other union workers came from as far away as California and Texas to support their brothers in labor. In all, 16,000 people attended the event. The attendees wore union jackets, ate popcorn, and brandished American flags. They listened to speeches by union leaders, including Peter Brennan. Brennan had served as the Secretary of Labor in the Nixon Administration, the leader of the Building Trades in New York, and was then the elected President of the AFL-CIO Building and Construction Trades Department. Following, the speeches, attendees listened to a variety of union bands, including Boots Randolph, a country-western blues saxophonist. The event demonstrated a few things. First, that Rocky Flats Plant workers supported their factory and were not persuaded by Rocky Flats Action Group, Ellsberg, and the other protesters. Second, that union workers from across the country were willing to devote their time and energy well beyond the usual call for Union duties to support their fellow laborers. And, finally, that thousands of average Americans were willing to fight for this manifestation of the military-industrial complex.[460]

The pro-nuclear rally and the larger Citizens for Energy and Freedom movement took the air out of the anti-Rocky Flats Plant protests. Although Rocky Flats Action Group and other anti-nuclear activists continued to flock to the plant year after year, they no longer worried the workers, nor dominated the press. In 1982, Coloradans got the opportunity to vote on whether Rocky Flats Plant should continue to operate. On November 3, Coloradans journeyed to their polling places to vote on a proposed amendment to the state constitution which would ban all "nuclear weapons component production in Colorado." The voters defeated the amendment 584,356 to 326,550.[461] In 1983, the AFSC organized an "encirclement" of the plant. The goal

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[460] Pat Buffer, "Rocky Flats Site History," 2002, Office of Legacy Management, Department of Energy; Roth, *Local 8031*, 66-7; Iversen, *Full Body Burden*, 185.
[461] Hobbs, *An Insider's View of Rocky Flats*, 42-3.

was to have activists join hands and encircle the plant's perimeter in peaceful protest. The operation happened on October 15, 1983. Twenty thousand people showed up, covering all but two or three miles of the seventeen-mile perimeter of the plant. Yet the press, Rockwell management, and the workforce paid little attention to the activists. Although the anti-Rocky Flats Plant movement had grown, it appeared that it did not threaten the plant.[462]

While driving to Rocky Flats Plant on the morning of the encirclement, Jack Weaver, then a plutonium production manager at the factory, saw the activists gather along the road. "Well, the peaceniks are back," he recalled thinking to himself. "I'm doing something that I think is valuable to the country. And oh, by the way, the reason you're out here able to protest is because I'm doing what I'm doing."[463] Weaver's attitude encapsulated the situation at Rocky Flats Plant in 1983. The workers remained committed to their conviction that Rocky Flats Plant provided safety, and not dangers, to Americans. Furthermore, the protests had become blasé in the eyes of the workers. While the activists returned to Rocky Flats Plant for annual demonstrations, their efforts yielded little. It looked like the nuclear loyalists had safeguarded the future of Rocky Flats Plant for now.

<u>The Struggle Over Pantex</u>

During the 1980s, Americans living in the Southern Plains cast a critical eye on Pantex. As the Reagan Administration saddled Pantex with a new mission, assembling neutron bombs,

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[462] "20,000 Link Up at Arms Protest," *Daily Sentinel*, 16 October 1983; Ackland, *Making a Real Killing*, 193.
[463] Jack Dale Weaver, interview by LeRoy Moore, 2 June 1998, OH1516, Carnegie Library for Local History, Boulder, Colorado; Ackland, *Making a Real Killing*, 194.

one local Roman Catholic bishop began a crusade against the factory. Bishop Leroy T. Matthiesen attacked Pantex on the grounds of Catholic morality. He implored workers to resign from Pantex, called for the federal government to abandon nuclear weapon manufacturing and the doctrine of deterrent, and sparked a conversation within the Roman Catholic Church on the ethics of the nuclear arms race. Thanks to national media coverage, Matthiesen won dozens of converts to his cause. His new followers—peace and environmental activists from Texas, Oklahoma, and New Mexico—organized a protest movement aimed at Pantex.

As the activists called attention to the immorality of nuclear weapons manufacturing and called for Pantex to close, Amarilloans defended Pantex and took aim at Matthiesen. City leaders maintained that Pantex was economically essential to the community. Local Catholics distanced themselves from the diocese and chastised their bishop. Some West Texans threatened Matthiesen for speaking out. Perhaps because the protest movement was small, or because Pantex was too essential to the local economy, Pantex workers felt no need to create a counter-protest organization. Despite Matthiesen and the other activists' actions, it looked like the crusade against Pantex was doomed from the beginning.

Although West Texans would come to consider him a rabble-rouser and an outsider, Matthiesen spent most of his life living peacefully in West Texas. Born on a cotton farm near Olfen in 1921, Matthiesen had deep roots in the Panhandle. In 1946, Matthiesen was ordained a Roman Catholic priest. For the balance of his life, he performed routine parish duties in and around the Diocese of Amarillo. While living and working in Amarillo for thirty-three years, Matthiesen had routinely driven past Pantex without giving it much thought. He knew it provided jobs to the balance of his parishioners. He also knew that it made weapons of war.

Pantex did not stir any strong emotions from Matthiesen for most of his life. It was simply a feature of the city.[464]

In the early 1980s, a few pious Americans drew Matthiesen's attention to Pantex. In March 1980, Matthiesen became the bishop of the Diocese of Amarillo. That summer, the Victory Noll Missionary Sister Regina Foppe challenged Matthiesen to condemn Pantex as "a theft from the poor." To Foppe, Pantex diverted government resources from the mouths of the hungry to assembling nuclear warheads. After speaking with Foppe, Matthiesen balked at condemning Pantex but began contemplating the morality of the facility. In February 1981, Matthiesen learned that the Oblate Priest Larry Rosebaugh and five other activists had scaled Pantex's outer security fence, held a vigil inside the gates, and been arrested. Stunned by the incident, Matthiesen visited Rosebaugh in the Potter County Detention Center. Rosebaugh told Matthiesen that Pantex was an immoral facility and that the bishop should pray about its existence. Months later, a deacon in the diocese met with Matthiesen to discuss Pantex. The deacon had a troubled conscience. He worked at Pantex and worried that he was contributing to an industry that contradicted his faith. Matthiesen temporized, guiding the deacon to stay on at Pantex for the time being.[465]

In August 1981, the Reagan Administration approved the assembly of the neutron bomb at Pantex. Like other West Texans, Matthiesen had voted for Reagan in 1980, primarily because he supported the Gipper's stance on parochial education and rural issues. However, the White

[464] A.G. Mojtabai, *Blessed Assurance: At Home with the Bomb in Amarillo, Texas* (Syracuse: Syracuse University Press, 1997), 53, 7; Bishop Leroy Matthiesen, "Let's Drop the Bomb: It's Time to Get Rid of Nukes," *U.S. Catholic*, April 2010.
[465] Matthiesen, "Let's Drop the Bomb"; "Six Arrested at Pantex Plant," *Amarillo Globe-News*, 6 February 1981. Rosebaugh received a one-year prison sentence for criminal trespassing. See Ron Gaston, "Pantex 6 Get Jail Sentences," *Amarillo Globe-News*, 13 April 1981.

House's pursuit of the neutron bomb infuriated Matthiesen. He deemed the weapon particularly venal because it was designed to spew radiation across its target while leaving infrastructure intact. According to Matthiesen, manufacturing such a weapon was an affront to God and the Church. Even more upsetting to the bishop was the notion that the neutron bomb would be assembled in his diocese. Matthiesen became convinced that Amarillo and the United States had lost their "moral moorings" by chasing the neutron bomb. He would no longer stand idly by while his community and country manufactured nuclear weapons.[466]

On August 23, 1981, Matthiesen publicly lambasted the neutron bomb and Pantex by publishing a tract in his diocesan newspaper, *West Texas Catholic*. In it, Matthiesen condemned the federal government for embracing the neutron bomb and assembling the device at Pantex. Furthermore, Matthiesen chastised the United States for its history of manufacturing nuclear weapons, arguing that all forms of the ordnance were immoral. Matthiesen recognized that the military-industrial complex was a participatory organization. Consequently, he also set his sights on the West Texans that assembled nuclear weapons at Pantex. He argued that everyone who played a role in the making of nuclear weapons, even the person whose job it was to paint the bombs, shared a degree of complicity in the "inherent evil" of the ordnance. He called for West Texans to "stop this madness," consider the consequences of their labor, and resign from Pantex.[467]

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[466] Matthiesen, "Let's Drop the Bomb"; Mojtabai, *Blessed Assurance,* 53-4; Stephanie Cooke, *In Mortal Hands: A Cautionary History of the Nuclear Age* (New York: Bloomsbury, 2009), 333.
[467] L.T. Matthiesen, "Statement on the Production and Stockpiling of the Neutron Bomb," *West Texas Catholic*, 23 August 1981; Joseph Nocera, "The Bishop Drops A Bomb," *Texas Monthly*, June 1982; Leroy T. Matthiesen, *Wise and Otherwise: The Life and Times of a Cottonpicking Texas Bishop* (Amarillo: Custom Printing Company, 2005), 139-41.

Figure 17: Bishop Leroy Matthiesen. 1980. Photograph courtesy of the Diocese of Amarillo Archives, Amarillo, Texas.

Matthiesen's anti-nuclear tract found immediate purchase with collegiate and religious institutions. Days after publishing his article, Matthiesen accepted an invitation to speak at West Texas State University about Pantex and his anti-nuclear message. One student advertised Matthiesen's lecture by plastering announcements on school bulletin boards, only to have a professor follow her and rip the advertisements down. In the end, Matthiesen found himself in front of an audience of two hundred students and faculty members. His talk, "I Didn't Know the Gun Was Loaded," criticized Pantex and other manifestations of the nuclear military-industrial complex for threatening the world with total annihilation. As a West Texan, Matthiesen could not resist using the cowboy trope to deliver his message. "It is high noon on Main Street on Planet Earth," Matthiesen said. "But the characters in the nuclear hats are not Clint Eastwood and Gary Cooper. The characters wearing the hats are dealers in death whose guns are loaded with noonday suns that vaporize and cremate and sow cancer. We need to be reminded of that and say 'No more,' for the alternative is annihilation." In the days following his lecture, Matthiesen received an invitation to speak at the interdenominational Riverside Church in New York City. Matthiesen once again delivered his signature speech, "I Didn't Know the Gun Was Loaded," to a crowd of New York parishioners.[468]

While speaking at Riverside Church, Matthiesen drew the attention of journalists, television crews, and writers to Pantex. Days after Matthiesen's address, the national media flocked to Amarillo to interview the bishop and investigate Pantex. *The New York Times* was the first national newspaper to spotlight Matthiesen. The paper sent Kenneth Briggs to Amarillo to write a story worthy of front-page copy. Briggs styled Matthiesen's efforts as an "unpopular, one-man campaign." He noted that not a soul in Amarillo had resigned from Pantex, despite Matthiesen's call.[469] *Time*, *Newsweek*, *Life*, *The New Yorker*, *The Washington Post*, and *The Texas Monthly* followed Briggs to Amarillo, as did television crews from ABC, CBS, NBC, and the BBC. Matthiesen's Riverside Church address also inspired the independent writer A.G. Mojtabai to travel to Amarillo. There, she interviewed Pantex employees, local ministers, and residents simply walking the city streets about their views on the factory.[470]

As Matthiesen drew journalists, writers, and national attention to Amarillo, local leaders defended Pantex. Responding to Matthiesen's criticism, Amarillo Mayor Rick Klein reminded West Texans about the economic benefits of the factory. "Pantex is good for the business

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[468] Matthiesen, *Wise and Otherwise*, 142-3, 152; Hunt, "'Host and Hostage,'" 349.
[469] Kenneth A. Briggs, "Religious Leaders Objecting to Nuclear Arms," *New York Times*, 8 September 1981.
[470] Matthiesen, *Wise and Otherwise*, 143, 146-8; Hunt, "'Host and Hostage,'" 350. For a few examples of the press Matthiesen received, see Colman McCarthy, "Brave Bishops," *Washington Post*, 3 October 1981; Richard N. Ostling, "Religion: Catholics Take to the Ramparts," *Time*, 19 April 1982; Joseph Nocera, "The Bishop Drops A Bomb," *Texas Monthly*, June 1982, 161-170; Mojtabai, *Blessed Assurance*, 62.

community," he proclaimed. "It's good for Amarillo. We never had any trouble with Pantex." Outside of this statement, however, city officials did little to launch a defense against Pantex's detractors.[471] Most believed they did not need to rally the public behind the factory because, they maintained, Pantex was already securely ingrained in the fabric of Amarillo. Amarillo City Manager John Ward said he did not ever "lose any sleep over Pantex" and that he did not think that other local residents did, either. "It's here. It's been here for a long time. People accept it. It's an important industry for the area," he said. The local press thought likewise. Dave Harter, the television sales representative for Channel 7 in Amarillo, told an investigator that Matthiesen's effort was a confrontation "against momentum—lots of years and lots of money." The local government and press were of one mind: Matthiesen's crusade was doomed before it began.[472]

Still, a few Amarilloans felt that Matthiesen's commentary posed a threat to Pantex and took action to defend the factory. The Southwest Baptist Church Pastor Alan Ford held a public event to boost Pantex, entitled "Pantex Appreciation Sunday." Held on May 23, 1982, the scene gathered hundreds of local residents to hear Ford defend Pantex as a local economic necessity and nuclear weapons as "a necessary part of defense."[473] Another local pastor, W. Winfred Moore of First Baptist Church, supported Ford's efforts. On April 8, 1983, Moore and Matthiesen took the stage at Amarillo College to debate Pantex and the nuclear arms race. During the event, Moore criticized Matthiesen for attacking the livelihood of the city and took

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471 Matthiesen, *Wise and Otherwise*, 144.
472 Mojtabai, *Blessed Assurance*, 58, 56.
473 Matthiesen, *Wise and Otherwise*, 144; Mojtabai, *Blessed Assurance*, 55; Charles Austin, "Nuclear Arms Can Be A Volatile Topic for Clergy," *New York Times*, 20 April 1982; Michael J. Weiss, Kent Demaret, and Sharon Watson, "After a Week of Nuclear Protest, the Machinery of War Remains Grimly in Place," *People*, 3 May 1982.

issue with the bishop's characterization of nuclear weapons as immoral devices in the face of Soviet aggression.[474] Other West Texans defended Pantex by harassing and attempting to intimidate Matthiesen. According to Matthiesen, "several" residents told him to take a one-way trip to the Soviet Union. One West Texan approached Matthiesen in the Amarillo airport and snarled, "traitor." Another sent Matthiesen a card reading: "Repent in Sixty day or die."[475]

Local Catholics began to turn against Matthiesen because of his stance against Pantex. Some of the faithful merely distanced themselves from the bishop and the diocese. Robert Gutierrez, an ordained deacon, decided he was "doing nothing wrong" by working at Pantex. When Matthiesen challenged him to "give up his livelihood" and quit the plant, Gutierrez asked to become an inactive deacon and stepped away from his church responsibilities.[476] Other parishioners stayed active in the diocese, but leveled criticism against Matthiesen. Along with challenging adults to quit Pantex, Matthiesen taught high school confirmation candidates about the immorality of the facility, drawing the ire of parents, who charged that Matthiesen was "brainwashing" their children with "radical" views. More of the faithful turned on Matthiesen when he allowed television crews to film a Confirmation Mass as part of their coverage of the bishop and Pantex. After the religious celebration, parents of the confirmation candidates chastised Matthiesen for turning "a church service into a political statement."[477] Over time, local Catholics began referring to Matthiesen as "an outsider," in contrast to his predecessor, Bishop Lawrence Michael De Falco. Although West Texans regarded De Falco as "one of us," he had

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[474] Paul H. Carlson, *Amarillo: The Story of a Western Town* (Lubbock: Texas Tech University Press, 2006), 215.
[475] Matthiesen, *Wise and Otherwise*, 142, 146, 144.
[476] Briggs, "Religious Leaders Objecting to Nuclear Arms."
[477] Matthiesen, *Wise and Otherwise*, 147-8, 145.

been born and raised in Pennsylvania, while Matthiesen had deep roots in West Texas. Indeed, it was Matthiesen's critique of Pantex that branded him as a stranger in his homeland.[478]

As Matthiesen navigated criticism and hostility, other Roman Catholic bishops in Texas came to his aid. The Diocese of San Angelo Bishop Joseph A. Fiorenza voiced support for Matthiesen and promised to call for a resolution of support by the other Texas bishops. On September 12, 1981, all twelve Roman Catholic bishops in Texas met in Corpus Christi to discuss Matthiesen, Pantex, and the neutron bomb. During the meeting, Fiorenza presented his resolution. It passed unanimously. Furthermore, the bishops adopted a statement attacking the White House's decision to assemble the neutron bomb. The document called on the Reagan Administration to "pursue every avenue to advance a nuclear arms treaty" and condemned the nuclear arms race in general. After the meeting, Fiorenza took to the press and asked the faithful to join them in their opposition. "We should not let our government go unchallenged," he said. "There has just been a drift in our country at this time and people need to know there is a moral dimension to these issues."[479]

Matthiesen and the other Texas bishops' commentary on Pantex and the nuclear arms race sparked a larger conversation within the Roman Catholic Church on the morality of nuclear weapons. In the November 1981, the National Conference of Catholic Bishops appointed a committee of five bishops, headed by Cardinal Joseph A. Bernardin, to undertake a nationwide consultation on the issue. In June 1982, the U.S. Bishop's Committee drafted a pastoral letter on war and peace. Taking cues from Matthiesen, the committee lambasted both the possession and

[478] Mojtabai, *Blessed Assurance*, 53.
[479] Matthiesen, *Wise and Otherwise*, 145-6, 155-7; "Texas Catholic Bishops Reject Neutron Bomb," *New York Times*, 13 September 1981.

use of nuclear weapons. The letter drew the attention of the Vatican. Weeks after the committee drafted the document, Pope John Paul II, acting through the Vatican Secretary of State Cardinal Agostino Casaroli, issued a statement on the possession of nuclear weapons as a deterrent. The enunciation condemned the use of nuclear weapons but judged the possession of nuclear weapons as deterrent as "morally acceptable." Nearly a year later, in May 1983, the U.S. Bishop's Committee met again to tend to their document. In order to align themselves with the papacy, the committee carefully edited their statement and issued it under the title *The Challenge of Peace*. The letter echoed the judgement of John Paul II, condemning the use of nuclear weapons but accepting their possession as a deterrent. Although Matthiesen and the other Texas bishops disagreed with the morality of deterrence, they reluctantly voted for the pastoral letter at the conference. As Matthiesen put it, he and the other Texas bishops did so in order to "get in line" with the Vatican.[480]

Although Matthiesen failed to convert West Texans and the Church hierarchy to his cause, his efforts did inspire one Pantex worker to quit the factory. In May 1982, one of Matthiesen's parishioners, Eloy Ramos, quit his job at Pantex after a year of soul-searching. Ramos had worked at Pantex for nearly sixteen years but came to believe that his labor would lead to an eventual nuclear holocaust.[481] After submitting his two-weeks notice, Ramos feared that his last day on the job would be filled with rancor. However, when he arrived at the factory for his final shift, he noted that "everybody acted normal, and many came and asked me not to

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480 Matthiesen, *Wise and Otherwise*, 145-6, 155-7; National Conference of Catholic Bishops, *The Challenge of Peace: God's Promise and Our Response, A Pastoral Letter on War and Peace, May 3, 1983* (Washington, D.C.: United States Catholic Conference, 1983); Matthiesen, "Let's Drop the Bomb."

481 "Religion News," *Galveston Daily News*, 12 June 1982; Cindy Lee, "Pantex Employee of 16 Years, Citing Religious Reasons, Quits," *Amarillo Globe-News*, n.d., folder 35, box 2, Toxic Tour of Texas Collection, Southwest Collection, Texas Tech University, Lubbock, Texas.

quit." At break time, some of the employees surprised Ramos with a couple of cakes and a small celebration honoring his work at the plant. At the end of the day, the other workers presented Ramos with a wristwatch and a sincere farewell. After leaving the factory, however, Ramos struggled to find a new job in Amarillo. He had been making nearly $12 an hour at Pantex and hoped to find a local position with similar pay. Yet, windswept Amarillo had little industry with pay comparable to Pantex, leaving Ramos in a lurch. Matthiesen set up a small welfare fund, the peace fund, to help support Ramos and other workers if they chose to resign. However, Ramos's pride and his belief in his "God given talents" led him to refuse the funds. While Ramos and his family struggled making ends meet, the local press made sure that other workers understood they would suffer from a similar fate if they left Pantex. After learning about Ramos's situation, the *Amarillo Daily News* published Ramos's story under the headline: "Pantex Ex-Worker Still Jobless."[482]

While Amarillo proved to be poor soil for sprouting Pantex activism, Matthiesen's efforts did inspire Americans living elsewhere on the Southern Plains to launch a challenge against Pantex. In 1983, activists from Texas, Oklahoma, and New Mexico formed the Red River Peace Network, an organization dedicated to the closure of Pantex, nuclear disarmament, and world peace. The group centered its efforts on organizing an annual event called the Pantex Pilgrimage. Held on August 6 through August 9, on the anniversaries of the Hiroshima and Nagasaki bombings, the pilgrimages challenged protesters to bicycle across the Panhandle to Pantex, camp outside of the factory gate, hold vigils for peace, and block the roads and railways leading to the facility in civil disobedience. According to the Red River Peace Network, the purpose of the pilgrimage was threefold. It served as a "grassroots educational outreach to people in towns

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[482] "Pantex Ex-Worker Still Jobless," *Amarillo Daily News*, 21 May 1982.

along the way." It provided "exposure of the deadly connections of nuclear power and waste, militarism, and the arms race." And, finally, it constituted a "peace witness." The pilgrimages lasted eleven years, from 1983 to 1994.[483]

Although the pilgrimages differed each year, the 1985 pilgrimage offers an emblematic snapshot of the peloton. That year, three-dozen cyclists made their way to Pantex. Most of the riders began their journey from the Comanche Peak nuclear power plant in Glen Rose, south of Fort Worth. A few started in Houston. Six cars and vans trailed them, carrying baggage, water, and snacks. Most of the cyclists were long-time activists, having cut their teeth in the various 1960s protest movements. Many of the cyclists were educators who taught young Americans about the political power of civil disobedience in the classroom and by example. Bobby Slovak, a government teacher at the A&M Consolidated High School in College Station, was one of these cyclists. Slovak told a reporter that although his students had been "very much affected by the conservative A&M environment and by the tenor of the times," he tried to "impress upon his high school seniors the idea that civil disobedience and other more 'unusual' forms of political participation are just as important to democracy as voting is." Slovak said that he was offended by TV commercials and programs that depicted his generation, the former 1960s activists, as "sell-outs." He hoped that by riding to Pantex he could serve as "evidence" that his generation was still concerned with social reform and revolution. Slovak was joined by Kathleen Stockwell, an art teacher from Austin and the chairwoman of the Red River Peace Network. Sporting a

[483] Kathleen Stockwell, "The 1987 Pantex Pilgrimage," "Pantex 1987 Extra" folder, box 7, Toxic Tour of Texas Collection, Southwest Collection, Texas Tech University, Lubbock, Texas; Red River Peace Network, "Pantex Pilgrimage & Peace Camp '87," "Pantex 1987 Extra" folder, box 7, Toxic Tour of Texas Collection, Southwest Collection, Texas Tech University, Lubbock, Texas; Red River Peace Network, "Pantex Pilgrimage 85 Goals," folder 24, box 6, Toxic Tour of Texas Collection, Southwest Collection, Texas Tech University, Lubbock, Texas; Hunt, "'Host and Hostage,'" 353.

floppy straw hat inscribed with a slogan celebrating five years of revolution in Nicaragua, Stockwell's attire did not inspire a feeling of solidarity with the West Texas populace. She, and the other riders, were not concerned with blending in. They were, in their own words, "an odd and freaky people," dedicated to disrupting the status quo that supported Pantex's presence in the Panhandle.[484]

Most of the pilgrims challenged Pantex not on the basis of politics, but on ideological and philosophical grounds. They believed that the only way to "win" the nuclear arms race was "not to play the game." The cyclists seldom spoke of "strategies" for changing the political system. In fact, they rarely spoke of politics at all. Not of first strike theory, nor deterrent, nor disarmament. Rather, they often spoke of "inner transformation" and spiritual progress. To the cyclists, the road to Pantex was about pursuing peace on an individual level by protesting a factory of war. One cyclist, Carl Schaer, encapsulated their moral philosophy, stating, "Whether we can stop [the nuclear arms race], or not, I don't know. All I can do is say 'no' as strong as I can. The rest is up to God." Some looked to Leo Tolstoy's "The Kingdom of God is Within You," for inspiration. Others looked to Gustavo Gutierrez, the father of liberation theology. Many looked to Gandhi.[485]

However, the most outspoken pilgrimage leader, John Stockwell, did critique Pantex on the basis of politics. A former CIA official, Stockwell had managed the United States's involvement in the Angolan Civil War in 1975. In December 1976, Stockwell quit the clandestine agency in protest of its paramilitary operations in Third World counties and relocated

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[484] "40 Years is Enough," n.d., folder 24, box 6, Toxic Tour of Texas Collection, Southwest Collection, Texas Tech University, Lubbock, Texas; Dave Denison, "On the Road to Pantex," *Texas Observer*, 30 August 1985.
[485] Denison, "On the Road to Pantex."

to Austin where his wife, Kathleen, taught school. There, in 1978, Stockwell published the exposé *In Search of Enemies*. In it, Stockwell argued that the CIA was counterproductive to national security and provided no benefit for the United States. After the CIA sued Stockwell for the incendiary claims he made in the book, Stockwell filed for bankruptcy and turned his attention to Pantex. Stockwell branded Pantex as the place "where the end of the world begins." He maintained that the plant, like the CIA, was counterproductive to national security because its products promised the destruction of the United States. As Stockwell biked alongside Kathleen and their thirteen-year-old daughter in the peloton, he stopped in small West Texas towns to educate passers-by on Pantex, give radio interviews, and meet with local newspaper editors. In his discussions, Stockwell took care to liken Pantex to the CIA, branding both as engrained entities that were counterproductive to American interests.[486]

After arriving in Amarillo on August 4, the cyclists joined with thirteen other protesters in a ditch on the side of the road outside the Pantex gate. There, the fifty activists listened to Matthiesen, John Stockwell, Daniel Ellsberg, Dr. Charlie Clements, and Jim Douglass deliver speeches on Pantex and the nuclear arms race. They also met with the *hibakusha* Sachi Yoshizaki and Shunzabra Tanabe, two Japanese survivors of the Hiroshima and Nagasaki bombings who traveled to the event to serve as witnesses of nuclear warfare. The main attraction, however, was the planned occupation of the Santa Fe railroad tracks leading to the factory. The protesters coordinated their occupation of the tracks with the local police and sheriff departments, which allowed the protest as long as no property was destroyed. After completing

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[486] John Stockwell, *In Search of Enemies: A CIA Story* (New York: W.W. Norton & Co., 1978); "Hear John Stockwell Speak on the Secret Wars of the CIA," n.d., folder 26, box 6, Toxic Tour of Texas Collection, Southwest Collection, Texas Tech University, Lubbock, Texas; John Stockwell to "Friends," n.d., folder 24, box 6, Toxic Tour of Texas Collection, Southwest Collection, Texas Tech University, Lubbock, Texas.

non-violence training, on August 6, a few select members of the group sat on the tracks for three days in protest. The goal of the sit-in was not to block a train carrying nuclear weapons. Those trains only traveled to Pantex three or four times a year. Rather, the sit-in served as a commemoration of the atomic bombings of Hiroshima and Nagasaki and, in the words of one event organizer, as "a strong, human statement of resistance to the continuation of the nuclear arms race." On August 10, the event was over. The protesters left Amarillo and began planning next year's expedition.[487]

Although most local residents ignored the pilgrims, a few supported the group. In 1986, Leslie and Cindy Breeding purchased twenty acres of land across Highway 60 from Pantex and erected the Peace Farm. The Peace Farm acted as a witness to Pantex. It was "a place to learn to live simply; a place for the people of Amarillo to learn a way of non-violence; and a place that can offer retreat and contemplation," Cindy explained. The Breedings understood that Pantex could not be dismantled without hurting the local economy. They did not blame local residents for working at the plant. Rather, they insisted that the state needed to provide "other meaningful work" to the community to replace Pantex. At the Peace Farm, thirteen other local anti-nuclear activists joined the Breedings to study non-violence and alternative forms of economic

[487] Denison, "On the Road to Pantex"; "Ellsburg: Stop the Testing," *Texas Observer*, 30 August 1985; "Pantex Pilgrimage '85: Hiroshima-Nagasaki Commemoration, 40 Years is Enough," file 20, box 6, Toxic Tours of Texas Collection, Southwest Collection, Texas Tech University, Lubbock, Texas; Red River Peace Network, "Together, Our Hearts United As One," folder 22, box 6, Toxic Tour of Texas Collection, Southwest Collection, Texas Tech University, Lubbock, Texas; Bob Henschen, "Civil Disobedience Planned at Pantex Nuclear Weapons Plant," file 20, box 6, Toxic Tours of Texas Collection, Southwest Collection, Texas Tech University, Lubbock, Texas.

development. They hoped that their modest think-tank would yield a "locally-acceptable" plan to dismantle Pantex and replace it with a "peaceful" economic entity.[488]

Although Matthiesen, the Red River Peace Network, and the Peace Farm worked hard to challenge Pantex's existence, their efforts yielded little. With the exception of Ramos, no workers resigned in protest. Pantex continued assembling and recycling nuclear weapons, including neutron bombs, throughout the 1980s. One way to explain the failures of the activist movement is by considering it size. Numbering less than one hundred people, perhaps the anti-Pantex movement was too small to effect change. Another possible explanation is that the movement had no environmental component. As a nuclear weapons assembly factory, Pantex did not produce dangerous radioactive pollutants. If it had, perhaps the activists could have rallied local residents against Pantex's radiological footprint, much like the Rocky Flats Plant protesters did.[489] Although their modest movement seemed to have little impact, the Pantex activists kept the pressure on at the close of the 1980s. Perhaps, in time, their efforts would pay off.

The Struggle Over Hanford

In the 1980s, Pacific Northwesterners clashed over Hanford. As production at Hanford escalated with the renewal of the nuclear arms race, a handful of Hanford workers became concerned that the plant's facilities were outdated and posed health hazards to the workforce and the general public. Over time, the concerned workers reached out to members of the press to

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[488] Uncatalogued Peace Farm Materials, Southwest Collection, Texas Tech University, Lubbock, Texas; "Anti-Nuclear Couple Settles 'Peace Farm' in Shadow of Amarillo's Pantex Plant," *Tyler Morning Telegraph*, 25 April 1987; Hunt, "'Host and Hostage,'" 353.

[489] Sam Cohen, "Check Your Facts: Cox Report Bombs," *Insight on the News*, 9 August 1999.

draw attention to Hanford. As journalists began casting a critical eye on the factory, hundreds of Pacific Northwesterners organized in opposition to Hanford. These activists claimed that Hanford saddled the region with radioactive pollution and perpetuated international tensions by producing plutonium.

As the activists published whistleblower complaints, gathered documentation on Hanford's radioactive footprint, and held rallies demanding the factory's closure, the local community rallied behind the plant. In 1986, Hanford workers partnered with Tri-Cities residents to form a counter-protest organization to defend their livelihood, the Hanford Family. This group claimed that the activists and the media were overplaying the dangers associated with the plant out of ignorance and for the pursuit of fame. Furthermore, the Hanford Family maintained that the plant helped secure international peace. Espousing the doctrine of nuclear deterrent, the Hanford Family believed that Hanford's plutonium helped make war with the Soviet Union so terrible it was not an option.

Throughout the Cold War, Hanford weathered several deactivations. The Johnson and Nixon administrations closed all but one of Hanford's nuclear reactors between 1964 and 1971. Furthermore, the Nixon White House shutdown Hanford's PUREX plant—the building where workers processed spent fuel rods into plutonium dioxide—in 1972.[490] These closures aligned with Johnson and Nixon's national security strategies, which relied less on nuclear deterrent and more on conventional weapons of war.[491] Despite these shutdowns, Hanford continued to produce plutonium throughout the 1970s via its remaining reactor, N Reactor. Operated by

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[490] Karen Dorn Steele, "Plutonium," *Spokesman-Review*, 2 December 1984.
[491] For an analysis of Johnson and Nixon's national security strategies, see John Lewis Gaddis, *Strategies of Containment: A Critical Appraisal of American National Security Policy During the Cold War* (New York: Oxford University Press, 2005), 197-234, 272-306.

Rockwell, N Reactor operated as a dual-purpose reactor, supplying nuclear power to the civilian electrical grid and producing the plutonium that Rocky Flats Plant workers molded into nuclear triggers.[492]

Ronald Reagan's ascent to the presidency revitalized Hanford. During his 1980 presidential campaign, Reagan brandished the phrase "peace through strength" against Jimmy Carter, accusing him of handicapping the United States's military might and thereby inviting enemies to attack the United States. Although his national security policy would later focus on procuring the Strategic Defense Initiative, a satellite weapon designed to destroy Soviet ICBMs, Reagan initially pursued "peace through strength" by increasing the United States's stockpile of nuclear warheads.[493] To do this, in 1982, the Reagan Administration called on Rockwell to reactivate Hanford's Z Plant, which turned plutonium nitrate solutions into nuclear triggers.[494] Then, in November 1983, the White House tasked Rockwell to reactive PUREX, the Hanford facility that reprocessed spent fuel to make weapons-grade plutonium.[495]

Although Z Plant helped bolster the nation's nuclear arsenal, the facility was plagued with problems. Most of the factory's troubles stemmed from its outdated technologies and years of neglect. While working in the plant, one employee, the low-level operator Ed Bricker, noted that its vacuum system did not work and that the process hoods were filthy. These problems

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[492] Michele Gerber, *Plutonium Production Story at the Hanford Site: Processes and Facilities History*, Report No. WHC-MR-0521 (June 1996), https://www.osti.gov/servlets/purl/664389.

[493] Lou Cannon, "Reagan: Peace Through Strength," *Washington Post*, 19 August 1980. For more on Reagan's national security strategy, see Gaddis, *Strategies of Containment*, 342-379.

[494] Karen Dorn Steele, "Plutonium," *Spokesman-Review*, 2 December 1984; Louise Kaplan, "Public Participation in Nuclear Facility Decisions: Lessons From Hanford," in *Science, Technology, and Democracy*, edited by Daniel Lee Kleinman (Albany: SUNY Press, 2000), 73; Brown, *Plutopia*, 287.

[495] Karen Dorn Steele, interview by Trisha Pritikin, 15 January 2019, Atomic Heritage Foundation, https://www.manhattanprojectvoices.org/tags/karen-dorn-steele; Karen Dorn Steele, "Plutonium," *Spokesman-Review*, 2 December 1984; Karen Dorn Steele, "PUREX Plant Tour Planned For Reporters," *Spokane Chronicle*, 14 January 1985.

reduced Z Plant's efficiency and threatened worker safety. These were not the only hazards that Bricker encountered at Z Plant. One day, Bricker discovered that Z Plant's blueprints and operating procedures were woefully out-of-date. The documents were so old that they did not show the new piping and valves put in place during the reactivation. If an uninformed worker misrouted plutonium slurry inside these new systems, the materials could set off a dangerous radioactive event. Bricker was also troubled by the state of the protective windows workers looked through while working with plutonium. Although the windows were structurally sound, they were so filthy that workers had a hard time seeing through them.[496]

Bricker was neither outsider nor rabble-rouser. He was a third-generation local resident, a pious Mormon, a father of five, a believer in the doctrine of nuclear deterrent, and a hard worker with a penchant for perfectionism. It was because he was dedicated to his community and his labor that he carefully documented all of the hazards he came across while working in Z Plant. After compiling a list of hazards present in the plant, Bricker submitted the document to Jim Albaugh, the head of Safety and Quality Assurance for Rockwell.[497]

By pointing out the hazards of Z Plant, Bricker unwittingly placed a target on his own back. One day after submitting his list of concerns, Bricker received an unscheduled, negative job appraisal. In August 1984, Bricker donned his rad-safe bodysuit to do routine work in Hanford's radioactive processing canyon. As he entered the canyon, Bricker's oxygen hose detached from its tank. As he scrambled for his backup air canister, he found that its handle had been taped shut. He ran for the exit, making it out in time before he collapsed from suffocation.

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[496] Brown, *Plutopia*, 287; Eric Nalder, "The Plot to Get Ed Bricker," *Seattle Times*, 30 July 1990; "Hanford Whistle-Blower Fears for Safety," *Longview Daily News*, 12 March 1987.
[497] Brown, *Plutopia*, 287; Nalder, "The Plot to Get Ed Bricker,"

After the incident, Bricker suspected that someone had deliberately tampered with his bodysuit to punish him for pointing-out the hazardous conditions in Z Plant. A DOE investigation followed. Although the DOE did not file an official report on the incident, an official told Bricker, off the record, that his suit had, in fact, been tampered with. The DOE failed to identify the culprit.[498]

Despite these reprisals, Bricker continued to call attention to Z Plant's troubling conditions. He wrote a series of letters detailing the problems of Z Plant to Rockwell management and complained to Hanford's DOE manager, Michael Lawrence. Instead of investigating Bricker's complaints, his supervisors sent him to the plant psychologist for a series of evaluations. Bricker maintained that these evaluations were part of a conspiracy to remove him from his job. If a psychologist diagnosed him with a mental health problem, Bricker would lose his security clearance. Over time, other Z Plant workers heard rumors that Bricker was trying to get the plant closed. Succumbing to fear of losing their jobs and anger, the laborers began harassing Bricker. They called him "whiner," "cocksucker," and "spy." They intimidated his family, too. While Bricker worked swing-shift, anonymous persons, ostensibly Hanford employees or other local residents, telephoned his wife with death threats.[499]

As Bricker navigated harassment from his bosses and coworkers, his family began to turn on him. Bricker's wife, Cindy, worked as a secretary at Rockwell's engineering office. Night after night, her husband told her that Z Plant was hazardous and needed significant renovations. Yet, everyone she worked with maintained that the factory was safe and needed few repairs.

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[498] "Hanford Whistle-Blower Fears for Safety," *Longview Daily News*, 12 March 1987; Brown, *Plutopia*, 287.
[499] Brown, *Plutopia*, 288; Nalder, "The Plot to Get Ed Bricker."

Cindy could not square the two stories. It appeared to her that her husband was either misinformed or paranoid. Arguments ensued. Bricker found no aid from his father-in-law, Harvey Earl Palmer. Palmer had worked at Hanford as a senior scientist. Like the other workers, Palmer argued that Z Plant was perfectly safe and quarreled with Bricker in the evenings. Worn down at work and at home, in 1984, Bricker asked for a transfer from Z Plant to Hanford's liquid waste storage area, the tank farms. The Rockwell personnel manager granted Bricker the transfer, as long as he promised to stop complaining.[500]

Z Plant was not the only Hanford building plagued with problems. In January 1984, PUREX workers discovered the presence of thoron particles in one of the building's smokestacks. Thoron is a radioactive gas produced by thorium decay. If inhaled, thoron particles can attach to human bronchi and cause lung cancer. The discovery of thoron in the smokestack prompted Rockwell to shutdown PUREX on January 25. Yet the firm maintained that thoron was a "non-problem" because its half-life was only twelve days. According to Rockwell spokeswoman Peggy Bennett, the thoron particles "did not get out of the plant stack" and were stuck to the sides of the smokestack from PUREX's previous operations "in the '60s and '70s."[501] After modifying procedures and control limits to account for the "off-normal" levels of thoron, Rockwell reopened PUREX on February 16. In other words, Rockwell did not remove the thoron. The firm just changed how it interpreted and reported thoron readings.[502]

Shortly after the thoron incident, an anonymous Hanford employee telephoned Karen Dorn Steele, a Spokane journalist that covered the thoron story. The woman claimed she was an

[500] Brown, *Plutopia*, 288-9; Nalder, "The Plot to Get Ed Bricker."
[501] Karen Dorn Steele, "Hanford Folk Deny Violation," *Spokane Chronicle*, 11 February 1984.
[502] "Hanford N-Plant Restarted," *Spokesman-Review*, 17 February 1984.

engineer at PUREX and told Steele that she was worried that PUREX would explode. The anonymous caller said that PUREX operated using outdated, "fifties-era technology" and unsafe equipment. Furthermore, she added that PUREX management had indicated that forty kilograms of plutonium had gone missing. "Nobody knew what 'missing' meant," Steele recalled. The material could have been stolen, misplaced somewhere in the facility, or perhaps was building up in a bend of a pipe. Following the story, Steele filed a Freedom of Information Act (FOIA) request for PUREX's "Material Unaccounted For" or "MUF" reports.[503] The DOE released a series of MUF reports to Steele weeks later. The papers documented that plutonium had gone missing at PUREX. Fearing that the missing plutonium could lead to a critical nuclear event at PUREX, Steele published stories in the *Spokesman-Review* and the *Spokane Chronicle* on PUREX's missing plutonium and the other hazards she believed PUREX posed to the regional community. By doing this, Steele hoped to convince other Washingtonians to put pressure on Rockwell and the DOE to locate the missing plutonium and close the PUREX plant.[504]

While Steele shed light on PUREX in the newspapers, an emergency gripped the plant in July 1984. The Reagan Administration's appetite for plutonium caused PUREX laborers to work overtime and focus solely on production. As a result, workers shirked their routine cleaning responsibilities. By July 25, the consequences of poor sanitation came to a head. Powdered plutonium had accumulated in PUREX's ventilation hoods. Overridden with plutonium dust, the vents spewed the particles across the factory. "It was just all over everywhere—on the floor, in

[503] Karen Dorn Steele, interview by Trisha Pritikin, 15 January 2019, Atomic Heritage Foundation; Karen Dorn Steele, "Hanford Folk Deny Violation," 11 February 1984, *Spokesman-Review*; Karen Dorn Steele, "Plutonium," *Spokesman-Review*, 2 December 1984; Brown, *Plutopia*, 289.
[504] Karen Dorn Steele, "PUREX Probe Finds Numerous Problems," *Spokane Chronicle*, 23 August 1984; Karen Dorn Steele, "Plutonium Plant: How Safe Is It?," *Spokesman-Review*, 26 August 1984; Karen Dorn Steele, interview by John Osborn, 15 February 2018, Center for Environmental Law and Policy, https://celp.org/karen-dorn-steele/.

the hoods—the workers were scared to death to go down there," one Hanford worker said. In response to the disaster, Rockwell shut down the plant for nine days. During the scouring that followed, workers recovered between five and thirteen kilograms of plutonium from the ventilation hoods and other parts of PUREX.[505]

While Rockwell tended to PUREX, peace advocates in the region organized in opposition to Reagan's Cold War rhetoric and the reactivation of the two Hanford plants. In September 1984, dozens of activists met at Spokane Unitarian Church to form the Hanford Education Action League (HEAL). The group defined its mission as "help[ing] citizens examine and…challenge policies that promote nuclear weapons at the expense of environmental quality, public health and human dignity." Led by Bill Hough, a Unitarian minister with a doctorate in chemistry, HEAL was particularly concerned with Hanford's environmental implications for nearby Spokane. They feared that the plant had poisoned the city with carcinogens as early as 1945, and that the community would soon feature a cancer epidemic. In order to determine if this was true, HEAL partnered with Robert Alvarez of the Environmental Policy Institute in Washington, D.C., to file FOIA requests pertaining to Hanford's radioactive emissions.[506]

While HEAL attempted to gather information, Hanford's DOE Operations Manager Michael Lawrence asked the DOE Office of Safeguards and Security to investigate PUREX for the missing plutonium. The DOE responded by conducting an audit in October 1984. The

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[505] Karen Dorn Steele, "Plutonium," *Spokesman-Review*, 2 December 1984.
[506] Historians, such as Michele Stenehjem Gerber and Kate Brown, have written that HEAL organized in 1985. However, newspaper articles in September 1984 mention the organization sponsoring events in the Spokane area. See, "Religion Calendar," *Spokane Chronicle*, 15 September 1984; "Events," *Spokane Chronicle*, 19 September 1984; Karen Dorn Steele, "Doctor: Spokane Faces Danger from Hanford," *Spokesman-Review*, 21 September 1984; Gerber, *On the Home Front*, 203; Brown, *Plutopia*, 290; For more on HEAL's goals, see, Hanford Education Action League, *Mission Statement and Goals* (Spokane: Hanford Action League, 1985); D'Antonio, *Atomic Harvest*, 30, 43; Karen Dorn Steele, "Coalition Seeks Data on Radiation," *Spokesman-Review*, 30 January 1986.

auditors discovered that PUREX had lost ten to thirteen kilograms of plutonium—enough plutonium to create a bomb with the strength of *Fat Man*. After reviewing the audit, Lawrence maintained that the plutonium had not been stolen and was lost inside of PUREX's piping. One Rockwell employee explained that the lost plutonium was a result of "an intense government push for plutonium" and PUREX's outdated technology. Indeed, in 1984 alone, PUREX reprocessed 890 metric tons of fuel using 1950s infrastructure. In light of the audit, and the July emergency shutdown, the DOE made changes at Hanford to ensure safety and efficiency. The department ordered that the heart of PUREX plant, N-Cell, close every two months for workers to take stock of its plutonium. In N-Cell, workers converted liquid plutonium into a powder oxide product. This product was then shipped to Rocky Flats and molded into nuclear triggers.[507]

Despite the measures, PUREX continued to suffer from problems. In December 1984, seven Rockwell employees were contaminated with plutonium while working at PUREX. Health examiners determined that two of the workers received internal doses of plutonium well below the permissible annual exposure level for nuclear workers. Rockwell officials told the press that they were conducting additional tests on two other workers to determine their exposure. Rockwell did not comment on the exposure levels of the remaining three workers. The firm determined that the contamination was linked to leaky glove boxes at PUREX. All of the contaminated workers returned to work within a week.[508]

Steele wrote about each mishap at PUREX in the *Spokesman-Review* and *Spokane Chronicle*, prompting Rockwell and the DOE to defend Hanford in the court of public opinion.

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[507] Karen Dorn Steele, "Plant Loses Nuclear Matter," *Spokesman-Review*, 2 December 1984; Karen Dorn Steele, "Plutonium," *Spokesman-Review*, 2 December 1984.
[508] Karen Dorn Steele, "Seven Workers Contaminated," *Spokesman-Review*, 14 December 1984.

On January 17, 1985, Rockwell and the DOE opened PUREX for the first time for a press tour. According to Steele, the event was meant to show the press that Rockwell and the DOE "had everything under control." In the eyes of the DOE, PUREX "was supposed to be the showcase plant for the new nuclear weapons buildup." As Lawrence put it, the tour was to offer an "open, candid and non-defensive" look at PUREX. Journalists from the *Oregonian*, the *Seattle Times*, and local TV stations flocked to PUREX. Steele also attended the tour as a representative of her two newspapers. Because Steele had little knowledge of nuclear physics, and therefore could not evaluate the statements made by the Rockwell and DOE tour guides, she brought Thomas Cochran, a physicist with the Natural Resources Defense Council, with her. Although Cochran had served as a health physics fellow with the AEC's radiation training program, he had earned a reputation as no-friend to the state's atomic programs. During the early 1980s, Cochran had participated in nonproliferation committees and criticized the reactivation of PUREX. Not surprisingly, Cochran raised questions about PUREX's safety throughout the tour. He was particularly concerned about the facility's missing plutonium, as well as the amount of plutonium PUREX routinely released into the environment. Cochran took issue with the fact that PUREX was exempt from Environmental Protection Agency emission rules because of its status as a defense installation. Lawrence and Rockwell health physicists took issue with Cochran's comments, claiming that he and the media "overplayed" the hazards of PUREX.

At the conclusion of the tour, Lawrence announced a new public-information policy, which promised to "immediately" release information to the press on all future events "involving death, serious injury, or exposures above 1/100ths of the allowable worker exposure guidelines." Despite this new policy, Steele and Cochran remained skeptical of the DOE, Rockwell, and all Hanford operations. They suspected that the department and the firm deployed their new open-book policy to get detractors off their backs and would keep future hazardous episodes to themselves.[509]

As Steele kept watch on PUREX, Rockwell fell under fire in January 1986—but not for its actions at Hanford. On January 26, 1986, the space shuttle *Challenger* broke apart 73 seconds into flight, killing its seven crew members. Rockwell International's Space Transportation Systems Division in Downey, California, had built the *Challenger* and, thus, the press turned to Rockwell to answer for the disaster. The firm refused to comment on the tragedy and its role in the manned space program. After learning about the *Challenger* disaster and Rockwell's lack of public response, Ed Bricker decided to go public with his Hanford concerns. He told Cindy that the *Challenger* provided evidence of Rockwell's negligence in managing dangerous technologies. The conversation won Cindy over. She decided to help her husband type reports documenting the hazards at Z Plant. The Brickers sent their reports to the Government Accountability Project, a nonprofit whistleblower protection and advocacy organization.[510]

As the Brickers waited to hear from the Government Accountability Project, the DOE finished processing HEAL's FOIA requests. In March 1986, Lawrence released 18,927 pages of declassified Hanford documents to the public. HEAL and Steele dug in. The balance of the documents chronicled a secret 1949 Air Force experiment at Hanford, known as the Green Run. During the experiment, Hanford released between 5,500 and 12,000 curies of iodine-131 into the

[509] Karen Dorn Steele, interview by Trisha Pritikin, 15 January 2019, Atomic Heritage Foundation; Karen Dorn Steele, "Top-Secret PUREX Opens Its Doors," *Spokane Chronicle*, 18 January 1985; Karen Dorn Steele, "PUREX Plant Tour Planned For Reporters," *Spokane Chronicle*, 14 January 1985; Karen Dorn Steele, "Journalists Get First Look Inside Controversial Plant," *Spokesman-Review*, 19 January 1985; Karen Dorn Steele, "PUREX," *Spokane Chronicle*, 18 January 1985.

[510] Nicholas D. Kristof, "Rockwell Closely Tied to the Shuttle Program," *New York Times*, 28 February 1986; Brown, *Plutopia*, 290; D'Antonio, *Atomic Harvest*, 116-7; Karen Dorn Steele, "Protestor," *Spokesman-Review*, 13 May 1988.

atmosphere to test the Air Force's capability to detect atmospheric radioactive particles. This experiment, the Air Force argued, would allow the military to gauge whether it could accurately monitor the Soviet Union's nuclear program by identifying airborne iodine-131. HEAL and Steele were incensed. Local residents had not been informed about the Green Run and had been exposed to large amounts of iodine-131.[511]

Although it has a half-life of only eight days, iodine-131 is a dangerous radioactive isotope. External exposure to large amounts of iodine-131 can burn the eyes and the skin. Iodine-131's beta and gamma emissions can cause mutation and death in cells that it penetrates and other cells up to several millimeters away. Iodine-131 can also be absorbed by ingesting contaminated food, including grain and dairy products, and will accumulate in the thyroid. There, its radiation kills thyroid tissues and can cause thyroid cancers.[512] The Green Run had exposed Pacific Northwesterners with iodine-131 and, perhaps, had led to countless cancer cases in the region. Steele would not let this revelation slip past the public eye. After devouring the

[511] Karen Dorn Steele, "Hanford's N-Impact Minimal, Says Official," *Spokesman-Review*, 28 February 1986; Karen Dorn Steele, "Hanford," *Spokesman-Review*, 28 February 1986; Brown, *Plutopia*, 291; D'Antonio, *Atomic Harvest*, 116-7; Karen Dorn Steele, "In 1949 Study Hanford Allowed Radioactive Iodine into Area Air," *Spokesman-Review*, 6 March 1986; Karen Dorn Steele, "Hanford's Bitter Legacy," *Bulletin of the Atomic Scientists* 44, no. 1 (January-February 1988): 20.

[512] Scott A. Rivkees, Charles Sklar, and Michael Freemark, "The Management of Graves' Disease in Children, with Special Emphasis on Radioiodine Treatment," *Journal of Clinical Endocrinology & Metabolism* 83, no. 11 (November 1998): 3767-76; Steven L. Simon, André Bouville, and Charles E. Land, "Fallout from Nuclear Weapons Tests and Cancer Risks: Exposures 50 Years Ago Still Have Health Implications Today that Will Continue into the Future," *American Scientist* 94, no. 1 (January-February 2006): 48-57; Jacob Robbins and Arthur B. Schneider, "Thyroid Cancer Following Exposure to Radioactive Iodine," *Reviews in Endocrine and Metabolic Disorders* 1, no. 3 (April 2000): 197-203; National Institute of Standards and Technology, "Radionuclide Half-Life Measurements," 6 September 2009, https://www.nist.gov/pml/radionuclide-half-life-measurements-data; Centers for Disease Control and Prevention, "Radioisotope Brief: Iodine-131 (I-131)," 4 April 2018, https://www.cdc.gov/nceh/radiation/emergencies/isotopes/iodine.htm.

Green Run documents, Steele published an article on the experiment in the *Spokesman-Review*.[513]

While Steele spread information on the Green Run across the Pacific Northwest, an international disaster threatened Hanford's existence. On April 26, 1986, the Chernobyl Nuclear Power Plant No. 4 reactor erupted. The explosion and subsequent fire sent radioactive isotopes across Europe. Soon after the Western World learned of the incident, activists in the Pacific Northwest began drawing comparisons between Chernobyl and Hanford. The *Seattle Times* journalist Eric Nalder joined with the *Newsweek* reporters William D. Marsach, George Raine, Brad Risinger, and Vern E. Smith to help fan the flames of comparison. The group dubbed Hanford "a Chernobyl in the making" and noted that both Chernobyl No. 4 and Hanford's N Reactor used graphite to moderate neutrons. This comparison was not entirely appropriate. Hanford's N Reactor differed from Chernobyl No. 4 in design, purpose, and operating procedures. Part of Chernobyl No. 4's failure was due to its large positive void coefficient. N Reactor featured a negative coefficient. Furthermore, it is worth noting that the Chernobyl No. 4 explosion was the result of workers purposefully operating the reactors at an unheard of low-power level as an experiment. The one comparison the journalists failed to make—perhaps one of the only valid comparison between the two facilities—was that Chernobyl No. 4 and N Reactor both featured a deficient safety culture. Both facilities were woefully out-of-date and were operating by organizations that showed little interest in drastic renovations.[514]

513 Steele, "In 1949 Study Hanford Allowed Radioactive Iodine into Area Air."

514 William D. Marsach, George Raine, Eric Nalder, Brad Risinger, and Vern E. Smith, "A Chernobyl in the Making?," *Newsweek*, 3 November 1986. Nalder partnered with the historian Hill Williams to write another piece comparing N Reactor to Chernobyl No. 4 for the *Seattle Times*. See, Hill Williams and Eric Nalder, "Hanford N Reactor Also Uses Graphite," *Seattle Times*, 29 April 1986. For information on nuclear reactor coefficients, see David Bodansky, *Nuclear Energy Principles, Practices, and Prospects*

While the Chernobyl disaster helped undermine Hanford's reputation in the national public eye, workers organized to defend the plant and their livelihood. In October 1986, one hundred workers formed the Hanford Family, a grassroots organization which defended Hanford in the court of public opinion. Led by Hanford chemist Mike Fox, Hanford Manager of Operating Procedures Cliff Groff, and N Reactor Training Director Larry Haler, the group dedicated itself to "changing the political and media climate [surrounding Hanford] from a negative one to a positive one." Wanting to become the most visible community group in the Tri-Cities, the Hanford Family opened an office along Richland's main street, George Washington Way. There, the Hanford Family sold baseball hats and bumper stickers reading "Proud of Hanford" to raise money to support themselves.[515]

The Hanford Family stylized their formation as a reaction to the negative press surrounding their beloved factory. "There was an awful lot of activity against us," Groff told an interviewer. HEAL and the media "were always pounding on us," he continued, "and we wanted some recognition that what we were doing was good for the country." "I think we feel we were besieged; I know I felt that way, and I felt we should fight back." The Hanford Family was proud of Hanford. They took pride in participating in the military-industrial complex. Echoing Reagan's "peace through strength" rhetoric, members of the Hanford Family argued that their

(New York: Springer, 2004). For more general information on N Reactor's design, see Gerber, *Plutonium Production Story at the Hanford Site*. For information on the numerous causes of the Chernobyl No. 4 disaster, see International Nuclear Safety Advisory Group, *INSAG-7 The Chernobyl Accident: Updating INSAG-1*, Safety Series No. 75-INSAG-7, 1992, https://www-pub.iaea.org/MTCD/publications/PDF/Pub913e_web.pdf. For a detailed technical comparison of N Reactor and Chernobyl No. 4, see Westinghouse Hanford Company, *A Comparison of N Reactor and Chernobyl*, by J.P. McNeece, R.P. Omberg, and E.T. Weber, Report No. WHC-EP-0094, March 1998, https://pdw.hanford.gov/document/E0029606.

[515] Larry Haler, interview by Robert Franklin, 3 April 2018, Hanford History Project, Washington State University Tri-Cities, Richland, Washington; Cliff Groff, interview by Robert Franklin, 10 August 2017, Hanford History Project, Washington State University Tri-Cities, Richland, Washington.

labor helped keep the United States safe. They maintained that the facility was the backbone of the local economy, employing more than thirty percent of the blue- and white-collar workers in the Tri-Cities. Furthermore, as nuclear physicists, chemists, and other scientific experts, they asserted that Hanford was environmentally safe, and that those who said otherwise were either uneducated outsiders or disgruntled employees looking for fame.[516]

The Hanford Family understood that the fate of their plant was linked to public opinion. Thus, they attempted to persuade the public of the merits and benefits of Hanford. To do this, the Hanford Family wrote to local newspapers, asking journalists to take care in covering the plant and rely on local testimonials rather than "outsider" allegations. They found room in letters-to-the-editor columns to make their case. The Hanford Family also understood the need for local activism. Mimicking the tactics of environmental activists, the family staged rallies and printed brochures promoting the excellent health of the community's residents and the plant's safety.[517]

While the Hanford Family found local support for its operations, anti-nuclear activists across the Northwest staged a large public event to challenge Hanford's existence. On October 26, 1986, between 800 and 1,000 men, women, and children joined hands on the Interstate Bridge over the Columbia River in protest of Hanford. The crowd consisted of Oregonians and Washingtonians, however, few Tri-Cities residents participated in the event. The protesters claimed that the DOE saddled their region with Hanford without local consent. As one protester,

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[516] "Hanford Workers Plan Own Hand-Holding Event," *Spokesman-Review*, 29 October 1986; Cliff Groff, interview by Robert Franklin; "Proud of Hanford," album 1, Hanford History Project Archives, Washington State University Tri-Cities, Richland, Washington. Reagan once again invoked "peace through strength" rhetoric in his February 26, 1986, address to the nation on the growing situations in the Philippines, Libya, and Central America. In the speech, Reagan argued that "strength is the most persuasive argument we have to convince our adversaries to negotiate seriously and to cease bullying other nations." See Ronald Reagan, "Address to the Nation on Nation Security," 26 February 1986, https://www.reaganfoundation.org/media/128843/nation3.pdf.
[517] Cliff Groff, interview by Robert Franklin.

Joanne McCaughan, put it: “Washington state has been used by the Department of Energy, the least they need to do is ask the people of Washington what they think.” The group sang songs and listened to several anti-nuclear speakers before linking hands over the river for twenty minutes.[518]

In response to the protest, the Hanford Family staged its own hand-holding event across the Columbia River in support of Hanford. The group originally planned to hold the event on a bridge in Umatilla, Oregon, but decided that turnout would “be better locally.”[519] On November 2, 1986, two thousand pro-nuclear activists stood on the cable bridge between Kennewick and Pasco. Fox called the event a “natural release of frustration and anger over 15 to 20 years of anti-nuclear sentiment.” Some demonstrators carried signs reading: “If you don’t work at Hanford, you’re a safety risk,” and “The Tri-Cities is a safe place to live.”[520] Many of the speakers at the rally emphasized Hanford’s safety record in defiance of the slew of whistleblower complaints and emergency shutdowns.[521] Following the event, Fox traveled to KWSU-TV studios in Pullman to record a televised defense of Hanford. The program featured footage on the Hanford Family’s “Hands Across the Columbia” rally and aired two different times in both Pullman and the Tri-Cities.[522]

In the weeks that followed, more residents of the Tri-Cities came forward to defend Hanford and criticize the activists and the media. In November, JoAnne Young wrote a letter to

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518 “Hundreds Protest Hanford Selection by Linking Hands,” *Longview Daily News*, 27 October 1986; William C. Crum, “Human Chain Protests Nuclear Dump,” *Spokane Chronicle*, 27 October 1986.
519 “Hundreds Protest Hanford Selection by Linking Hands,” *Longview Daily News*, 27 October 1986
520 “2,000 ‘Hanford Family’ Members Join Hands,” *Longview Daily News*, 3 November 1986; “Hanford Family,” *Spokesman-Review,* 3 November 1986.
521 “Pro-Hanford Demonstrators Span Columbia,” *Spokane Chronicle*, 3 November 1986.
522 “Hanford Family on TV,” *Tri-City Herald*, 9 November 1986.

the editor of the *Tri-City Herald*. In it, Young claimed that "no other industry has a better safety record" than the nuclear industry. "If the purpose of the news media is really to educate and inform, why hasn't more been published concerning the hazardous materials we are exposed to every day through eating, drinking, breathing, and skin absorption," she asked. Pointing to Environmental Protection Agency reports, Young argued that benzene fumes from gas pumps, tetrachloroethylene from dry cleaners, chloroform in tap water, and insecticides were "three times more likely to cause cancer than any airborne pollutant" stemming from Hanford. "Citizens of Washington," she concluded, "Hanford isn't going to cause your death. But through your own ignorance and disregard for the hazardous materials you are exposing yourselves to every day, you are committing passive suicide."[523] Richard Harper also chastised the activists in the newspaper. A farmer in Kennewick, Harper had tilled soil for nearly thirty years downwind from Hanford. He maintained that throughout his career he had never "seen any ill effects" from Hanford. "If you people who are protesting have facts other than your emotions you are dealing with, you should be heard," he continued. "Short of fact, why not let the scientific people with knowledge lead the people in a logical direction…. If there is a joining of hands on the bridges, it should be for building and keeping a strong America."[524]

While the Hanford Family rallied local residents to defend the factory, the Chernobyl disaster finally forced the DOE to make changes at Hanford. The DOE understood that both Chernobyl No. 4 and N Reactor featured poor management and outdated technologies. To rectify these similarities, the DOE took two actions. In December 1986, the DOE moved on from Rockwell and granted a $4 billion, five-year contract to Westinghouse Electric Corporation to

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[523] JoAnne Young, "Toxic Threats Closer to Home," *Tri-City Herald*, 10 November 1986.
[524] Richard K. Harper, "Emotions are a Poor Basis for Protest," *Tri-City Herald*, 12 November 1986.

operate Hanford. Then, in January 1987, the DOE closed N Reactor to investigate its infrastructure and safety measures. The DOE indicated that this closure was only to last six months. Activists held their breath, hoping that it would be permanent. The DOE told the press that the Tri-Cities would lose 19,780 jobs if it decided to close N Reactor for good.[525]

As the DOE shuttered N Reactor, it learned of Bricker's outreach to the Government Accountability Project. In January 1987, the DOE's Assistant Director of Safeguards and Security Office Whitney Walker met with Hanford Assistant General Manager Clegg Crawford to discuss the "Bricker problem." Whitney, the overseer of four hundred Hanford security officers, presented an action plan for the "timely termination" of Bricker. The document was titled "Special Item—Mole." In order to fire Bricker, the Hanford brass sought compromising information that would justify his termination or induce him to quit. To acquire such information, Hanford security set up a special office at the plant, called the "Bricker War Room." There, security officers analyzed Bricker's psychological exams, testimonies given by his coworkers, and recordings of his conversations obtained by secret bugs and wires. All Bricker could do was wait and hope that the Government Accountability Project would finally come to his aid.[526]

As the atomic workforce's effort to get Bricker demonstrates, the struggle over the fate of Hanford was truly a grassroots contestation. While security officials spent hundreds of hours analyzing Bricker's dossier, activists and journalists continued to keep the pressure on Hanford.

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[525] Fox Butterfield, "Nuclear Arms Industry Eroded as Science Lost Leading Role," *New York Times*, 26 December 1988; Glen Warchol, "DOE Awards Huge Hanford Contract to Westinghouse," *United Press International*, 12 December 1986; Lonnie Rosenwald, "DOE Shuts Down Two Hanford Plants," *Spokesman-Review*, 9 October 1986; "Lawmakers Study Ways to Aid Tri-Cities Economy," *Walla Walla Union-Bulletin*, 23 April 1987.
[526] Brown, *Plutopia*, 292; John Wilson and Larry Lange, "Whistle-Blower Was a Target for Reprisals," *Seattle Post-Intelligencer*, 31 July 1990; Nalder, "The Plot to Get Ed Bricker."

Meanwhile, the Hanford Family worked hard to rally the Tri-Cities around the factory.[527] Throughout the 1970s and the 1980s, westerners organized to attack and defend Hanford, Pantex, and Rocky Flats Plant. By recognizing the grassroots divide over the West's nuclear weapons factories, we come to see another way in which the military-industrial complex was a participatory system, challenged by some and championed by others.

[527] "Hanford Protesters to Enter Reservation," *Walla Walla Union-Bulletin*, 23 April 1987.

Chapter Seven

Demilitarization and the Uncertain Future: Rocky Flats Plant, Hanford, Pantex, and Los Angeles's Aerospace Industry at the End of the Cold War

The business of atomic war fundamentally changed in the late 1980s and the early 1990s. In some respects, the grassroots struggles over the fate of Rocky Flats Plant, Hanford, and Pantex were rendered moot by larger geopolitical developments. The 1987 Intermediate-Range Nuclear Forces Treaty (INF Treaty) and the subsequent collapse of the Soviet Union transformed the military-industrial complex, dismantling some institutions and reconfiguring others. Ironically, the Cold War, which seemingly threatened to end all human life in an atomic inferno, had been a source of stability for dozens of firms and millions of American workers. The end of the Cold War and the dawn of demilitarization created new anxieties for the nuclear firms and their workers. While some firms bowed out of nuclear work altogether, others looked to consolidate in order to weather the defense budget cuts that accompanied the fall of the U.S.S.R.

This chapter examines what the INF Treaty and the end of the Cold War meant for Rocky Flats Plant, Hanford, Pantex, and Los Angeles's aerospace industry. It maintains that the INF Treaty and the collapse of the Soviet Union were the twin-forces that ultimately ended production at Rocky Flats Plant and Hanford, concluded warhead assembly at Pantex, and collapsed Los Angeles's aerospace economy. While environmentalists celebrated these developments, these transformations came at a cost. Thousands of Rocky Flats Plant and Hanford workers weathered this nuclear collapse by finding jobs ridding their respective factories and landscapes of radioactive pollutants. Pantex and aerospace workers were not as fortunate. Pantex and the aerospace factories had not produced radioactive waste. Thus, when Pantex and the aerospace plants contracted, their workers struggled to secure local employment.

Indeed, radioactive waste was a source of wealth for Rocky Flats Plant and Hanford employees. I do not mean to suggest that radioactive contamination was on balance a good problem to have. However, I do intend to make the unsettling observation that remediating nuclear waste proved lucrative to former weapons workers.

While radioactive waste remediation provided new jobs for Rocky Flats Plant and Hanford workers, Pantex and aerospace workers faced an uncertain economic future. During the 1990s, Pantex disassembled nuclear warheads and thus was not immediately ruined by the INF Treaty and the Soviet collapse. Recognizing that disassembly could not continue indefinitely, Pantex workers and boosters called on the U.S. Department of Energy (DOE) to grant the factory a new mission to keep the plant going and its workers employed. As the Soviet Union fell, so did Los Angeles's aerospace workers. The INF Treaty and the end of the Cold War led the Bush and Clinton administrations to slash defense spending and dismantle the aerospace economy. As thousands of aerospace workers found themselves on welfare, the defense cuts carved a crater in the greater Los Angeles economy.

Along with probing how demilitarization transformed Rocky Flats Plant, Hanford, Pantex, and the aerospace industry, this chapter chronicles how workers faced the uncertain future as their institutions fell apart. Some succumbed to fear, anxiety, and depression. Others seamlessly moved on to remediation jobs. Still others continued to harass whistleblowers, such as Ed Bricker, in an attempt to safeguard their jobs. For many, the end of the Cold War promised a new period of peace and stability. However, for western weapons workers, the fall of the Iron Curtain produced new fears about the future.

The End of Rocky Flats Plant

Although the fall of the Soviet Union destroyed the state's demand for nuclear triggers and prompted Rocky Flats Plant to close for good, a series of domestic events struck blows against the plant's viability. The beginning of the end of Rocky Flats Plant can be traced to the establishment of the U.S. Environmental Protection Agency (EPA) and the subsequent laws that empowered the new bureaucracy. In 1970, President Richard Nixon signed an executive order establishing the EPA, a bureaucracy charged with setting goals and standards for environmental quality. As Nixon put it, the organization would treat "air pollution, water pollution and solid wastes as different forms of a single problem." In 1976, Congress passed the Resource Conservation and Recovery Act (RCRA) to discourage companies from producing hazardous wastes and to spur industrial recycling. In accordance with RCRA, the EPA set hazardous waste standards for private industry and monitored emissions. In December 1980, when the Love Canal controversy made clear that RCRA did not require firms to remediate their hazardous waste sites, Congress passed the Comprehensive Environmental Response, Compensation, and Liability Act, popularly known as the "Superfund" law or CERCLA. The law empowered the EPA to investigate and clean up private sites contaminated with hazardous substances.[528]

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[528] Samuel P. Hays, *Beauty, Health, and Permanence: Environmental Politics in the United States, 1955-1985* (New York: Cambridge University Press, 1987), 193-200, 203-5; Robert Gottlieb, *Forcing the Spring: The Transformation of the American Environmental Movement* (Washington, D.C.: Island Press, 2005), 180-1; Jack Lewis, "The Birth of the EPA," *EPA Journal*, November 1985, 9; *An Act to Provide Technical and Financial Assistance for the Development of Management Plans and Facilities for the Recovery of Energy and Other Resources from Discarded Materials and for the Safe Disposal of Discarded Materials, and to Regulate the Management of Hazardous Waste*, Public Law 94-580, *U.S. Statutes at Large* 90 (1976): 2795-2841; *An Act to Provide for Liability, Compensation, Cleanup, and Emergency Response for Hazardous Substances Released into the Environment and the Cleanup of Inactive Hazardous Waste Disposal Sites*, Public Law 96-510, *U.S. Statutes at Large* 94 (1980): 2796-2811. For more on Love Canal, see Elizabeth D. Blum, *Love Canal Revisited: Race, Class, and Gender in Environmental Activism* (Lawrence: University Press of Kansas, 2008).

Throughout the early 1980s, the EPA attempted to gain environmental jurisdiction over the DOE's nuclear factories, including Rocky Flats Plant. In 1984, the National Resources Defense Council, a non-profit environmental advocacy group, won a lawsuit to force the DOE's Oak Ridge facility to conform to RCRA pollution requirements. That same year, the EPA proposed that Rocky Flats Plant be included in its National Priorities List, part of the 1980 Superfund law listing the nation's most polluted sites. However, the Superfund law did not allow federal sites to be listed. The DOE maintained that its installations were exempt from the EPA's jurisdiction, arguing that the Atomic Energy Act granted the AEC and its successor organizations autonomy from bureaucratic oversight. However, the Chernobyl accident in 1986 forced the DOE's hand. As more environmentalists and journalists scrutinized the United States's nuclear facilities following Chernobyl, the DOE capitulated to the EPA. In July 1986, the DOE recognized that the EPA had authority to regulate its radioactive waste under RCRA.[529] Three months later, Congress reauthorized and amended CERCLA to allow the EPA to list DOE facilities on its National Priorities List.[530]

While the EPA began investigating Rocky Flats Plant's environmental footprint, a series of events prompted the Federal Bureau of Investigation (FBI) to turn its gaze on the factory. On April 24, 1987, *ABC News* ran a program titled "The Bomb Factories." In it, the ABC correspondent Richard Threlkeld described Rocky Flats Plant as a "national disgrace" which "constituted a threat to national security and a threat to public safety." Threlkeld correctly noted

[529] Len Ackland, *Making a Real Killing: Rocky Flats and the Nuclear West* (Albuquerque: University of New Mexico Press, 1999), 200-1; F.G. Gosling and Terrence R. Fehner, *Closing the Circle: The Department of Energy and Environmental Management, 1942-1994* (draft) (Washington, D.C.: U.S. Department of Energy, 1994), 33-9, 46, https://www.energy.gov/sites/prod/files/2013/04/f0/Gosling%20and%20Fehner%20-%20Closing%20the%20Circle%20%28complete%29.pdf.

[530] Ackland, *Making a Real Killing*, 205.

that much of the plant's equipment was old and that the DOE did little to supervise Rockwell's activity at the facility. These astute observations combined with the fact that the factory handled nuclear materials to catch the attention of the FBI. The bureau began questioning if Rocky Flats Plant was in compliance with RCRA pollution regulations. A few days later, a congressional hearing revealed that an internal DOE memo framed Rocky Flats Plant as an environmental hazard. According to the memo, Rocky Flats Plant was "in poor condition generally in terms of environmental compliance." "We basically have no RCRA groundwater monitoring wells," the memo continued, "our permit applications are grossly deficient (some of the waste facilities there are patently 'illegal'). We have serious contamination, and we have extremely limited environmental and waste characterization data for a site of this complexity." The memo was a smoking gun. Rocky Flats Plant had violated RCRA requirements. After learning about the memo, the FBI launched a formal investigation on Rocky Flats Plant's environmental practices.[531]

While the FBI collected information on Rocky Flats Plant, the facility suffered from yet another human health accident. On October 7, 1988, the DOE ordered Rockwell to shut down Building 771, one of the factory's trigger assembly facilities, after a DOE investigator and two plant workers walked into an unmarked, unsafe room and were irradiated. The shutdown brought production at Rocky Flats Plant to a halt. The order to shutdown Building 771 prompted the FBI

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[531] Tom Shales, "ABC's Alarming 'Bomb Factories,'" *Washington Post*, 24 April 1987; John Corry, "'The Bomb Factories' on ABC," *New York Times*, 23 April 1987; Joan Lowry, "Government OK's Flats Cleanup to Deflect Scrutiny, Memo Says," *Rocky Mountain News*, 29 April 1987; "Briefing for Mary L. Walker for Meetings with Admiral Foley, General Counsel Farrell and with the Under Secretary on Rocky Flats," 14 July 1986, https://rockyflatsambushedgrandjury.com/wp-content/uploads/19860714-7-page-Briefing-for-Mary-L.-Walker-et-al.pdf; U.S. Congress, House of Representatives, Committee on Science, Space, and Technology, Subcommittee on Investigations and Oversight, *Environmental Crimes at the Rocky Flats Nuclear Weapons Facility: Hearings Before the Subcommittee on Investigations and Oversight of the Committee on Science, Space, and Technology*, 102nd Cong., 2nd sess., 1992, 399-400; Ackland, *Making a Real Killing*, 206.

to test the integrity of Rocky Flats Plant's management. On December 9, 10, and 15, an FBI plane flew over Building 771 and snapped photographs of its incinerator with an infrared camera. The FBI reasoned that if Rockwell was operating the plant according to DOE policies then the incinerator should be closed and appear cold in the photographs. After reviewing the photographs, an EPA analyst concluded that Building 771's smokestack was hot. In other words, the FBI and the EPA had evidence that Rockwell continued to operate Building 771 despite the DOE's order to shut down the building.[532]

In June 1989, the FBI and the EPA took the photographs to Secretary of Energy James Watkins. The investigators also provided a 116-page application and affidavit for a search warrant, arguing that "probable cause" existed that Rockwell had committed environmental crimes at the factory by not complying with RCRA. After reviewing the documents, Watkins signed a memorandum of understanding with the U.S. Attorney General, the EPA director, the FBI director, and the U.S. Attorney in Denver, providing the FBI and the EPA with the ability to search Rocky Flats Plant and gather information on its operations and environmental footprint.[533]

On June 6, 1989, more than seventy-five FBI and EPA investigators descended on Rocky Flats Plant. Under the auspices of Operation Desert Glow, the team brandished warrants to search and seize records in thirty-one buildings and photograph and sample twenty waste disposal areas. The search lasted for ten days and yielded 184 boxes of documents. Among them was the diary of Dominic Sanchini, Rockwell's manager of Rocky Flats Plant. FBI agents examined the diary closely and highlighted incriminating entries. July 1, 1986: "Environment

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[532] Keith Schneider, "2D Nuclear Plant Is Ordered Closed by Energy Department," *New York Times*, 11 October 1988; Subcommittee on Investigations and Oversight, *Environmental Crimes at the Rocky Flats Nuclear Weapons Facility*, 770-2; Ackland, *Making a Real Killing*, 212-3.
[533] Ackland, *Making a Real Killing*, 214.

becoming a big deal. The EPA can destroy us." May 6, 1987: "Don't tell press… Tie mind, mouth and asshole together. DOE doesn't follow the law."[534]

During the raid, FBI investigators met with factory workers, including Farrel Hobbs. According to Hobbs, the inspectors told workers "in general terms that the site was under investigation for criminal environmental activities." "The fact that no specific information was given made the meeting feel even more intimidating," Hobbs continued. Fear took over most plant workers. "I don't want to be out of a life, and I don't want my kids to be out of a life," one worker said. "I was scared, but it wasn't about the dangers of what we were doing," Hobbs explained. "The unknown about what was going to happen to me the next day was very frightening… I could not think of anything that would have caused the raid… I remember sitting in my office for quite some time, stunned and worried." A few workers were more confident that everything was in order at the factory and that the raid would not threaten their livelihood. "I'm going to sit back and wait… all they're doing is crying wolf at this point," one man related.[535]

For many workers, the raid on Rocky Flats Plant constituted a betrayal by the federal government. Hobbs told the FBI investigators about the factory's environmental monitoring programs, which included the collection of air, water, soil, vegetation, and wildlife samples. To Hobbs, that factory "had a very comprehensive environmental program." Yet the tenor of the

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[534] Federal Bureau of Investigation, *Application and Affidavit for Search Warrant*, for Rocky Flats, U.S. District Court, case 89-730m, https://rockyflatsambushedgrandjury.com/wp-content/uploads/19890614-Search-Warrant-89-730M-Return.pdf; Federal Bureau of Investigation, *Application and Affidavit for Search Warrant*, for Rocky Flats, U.S. District Court, case 89-753m, https://rockyflatsambushedgrandjury.com/wp-content/uploads/19890614-FBI-Rocky-Flats-Search-Warrant-Case-No-89-753M.pdf; Janet Day and Sue Lindsay, "U.S. Agents Raid Rocky Flats," *Rocky Mountain News*, 7 June 1989; Ackland, *Making a Real Killing*, 215-6; Barry Siegel, "Showdown at Rocky Flats," *Los Angeles Times*, 8 August 1993.
[535] Farrel D. Hobbs, *An Insider's View of Rocky Flats: Urban Myths Debunked* (Coppell: CreateSpace Independent Publishing Platform, 2010), 54-5.

interviews suggested to Hobbs that the agents were trying to entrap him. For example, the agents asked Hobbs to describe beryllium's properties to them. Hobbs believed that if he failed to relate every detail of beryllium's elemental profile then the agents would use that as evidence of incompetence and potentially place him in prison for negligence. Another worker left his interview with the FBI with a similar conclusion. "We fear they'll find a technicality to make us red-faced," he said. This method of investigation infuriated Hobbs and the other plant workers. "The Justice Department representing my country wanted to put me in prison," Hobbs explained. "I had considered myself to be a completely loyal citizen, and had taken an oath when I was commissioned as an Army officer [before working at the plant] that included a promise to obey the law of the land. I never considered that oath to have expired. I had been willing to serve in whatever mission I was assigned. Now the country was treating me as if I could not be trusted." In Hobbs's view, the government had turned against him.[536]

Hobbs blamed the media for the situation. As Hobbs explained, during the raid the media had "much interest" in listing "exotic pollutants" that the FBI found at the plant without providing its readers and viewers with detailed information of the chemicals' toxicological profiles. This method of reporting helped position the chemicals at Rocky Flats Plant as extraordinarily harmful to humans and the environment. Ignorance bred fear. Twelve days after the conclusion of the raid, the *Rocky Mountain News* explained to its readers that most of the "exotic chemicals" present at the plant were harmless to humans, wildlife, and vegetation. Many of the chemicals were simply flavor additives found in the plant's cafeteria, fragrances on worker clothes, and fertilizers on the plant's grounds. But the damage had already been done. Most

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[536] Hobbs, *An Insider's View of Rocky Flats*, 55-7, 59.

Coloradans deemed the raid to not be a fact-finding endeavor, but evidence of the plant's criminality. To many, the DOE and Rockwell were guilty until proven innocent.[537]

On August 1, 1989, federal judge Sherman Finesilver swore in 23 Coloradans to consider whether or not the DOE or Rockwell committed illegal activities at Rocky Flats Plant. Almost immediately, the judge instructed the impaneled grand jury how to write a report and issue criminal indictments. Over the course of two years, the jurors examined information gathered by the FBI and the EPA and heard testimonies. Readers interested in the specifics of the grand jury investigation will be disappointed by the information provided here. Proceedings from the investigation are still sealed, leaving little for the historian to investigate. In the end, some jurors wanted to issue indictments however, according to news reports, the Justice Department did not believe the grand jury had sufficient evidence to justify the indictments. Some members of the grand jury wanted Rockwell officials to go to prison, but the Justice Department and other jurors were satisfied with a 1992 plea bargain in which Rockwell admitted to 10 federal environmental crimes and agreed to pay $18.6 million of its own funds in fines. Notably, the fines were not based on evidence gathered from the raid but on reports prepared by Rockwell and submitted to the DOE prior to Operation Desert Glow. These violations included discharging fecal coliform and biochemical oxygen in excess of permitted limits into the local environment.[538]

Although federal law forbade the jurors from providing information to the press, a few jurors tempted fate and took to the public arena. For example, in September 1992, anonymous

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[537] Hobbs, *An Insider's View of Rocky Flats*, 55-7, 59; "Exotic Waste Identified," *Rocky Mountain News*, 18 June 1989.
[538] Wes McKinley and Caron Balkany, *The Ambushed Grand Jury: How the Justice Department Covered Up Government Nuclear Crimes and How We Caught Them Red Handed* (New York: Apex Press, 2004), 31-2; Barry Siegel, "Showdown at Rocky Flats," *Los Angeles Times*, 15 August 1993, Hobbs, *An Insider's View of Rocky Flats*, 77-9.

jurors leaked a 124-page report to *Westword*. The report documented that the grand jury had crafted indictments charging three DOE officials and five Rockwell employees with environmental crimes.[539] In November 1992, members of the grand jury held a press conference on the steps of the Denver courthouse and called on the president to launch an investigation into the government's prosecution of Rockwell and the DOE. Throughout the 1990s and the early 2000s, the foreman of the grand jury, Wes McKinley, gave several interviews and wrote a "tell-all" book about the grand jury and its investigation. McKinley alleged that the Justice Department covered up the DOE and Rockwell's environmental crimes. In 2005, for example, McKinley told *Hustler* that the FBI raid was conducted "to cover up what the DOE did rather than actually prosecute it."[540] One year earlier, McKinley co-authored a book on his experience as a member of the grand jury. The book begins with an open letter to Congress from FBI Special Agent Jon Lipsky, who led the FBI's raid on Rocky Flats Plant. "My superiors have ordered me to lie about a criminal investigation I headed in 1989," Lipsky wrote. "We were investigating the U.S. Department of Energy, but the U.S. Justice Department covered up the truth. I have refused to follow the orders to lie about what really happened during that criminal investigation at Rocky Flats Nuclear Weapons Plant. Instead, I have told the author of this book the truth." Throughout the book, McKinley claims that the Justice Department covered up the environmental crimes at Rocky Flats Plant. To support this allegation, McKinley claims, according to Lipsky's recollections, that the Justice Department gave Rocky Flats Plant managers advanced notice of the raid. If such an action did occur—and it is unclear if it did—

[539] Bryan Abas, "The Secret Story of the Rocky Flats Grand Jury," *Westword*, 30 September 1992; Matthew L. Wald, "New Disclosures Over Bomb Plant," *New York Times*, 22 November 1992; Patricia Calhoun, "Will the Rocky Flats Grand Jury Files Finally Be Opened?," *Westword*, 11 January 2019.
[540] Brian Lipsett, "Rocky Flats: A Plea Bargain in Public View," in *Environmental Crime: Enforcement, Policy, and Social Responsibility*, ed. Mary Clifford (Gaithersburg: Aspen Publishers, Inc., 1998), 401; Bruce David and Mark Cromer, "Rocky Mountain Meltdown," *Hustler*, January 2005, 30-5.

then Rocky Flats Plant officials could have removed the most hazardous products off-site before the FBI arrived. Additionally, McKinley alleges that Justice Department officials instructed Lipsky "to stop looking for more evidence against Rockwell and Energy Department officials" after the grand jury was impaneled.[541] It is worth noting that William Smith, Lipsky's EPA partner on the investigation, refuted these claims. "Jon kind of went off the deep end," he said. "He started seeing conspiracy theories in everything."[542] We cannot accurately evaluate McKinley and Lipsky's claims until the federal government unseals the grand jury files.

One month after the grand jury was impaneled, Rockwell abandoned the plant. On September 15, 1989, Rockwell executives threatened to close Rocky Flats Plant unless the federal government granted them immunity from criminal and civil prosecution for violating environmental laws. Six days later, Rockwell filed a civil lawsuit against the Justice Department, the DOE, and the EPA, claiming that it was "being ordered by the Department of Energy to generate wastes for which there was no legal disposal system, opening it to prosecution by the E.P.A." The lawsuit noted that the federal government had not delineated an approved method of disposing radioactive waste to meet EPA standards and yet if Rockwell ceased producing triggers the DOE could charge it with default on its contract. Rockwell was caught in a vise. The next day, the DOE announced an agreement with Rockwell to terminate the company's contract at Rocky Flats Plant "in the best interest of both parties."[543]

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[541] McKinley and Balkany, *The Ambushed Grand Jury*, 16-8, 95.
[542] Quentin Young, "Rogue Agent," 5280, May 2016, https://www.5280.com/2016/04/rogue-agent/.
[543] Matthew L. Wald, "Rockwell Is Giving Up Rocky Flats Plant," *New York Times*, 23 September 1989; Rick Wartzman and Barbara Rosewicz, "Rockwell Sues 3 U.S. Agencies, Saying It Is 'Caught in Feud' Over Rocky Flats," *Wall Street Journal*, 22 September 1989.

In late September 1989, the DOE named EG&G, Inc., the firm that operated the DOE's Idaho nuclear research and waste site, the operating contractor of Rocky Flats Plant. Colorado Representative David E. Skaggs praised the management change, saying it reflected Secretary Watkins's effort to bring "the functional equivalent of perestroika to the nuclear weapons business." In addition to pledging more transparency from the DOE, Watkins promised the American people that "safety concerns would take priority over production schedules." Consequently, the new Rocky Flats Plant contract tasked EG&G to not only manufacture triggers but improve safety practices at the factory and begin cleaning up the site's hazardous waste dumps. EG&G could not refuse the DOE's offer. The firm depended on the federal government for 60 percent of its business. Most of its contracts with the DOE were typical cost-plus fixed fee agreements, leaving EG&G with low profit margins. Before agreeing to the Rocky Flats Plant contract, EG&G corporate analysts predicted that their 1989 profit margins were likely to fall short of the company's goals. EG&G needed Rocky Flats Plant as much as the DOE needed EG&G.[544]

Rocky Flats Plant continued to produce plutonium triggers under EG&G, however, the new management did not alleviate the plant's environmental and human health problems. On October 7, 1989, the *Denver Post* disclosed an inspection team's discovery of "pounds of plutonium" in a ventilation duct in Building 771. The story reported that "significant quantities" of plutonium might have accumulated in other ducts in the building in amounts sufficient to cause "criticality accidents." The story failed to note that criticality requires that plutonium-239

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[544] Matthew L. Wald, "Rockwell Is Giving Up Rocky Flats Plant," *New York Times*, 23 September 1989; "EG&G Will Manage Nuclear Arms Plant in $2.5 Billion Contract," *Wall Street Journal*, 12 October 1989; T.R. Reid, "Watkins Confronts Rocky Flats Issue," *Washington Post*, 1 December 1989; John Holusha, "EG&G's Risk at Rocky Flats," *New York Times*, 3 December 1989.

be configured in a certain way to facilitate a chain reaction. Nevertheless, the story caused widespread alarm on the Front Range that Rocky Flats Plant was going to blow. Faced with this new safety violation, Watkins temporarily ended plutonium operations at Rocky Flats Plant on November 13. Ironically, that same day, Colorado Congressman David Skaggs and Colorado Governor Roy Romer told the public that the illegal waste burning alleged in the FBI's affidavit for the search warrant had not taken place. The EPA analyst had misread the infrared photographs of Building 771.[545]

Throughout 1990 and 1991, the DOE pushed to reactivate Rocky Flats Plant. In April 1990, Watkins told Congress that the plant needed to restart in order to manufacture triggers for the Trident II submarine missiles. This argument was rendered moot a month later when top military officials testified in a closed congressional hearing that the impending disintegration of the Soviet Union meant that a delay in Trident II production would "not compromise national security." While Watkins continued to jockey for grounds to reopen the factory, Rocky Flats Plant workers called on local politicians to support restarting plant operations. In April 1991, fifty workers met with Congressman Skaggs at a public meeting at the United Methodist Church in downtown Boulder. Under a banner reading "Rocky Flats—Working to Keep America Free," the Steelworkers union leader Jim Kelly told Skaggs that the permanent closure of the factory constituted "a declaration of economic war on the United Steelworkers of America at that plant."[546]

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[545] Thomas Graf, "Plutonium in Flats Ducts Enough to Spark Radiation," *Denver Post*, 7 October 1989; Keith Schneider, "Energy Secretary Says Rocky Flats Will Be Closed Indefinitely," *New York Times*, 2 December 1989; Mark Obmascik, "Illegal Burn Didn't Occur, Officials Say," *Denver Post*, 30 November 1989; Ackland, *Making a Real Killing*, 220-1.
[546] Ackland, *Making a Real Killing*, 223-4, 226; Gosling and Fehner, *Closing the Circle*, 76-7.

Despite the efforts of Watkins and the factory workers, Rocky Flats Plant did not reopen. The Soviet Union collapsed in December 1991, taking Rocky Flats Plant with it. One month after the U.S.S.R. fell, President George H.W. Bush ordered the military and the DOE to cease production of new W-88 nuclear warheads for the Trident II missiles, citing that the Soviet collapse destroyed the nation's demand for the ordnance. Furthermore, Bush maintained that cutting the program would help the American taxpayers save $50 billion over the course of five years. The collapse of the W-88 program left Rocky Flats Plant with no munitions orders. The struggle over Rocky Flats Plant was over. In March, Watkins announced that the factory's mission would switch from trigger fabrication to environmental restoration and waste management. In response, EG&G laid off 4,500 workers. It retained 4,000 others to clean up the facility. The plant's nuclear contamination became a new source of wealth for these Coloradans. Thousands of workers utilized their expertise in nuclear physics, chemistry, engineering, and environmental monitoring to locate and remove radioactive pollutants from the landscape. Indeed, those Coloradans who had helped pollute the Front Range by making nuclear triggers were undertaking a new quest to clean up after themselves. In 2006, the EPA declared remediation complete despite the fact that Rocky Flats Plant's underground contamination was still in place. In 2012, investigators documented that the landscape continued to emit low levels of radiation. Indeed, the future of Rocky Flats Plant remains up for grabs.[547]

[547] Ackland, *Making a Real Killing*, 227; Frank Scandale, "Meeting on Flats Almost Free-for-all as Sides Get Vocal," *Denver Post*, 3 May 1991; Terence Hunt, "Bush Wants Tax Breaks, Military Cuts," *Boulder Daily Camera*, 29 January 1992; George H.W. Bush, "Address Before a Joint Session of the Congress on the State of the Union," 28 January 1992, https://www.presidency.ucsb.edu/documents/address-before-joint-session-the-congress-the-state-the-union-0; Hobbs, *An Insider's View of Rocky Flats*, 99; Laura Snider, "Study: Rocky Flats area Still as Contaminated with Plutonium as 40 Years Ago," *Boulder Daily Camera*, 18 February 2012.

The End of Hanford

After the DOE shut down N Reactor in 1987, Hanford contained only two buildings that conducted plutonium work: Z Plant and PUREX. Following yet another safety violation, PUREX closed for six weeks in early 1988. In December 1988, it closed again for a year when steam pressures fell below the levels necessary to support backup safety equipment. While workers remodeled PUREX, President Ronald Reagan and Soviet General Secretary Mikhail Gorbachev enacted the INF Treaty. Although Reagan had begun his presidency by emphasizing nuclear production, by the late 1980s he had pivoted to favoring a new technology to deter Soviet aggression: the Strategic Defense Initiative. The pursuit of this satellite weapon allowed Reagan to envision a safe transition to a non-nuclear world and persuade Gorbachev to sign the INF Treaty on December 8, 1987. The agreement banned all of the two nation's intermediate and short-range land-based ballistic missiles, cruise missiles, and missile launchers. Reagan officially proclaimed the treaty on December 27, 1988. As a result of the treaty, the United States rushed to destroy its missiles, with the exception of its ICBMs and air and sea-launched ordnance, by the June 1, 1991 deadline. Along with banning these devices, the treaty created the basis for deep cuts in ICBMs, submarine-launched ballistic missiles, and nuclear bombers. By tasking the United States to stop purchasing and destroy an entire class of missiles, the treaty killed the state's demand for Hanford plutonium. In response, the DOE closed Z Plant in 1989. Meanwhile, the DOE halted PUREX's renovations and placed the building on standby.[548]

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[548] Fluor Hanford, Inc., "History of Hanford Site Defense Production (Brief)," by M.S. Gerber, February 2001, 9, https://www.osti.gov/servlets/purl/805998; Westinghouse Hanford Company, "A Brief History of the PUREX and UO_3 Facilities," by M.S. Gerber, November 1993, 14, https://www.osti.gov/servlets/purl/10115226; Treaty Between the United States of America and the Union of Soviet Socialist Republics on the Elimination of their Intermediate-Range and Shorter-Range

Figure 18: President Reagan and General Secretary Gorbachev signing the INF Treaty in the East Room of the White House. 8 December 1987. Photo by the White House Photographic Office. Image Identifier 198588. Photography courtesy of the Ronald Reagan Presidential and Museum, Simi Valley, California.

With production halted, the DOE moved to address Hanford's environmental footprint. The Hanford landscape was home to 63 percent of all high-level nuclear waste in the country. On May 15, 1989, the DOE, the EPA, and Washington state signed a comprehensive cleanup and compliance agreement regarding Hanford's waste. The Hanford Federal Facility Agreement and Consent Order, or the Tri-Party Agreement, sought to remediate Hanford in compliance with CERCLA remedial action provisions and RCRA treatment, storage, and disposal regulations. More specifically, the agreement defined and ranked CERCLA and RCRA cleanup commitments

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Missiles (INF Treaty), proclaimed by U.S. President 27 December 1988, U.S. Department of State, https://2009-2017.state.gov/t/avc/trty/102360.htm#text*;* John Lewis Gaddis, *Strategies of Containment: A Critical Appraisal of American National Security Policy During the Cold War* (New York: Oxford University Press, 2005), 366-7; "Feds: Hanford's Plutonium Finishing Plant is Demolished," *Seattle Times*, 5 February 2020; U.S. Department of Energy, "Plutonium Finishing Plant," June 2006, https://web.archive.org/web/20060926023643/http://www.hanford.gov/rl/uploadfiles/FACT_PFP_0606.pdf.

and established which organization was responsible for each remediation measure.[549] The EPA's first task was to tend to the 177 nuclear waste storage tanks at the site. Sixty-six of the tanks were leaking, or were suspected of leaking, approximately 750,000 gallons of nuclear waste into the ground. In addition to removing the tanks and cleaning up their waste, the agreement tasked the EPA to take charge of Hanford's 55 disposal areas, which contained radioactive and chemical wastes. While investigating Hanford's environment, the EPA discovered that Hanford managers had deliberately poured radioactive effluent into the soil when the factory ran short of storage tanks. Experts estimated that more than 100 million gallons of radioactive effluent were disposed of in this manner.[550]

The cleanup helped Hanford's detractors and the Hanford Family find common ground. Both groups recognized that the project would prove lucrative for the local community. "Thirty-plus years of cleanup is going to be very steady work," said the Hanford Education Action League leader Jim Thomas.[551] The Hanford Family also recognized the economic benefits of cleanup and endorsed the Tri-Party Agreement. "If it means jobs, bring it on," one member said.[552]

Although the cleanup seemed to help patch-up the differences between Hanford's detractors and boosters, it did not stop Hanford workers from harassing Ed Bricker. Throughout 1989, local residents continued to harass Bricker for shedding light on the factory's hazardous

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[549] U.S. Department of Energy, U.S. Environmental Protection Agency, Washington State Department of Ecology, *Hanford Federal Facility Agreement and Consent Order 89-10* (Richland: U.S. Department of Energy, May 1989).
[550] Karen Dorn Steele, "Hanford in Hot Water," *Bulletin of the Atomic Scientists* 47, no. 4 (May 1991): 7-8.
[551] Ken MacQueen, "A Nuclear Cloud Hangs Over Hanford," *Edmonton Journal*, 16 June 1991.
[552] Deeann Glamser, "N-Cleanup Turns Bomb Town to Boom Town," *USA Today*, 25 March 1992; Cliff Groff, interview by Robert Franklin, 10 August 2017, Hanford History Project, Washington State University Tri-Cities, Richland, Washington.

conditions. Bricker continued to complain that his phone was bugged, that he was being tailed, and that his family members were being intimidated. Westinghouse disputed its involvement in these intimidation tactics but relented that "Mr. Bricker had in fact been harassed by fellow workers." Westinghouse maintained that its workers believed that Bricker's whistleblowing threatened the reactivation of PUREX. Consequently, workers harassed Bricker because they feared his comments would lead to their unemployment. Harassment was a means workers employed to help safeguard their future. A spokesman for the company, L.B. Moore, maintained that Westinghouse "had done everything it could to stop such harassment." Bricker countered, arguing that Westinghouse had harassed him by forcing him to see a psychologist in order to obtain a diagnosis which would revoke his security clearance. Westinghouse shot back, asserting that it never ordered Bricker to see a psychologist, but told him to check into the Hanford Environmental Health Foundation, a medical contractor which serviced Hanford employees, for a "comprehensive medical evaluation." Westinghouse stated that Bricker told the firm in writing that he had experienced "work-caused stress," which led managers to recommend the medical evaluation. Westinghouse argued that the health clinic ordered Bricker's psychological evaluation. When asked about the Bricker case, Bricker's psychologist, Ray Booth, could not recall how Bricker came to be his patient. Booth had left Hanford before the press probed the issue and therefore did not have access to Bricker's file. It is worth noting that Booth said some of his patients were referred to him by plant management. Booth also stated that "nothing derogatory came out of my evaluation" of Bricker.[553]

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[553] Matthew L. Wald, "4 Say Atom Industry Ordered Counseling and Harassed Them," *New York Times*, 6 August 1989.

Seeking justice, Bricker hired the attorney Tom Carpenter, a man who also served as the director of the Government Accountability Project office in Seattle. The duo petitioned the DOE Inspector General to examine his case and confirm that he had been targeted by Rockwell and Westinghouse. The Inspector General acquiesced to Bricker's request. In September 1990, a congressional report revealed that the DOE Inspector General had tasked Westinghouse's security team at Hanford to conduct the investigation. The report also noted that "there is also strong evidence that the I.G. actually initiated a phony investigation against the whistle-blower himself, rather than into his allegations." In response to these claims, the DOE Inspector General's Office hired a former intelligence operative to investigate Rockwell and Westinghouse.[554]

In addition to requesting that the DOE to investigate Bricker's case, Bricker and Carpenter petitioned the U.S. Department of Labor to launch its own investigation. The task fell to Labor Inspector John Spear. Spear journeyed to Hanford, interviewed employees, and gathered documents from the plant. Among the documents Spear unearthed was "Special Item—Mole." Written by the former Air Force counterintelligence officer and assistant director of the Hanford security patrol Whitney Walker, the memo described how Hanford security "fanned out" to the homes of employees that worked with Bricker to gather information. In another memo, Rockwell officials documented how they asked a worker to pretend to be a whistleblower and meet with Bricker and collect information. Yet another document revealed that

[554] Martin Tolchin, "Senators Accuse Inspectors of 'Pattern of Wrongdoing,'" *New York Times*, 9 September 1990; U.S. Congress, House of Representatives, Subcommittee on the Civil Service of the Committee on Post Office and Civil Service and Subcommittee on Civil and Constitutional Rights of the Committee on the Judiciary, *Standards and Due Process Procedures for Granting, Denying, and Revoking Security Clearances: Joint Hearings before the Subcommittee on the Civil Service of the Committee of Post Office and Civil Service and the Subcommittee on Civil and Constitutional Rights of the Committee on the Judiciary*, 101st Cong., 1st and 2nd sess., 1989 and 1990, 128.

Westinghouse attempted to recruit one of Bricker's friends to wear a wire and secretly record his conversations with Bricker. Spear also reported that several Hanford employees told him that they were harassed for standing up for Bricker or associating with him. After reviewing this information, Spear concluded that Rockwell, Westinghouse, and the DOE had harassed Bricker and violated his rights in retaliation for his complaints. Spear recommended that the trio compensate Bricker and that Westinghouse remove critical remarks from his employment file. However, because the DOE had indemnified Rockwell and Westinghouse, the compensation burden would fall solely on the DOE and the American taxpayers.[555]

While the Government Accountability Project negotiated with the DOE for a large settlement on Bricker's behalf, Bricker filed suit against Westinghouse and Rockwell in 1990.[556] Seeking damages of $30 million, Bricker alleged that Rockwell and Westinghouse violated his constitutional right to free speech and invaded his privacy "for the specific purpose and deliberate intention of injuring him." His attorney, Carpenter, argued that Rockwell and Westinghouse operated Hanford as "federal officers" and therefore when they violated Bricker's constitutional rights they fell afoul of the legal precedent set in the 1971 Supreme Court ruling on *Bivens v. Six Unknown Federal Narcotics Agents*. The *Bivens* ruling established that the victims of a constitutional violation by a federal agent had a right to recover damages from the agent in federal court. Rockwell and Westinghouse denied the allegations. Craig Kuhlman, a Westinghouse spokesman, said that the firm had been willing to look into Bricker's allegations

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[555] Eric Nalder, "The Plot to Get Ed Bricker," *Seattle Times*, 30 July 1990; Michael Allen, "Security Experts Advise Firms to Avoid Panic, Excess Zeal in Probing Data Leaks," *Wall Street Journal*, 20 September 1991; Jim Donahue, "The Westinghouse Web," *Multi-National Monitor*, March 1992, https://www.multinationalmonitor.org/hyper/issues/1992/03/mm0392_11.html.
[556] Nalder, "The Plot to Get Ed Bricker"; Michael O'Rourke, "Blowing the Whistle on Whistleblowers," *Cascadia Times*, July 1995, 12.

of surveillance but that Bricker was uncooperative. Westinghouse also noted that it had "bent over backwards to accommodate whistleblowers." Rockwell made no comments to the press about the case.[557]

The DOE Inspector General tendered its report to Congress in the summer of 1991, concluding that Hanford security possessed "equipment for wiretapping, eavesdropping, and other surveillance of employees, in violation of department regulations and Federal law." It is illegal in most cases for wiretapping equipment or eavesdropping devices to be used without a court order. Only law enforcement agencies designated by the states and investigative agencies designated by Congress are lawfully allowed to use such equipment. Despite documenting Westinghouse's possession of the equipment, Inspector General John C. Layton said that he found "no direct evidence that the surveillance equipment had been used against critics of the plant." "Violating a regulation is not the same as an act that is illegal," Layton clarified. Westinghouse denied using the equipment, claiming that Rockwell left the gear at Hanford.[558]

In September 1991, the federal judge Alan McDonald dismissed Bricker's lawsuit against Rockwell and Westinghouse. The court ruled that "the record as it currently stands is insufficient for any determination as to whether defendants are 'federal actors' against whom liability can be imposed under *Bivens*." Simply put, Carpenter failed to persuade McDonald that Rockwell and

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[557] *Bricker v. Rockwell Hanford Operations*, No. CY-90-3090-AAM, 1991 U.S. Dist. LEXIS 18965 (E.D. Wash. September 17, 1991); *Bivens v. Six Unknown Named Agents of Federal Bureau of Narcotics*, 403 U.S. 388 (1971); Patrick Lee, "Firms Use Spying to Silence Critics," *Los Angeles Times*, 26 December 1991; Allen, "Security Experts Advise Firms to Avoid Panic, Excess Zeal in Probing Data Leaks."
[558] Keith Schneider, "U.S. Reports Spying on A-Plant Workers," *New York Times*, 1 August 1991; Keith Schneider, "U.S. Confiscating A-Plant Wiretaps," *New York Times*, 2 August 1991; Donahue, "The Westinghouse Web."

Westinghouse were federal agents and not contractors. Thus, McDonald ruled that a *Bivens* remedy was not appropriate.[559]

Bricker and Carpenter appealed the dismissal. The U.S. Court of Appeals for the Ninth Circuit affirmed the district court's previous judgement. In addition to noting that a *Bivens* remedy did not apply to Bricker's case, the court described three other remedies available to Bricker. The DOE required that collective bargaining agreements at contractor-operated facilities should provide "an effective grievance procedure with arbitration as its final step." The collective bargaining agreement between Westinghouse and Bricker's union, the Hanford Atomic Metal Trades Council, contained a grievance procedure and required that it be used to resolve "claims and disputes on all matters subject to collective bargaining." The agreement also provided for arbitration of any unsettled grievances that involved a "disciplinary penalty…which is alleged to have been imposed without just cause." The court also noted that DOE Order 5438.1A provided a procedure for investigating claims of discrimination and stated that "if it is found that such discrimination has occurred, the field organization shall assure that appropriate measures are taken by the contractor, including rehiring or reinstatement of the employee, restoration of lost seniority, and back pay." The court also stated that 29 U.S. Code § 157 gave the National Labor Relations Board discretion to devise remedies for unfair labor practices, which included discharges based on voicing safety complaints. Thus, the court concluded that Bricker could not receive damages under the *Bivens* precedent and should seek remedies using the above procedures and institutions.[560]

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[559] *Bricker v. Rockwell Hanford Operations*, No. CY-90-3090-AAM, 1991 U.S. Dist. LEXIS 18965 (E.D. Wash. September 17, 1991); "Westinghouse Electric Corp.: Hanford Unit Says Court Dismissed Employee Lawsuit," *Wall Street Journal*, 19 September 1991.
[560] *Bricker v. Rockwell Int'l Corp.*, 10 F. 3d 598 (9th Cir. 1993).

Bricker quit Westinghouse in November 1991. Like other Hanford employees, Bricker found himself working for the Washington State Department of Health on the cleanup project. Brandishing a Geiger counter, Bricker traversed the Hanford site as a radiation monitor.[561] In 1995, Bricker and his allies at the Government Accountability Project finally came to an agreement with the DOE on the compensation owed to Bricker based on the Labor Department's investigation. The taxpayers footed the $200,000 bill and more than $1 million in attorney fees. The Bricker saga was over.[562]

Following the dissolution of the Soviet Union, the DOE took PUREX off standby and shuttered the plant. But the problems at Hanford continued. The DOE estimated that the cleanup would cost $100 billion and take fifty years. Moreover, the cleanup was not designed to remove all of the hazardous materials from the land. Some of the materials, including 114 nuclear submarine reactors, were to stay entombed at Hanford in perpetuity. Although Hanford's wastes posed human and environmental health hazards, most local residents did not view the wastes as burdens. Rather, they maintained that they were a new source of wealth. Sam Volpentest, a member of the Tri-City Industrial Development Council, framed the site's radioactive waste as a "gold mine." "Green stuff is floating down from heaven," he said. Within a few years, more than eighteen thousand people, a forty-year high, were working at Hanford on the cleanup. As federal dollars flowed to the cleanup, new homes, offices, and a golf course sprouted in the Tri-Cities. The Richland school district reported that it expected its student body to grow by 30 percent in two years. With the economic future of the Tri-Cities secured, the Hanford Family "just kind of melted away." "The job had been completed," Larry Haler explained. However, the Hanford

[561] O'Rourke, "Blowing the Whistle on Whistleblowers," 12; Donahue, "The Westinghouse Web."
[562] Ephraim Payne and Ray Ring, "The Hanford Whistleblowers," *High Country News*, 10 February 2014.

Family's leaders did not disappear from public life. Haler went on to become a member of the Richland City Council, Richland mayor, and finally a state legislator. Cliff Groff became a member of the Kennewick City Council. Mike Fox partnered with former Rocky Flats Plant workers and traveled across the West giving speeches in defense of nuclear technologies. The business of nuclear war had worked for the Priest Rapids Valley. It appeared that the business of nuclear waste would work for the region, as well.[563]

Searching for a Future at Pantex

The INF Treaty prompted the Pentagon to change Pantex's mission from assembling nuclear weapons to disassembling them by hand. Unlike production, disassembly could not last forever. "What will happen to Pantex and its three thousand workers when all the surplus warheads are taken apart?" the *Texas Monthly* asked. While workers worried about the future of Pantex and their employment, the FBI raided Rocky Flats Plant. As the FBI and the EPA gathered information on Rocky Flats Plant, the DOE shipped Rocky Flats Plant's nuclear triggers to Pantex for interim storage.[564]

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[563] Westinghouse Hanford Company, "A Brief History of the PUREX and UO_3 Facilities," 14; Brown, *Plutopia*, 293; John M. Findlay and Bruce Hevly, *Atomic Frontier Days: Hanford and the American West* (Seattle: University of Washington Press, 2011), 258; Deeann Glamser, "N-Cleanup Turns Bomb Town to Boom Town," *USA Today*, 25 March 1992; Larry Haler, interview by Robert Franklin, 3 April 2018, Hanford History Project, Washington State University Tri-Cities, Richland, Washington; Cliff Groff, interview by Robert Franklin.

[564] Robert Alvarez, "Energy in Decay," *Bulletin of the Atomic Scientists* 56, no. 3 (May/June 2000): 31; Gary Cartwright, "Disarmed and Dangerous," *Texas Monthly*, November 1994, 104; Alex Hunt, "'Host and Hostage': Pantex and the Texas Panhandle," *Southwestern Historical Quarterly* 118, no. 4 (April 2015): 354-5.

In 1989, Pantex workers and local boosters created a new organization to safeguard the future of Pantex and its workforce, Panhandle 2000. Led by Wales Madden Jr. and Jerry Johnson, this bipartisan movement lobbied to bring plutonium trigger manufacturing to Pantex. Madden, Johnson, and other Panhandle 2000 members argued that Pantex's safety record made the facility a logical choice for taking over Rocky Flats Plant's mission. Recognizing that this new mission would require the plant to physically expand, Panhandle 2000 promised to purchase all the water, utilities, roads, and land the DOE might require for the project. Additionally, the boosters argued that the DOE could use eminent domain proceedings to seize nearby lands if any of the landowners refused to sell their property. When the Soviet Union collapsed in late 1991, Panhandle 2000 recognized that the state's demand for new nuclear triggers had dissipated. Consequently, the organization changed its objective and petitioned the DOE to make Pantex the permanent storage facility and disassembly site for the plutonium triggers. This too would require more land, water, utility lines, and roads. Consequently, Panhandle 2000 stood by its original plan to buyout local landowners and went so far as to craft a document listing more than one hundred family farms that it planned to purchase. Madden estimated that this new scheme would create 5,000 to 10,000 new jobs at Pantex, increase the plant's annual budget from $250 million to $1.3 billion, and send another $11.3 billion into the local economy via construction work.[565]

Madden supplemented this storage proposal by advocating for the creation of a new scientific facility in Amarillo, which he called the National Resource Center for Plutonium. Madden envisioned an institution that would bring together nuclear physicists and corporate

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[565] Kenneth J. Garcia and David Perlman, "Fighting for Lethal Leftovers," *San Francisco Chronicle*, 13 April 1995; Cartwright, "Disarmed and Dangerous"; Jim McBride, "Pantex Hits the Pits in Repackaging," *Amarillo Globe-News*, 9 July 2004.

officials to study uranium and plutonium with the goal of creating new nuclear reactor fuels to sell in the international marketplace. This institution would be staffed by a consortium of scientists from Texas Tech University, Texas A&M University, and the University of Texas. In other words, this institution would serve as a think tank to salvage the waning business of atomic war. Madden reasoned that if “three universities put their reputations on the line, that would be cover politicians needed in order to act” on the idea. Support from local universities might mitigate public scrutiny.[566]

Not all local residents supported Panhandle 2000. Almost immediately after Madden and Johnson organized Panhandle 2000, a group of West Texans formed Panhandle Area Neighbors and Landowners (PANAL). Led by Doris and Phillip Smith, PANAL argued against Panhandle 2000’s trigger storage and disassembly plan. Although the group recruited some former Pantex protesters, the majority of PANAL membership consisted of the farmers whose lands were targeted by Panhandle 2000’s proposal. Most of these families were politically conservative and had no previous experience in activism. They primarily mobilized the language of property rights and agricultural stewardship to challenge Panhandle 2000’s plan. “We told people we didn’t want to be thought of as environmentalists,” Doris Smith said. “We were farmers—agriculturists. Without realizing it, I guess, we’ve become activists.” Notably, LeRoy Matthiesen, the Catholic Bishop that led the 1980s charge against Pantex, was not involved in this new protest movement. Throughout the 1990s, Matthiesen stepped away from Pantex activism and devoted much of his time to covering-up child sex abuse allegations in his diocese.[567]

566 Cartwright, “Disarmed and Dangerous.”
567 Hunt, “‘Host and Hostage,’” 355; Cartwright, “Disarmed and Dangerous”; Betsy Blaney, “Amarillo Diocese Hit Hard by Sex Abuse,” *Washington Post*, 2 September 2002; “Suit Claims Priest Fathered

While Panhandle 2000 and PANAL sparred with each other in the court of public opinion, Pantex fell under environmental scrutiny. In July 1991, the EPA found arsenic, lead, mercury, and barium in ditches and shallow ponds where Pantex's treated wastewater had been discharged. While the EPA documented these pollutants, the DOE identified 144 sites of suspected heavy metal contamination at Pantex. The EPA and the DOE attributed this contamination to the plant's activities during World War II. In response to this disclosure, the EPA nominated Pantex for its Superfund list. At the same time, the DOE maintained that storing plutonium triggers at Pantex in perpetuity "would pose no significant environmental impact" nor threaten Pantex workers and the local community.[568]

While the EPA investigated Pantex's environmental footprint, Congress moved forward with Madden's national resource center proposal. In 1994, Congress provided $9 million to create the National Resource Center for Plutonium. In providing funding for the institution, Congress and the DOE modified Madden's vision for the institution and tasked the laboratory to study plutonium "storage, disposition, potential utilization, and transportation." Additionally, Congress did not guarantee that the resource center would exist in perpetuity. Rather, Congress merely endowed the institution with the capital to begin operations. Its annual funding was "subject to availability of funds" via congressional appropriations.[569] Recognizing the fragility of the resource center, PANAL launched a new political argument against the institution, claiming

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Child, Diocese Covered Up Abuse," MyPlainview, 10 July 2002, https://www.myplainview.com/news/article/Suit-claims-priest-fathered-child-diocese-9029232.php; Don Munsch, "Former Bishop Defends Actions," *Amarillo Globe-News*, 9 July 2002; "Amarillo Diocese Says Hiring Convicted Child Molester 'A Serious Mistake,'" *Amarillo Globe-News*, 31 December 2013; *Rendon v. Roman Catholic Diocese*, 60 S.W.3d 389 (Tex. App. 2001).

[568] "Pantex Leaks," *Texas Observer*, 12 January 1996, 24; Hunt, "'Host and Hostage,'" 355-6; "Pantex Pitches Plutonium Storage," *Texas Observer*, 26 November 1993, 17.

[569] U.S. Congress, Senate, Committee on Armed Services, *Department of Defense Authorization for Appropriations for Fiscal Year 1995 and the Future Years Defense Program: Hearings Before the Committee on Armed Services, United States Senate,* 103rd Cong., 2nd sess., 1994, 966-7.

that it was an example of “pork barrel politics.” More specifically, PANAL claimed that Texas Congressman Bill Sarpalius traded his vote on President Clinton’s 1994 budget bill in exchange for funding for the laboratory.[570]

While Texas Tech University, Texas A&M University, and the University of Texas scientists laid the groundwork for the resource center, the EPA finally weighed-in on Pantex. In April 1994, Mason and Hanger-Silas Mason attempted to stay the EPA’s investigations of Pantex by suspending plant operations for three months in order to tend to its pollutants. While workers scoured the landscape for lead, barium, and other metal pollutants, the EPA listed Pantex as a Superfund site. Notably, the EPA did not determine what contaminants and exposure risks were present at Pantex. Rather, the EPA designated Pantex as a Superfund site because it determined that Mason and Hanger-Silas Mason did not have a system in place to “adequately” treat effluent before it entered the groundwater nor did it store its solid waste in protective casings. To rectify this situation, the EPA partnered with the DOE and the Texas Commission on Environmental Quality to install synthetic liners on Pantex’s ditches, cover the site’s solid waste trenches, and construct new groundwater pumps and treatment systems around the plant.[571]

The latter-day struggle over Pantex’s future ended with little aplomb. In 1998, Energy Secretary Bill Richardson awarded the trigger work to the DOE’s Savannah River plant in South Carolina. In a last gasp of activism, Panhandle 2000 accused Richardson of corruption. The

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[570] Cartwright, “Disarmed and Dangerous.”

[571] D. Cluff, “Amarillo National Resource Center for Plutonium, Work Plan Progress Report, November 1, 1995—January 31, 1996,” 1996, https://www.osti.gov/biblio/226142; Hunt, “‘Host and Hostage,’” 356; Babcock & Wilcox, Technical Services Pantex, LLC with Sapere Consulting, Inc., “Record of Decision for Groundwater, Soil and Associated Media: Pantex Plant, Carson County, Texas,” September 2008, 1-1, 1-2, https://pantex.energy.gov/sites/default/files/016005.pdf; U.S. Environmental Protection Agency, U.S. Department of Energy, and the Texas Commission on Environmental Quality, “Pantex Plant Interagency Agreement,” December 2007, 1-5, https://pantex.energy.gov/sites/default/files/012031.pdf.

group claimed that the Savannah River plant was outdated compared to Pantex and had a poorer safety record. Thus, Panhandle 2000 concluded that the secretary had assigned the trigger work to Savannah River as a political gift to Jim Hodges. Hodges, a Democrat and Clinton ally, had just won the governorship of South Carolina. Meanwhile, Amarillo had elected Mac Thornberry, a Republican and critic of the Clinton administration, to the House of Representatives and sent George W. Bush to the governor's mansion in Austin. Shortly after launching this complaint, Panhandle 2000 disbanded. PANAL followed suit.[572] At the end of 1998, Pantex faced an uncertain future. Workers could not disassemble nuclear weapons indefinitely. The site's environmental hazards did not appear to require much capital or labor to rectify. Nor did its environmental footprint appear to yield a legacy of human health problems. The National Resource Center for Plutonium was left with a daunting task: find a peaceful use for surplus plutonium or a safe and secure way of disposing it.[573] Pantex appeared to be living on borrowed time.

The End of Los Angeles's Aerospace Bonanza

The INF Treaty devastated Los Angeles's aerospace industry. Before the treaty took effect, there were 746,000 aerospace and electronics jobs in California. The state was home to one in four U.S. aerospace jobs. In Los Angeles County alone, aerospace jobs accounted for 10 percent of the national total. In 1989, one year after Reagan proclaimed the treaty, there were only 635,000 aerospace and electronics jobs in California. As the military stopped purchasing

[572] Hunt, "'Host and Hostage,'" 356-7; "Pantex Supporters Disappointed," *Amarillo Globe-News*, 23 December 1998.
[573] Cartwright, "Disarmed and Dangerous."

and dismantled an entire class of missiles, virtually every defense contractor in Los Angeles laid-off employees. In 1989, TRW dropped one thousand jobs. Rockwell dropped five thousand. Northrop dropped three thousand. Hughes dropped six thousand. McDonnell Douglas asked five thousand managers to resign and compete against one another for 2,900 jobs. Economists described these early defense layoffs as "correctives" to the military buildup of the early 1980s. Few acknowledged that the entire aerospace industry might be in trouble.[574]

As the aerospace companies contracted, they sparked a larger recession that engulfed Los Angeles and the state of California. According to the California State Department of Finance, 957,000 Californians were out of work in November 1990. One year later, the number had grown to 1.1 million. Pat Fugami, a research analyst for the state of California, linked the recession to the decline in "high technology jobs in the aerospace industry." The University of Southern California Economics Professor Richard Day concurred, noting that the federal government's cutbacks in defense spending gave Los Angeles a "weak economy." "We had a massive defense budget under the Reagan [Administration]," Day said. "During a recession you don't want to cut expenditures, and that's what's happening."[575]

Many of the white-collar aerospace workers had never been jobless and struggled with their social and economic fall. Such was the case of Ezequiel Varela of Covina. Varela had worked for twenty-five years as an engineer at General Dynamics, the parent company of Convair. Believing that the Cold War insulated his position from typical market fluctuations,

[574] Franki V. Ransom, "A Victim of High-Tech Decline," *Los Angeles Times*, 5 January 1992; Robert F. Schoeni, Michael Dardia, Kevin F. McCarthy, and Georges Vernez, *Life After Cutbacks: Tracking California's Aerospace Workers* (Santa Monica: RAND, 1996), xi, xii; Robert C. McFarlane, "Time Out on Defense," *Washington Post*, 3 January 1988; Joan Didion, *Where I Was From* (New York: Vintage International, 2004), 131-2.

[575] Schoeni, Dardia, McCarthy, and Vernez, *Life After Cutbacks*, 1; Franki V. Ransom, "A Victim of High-Tech Decline," *Los Angeles Times*, 5 January 1992.

Varela and his family freely spent his earnings on expensive clothes, entertainment, and fine dining. In August 1991, General Dynamics laid off the 49-year-old father of five. It was the first time Varela was jobless since leaving college in 1961. Varela had been making $4,083 a month, or $49,000 a year, at his old job. In 1992, he was receiving $840 a month, or $10,080 a year, in unemployment. He had about $4,000 in savings. However, this money came from a home-improvement loan he took out shortly before he lost his job. He spent this money because he had to, although he knew he would struggle to pay it back. Because he no longer had health insurance, Varela instructed his children to "take Vitamin C and eat lots of oranges." After struggling with unemployment for five months, Varela swallowed his pride and enrolled in Networking Experience Unlimited, a state self-help program for unemployed professionals. Unfortunately, the historical record does not document what happened to him next.[576]

Ernie Cardona shared a similar story. Cardona had worked as a manager at the Northrop Corporation Electronics Systems Division in Hawthorne. In 1991, he too found himself out of work for the first time in his life. "Every single day I look for a job," the 42-year-old said. "It's very stressful. There's no income for the house payments, and property taxes, car insurance and house insurance are due." He received $800 a month in unemployment benefits, however, his monthly house payment was $1,300. There was no money left for necessities, let alone to help support his four children which lived with his ex-wife. "Forget the food, there's no food," Cardona said. "Sometimes my sister supplies me with some. It's sad. I [could not] afford to buy my children Christmas gifts." Cardona sent out more than 100 resumes. No one replied. Cardona's future appeared bleak.[577]

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576 Franki V. Ransom, "A Victim of High-Tech Decline," *Los Angeles Times*, 5 January 1992.
577 Ibid.

The dissolution of the Soviet Union in late 1991 further deepened the aerospace recession. As the Soviet Union fell, the Bush administration implemented defense cuts as a percentage of GDP, and not a set dollar amount, in the name of lowering taxes and the federal deficit. These cuts aligned with the Joint Understanding on Strategic Forces, an agreement between the United States and Russia that called for both nations to reduce their nuclear stockpiles by 50 percent and eliminate all ICBMs featuring multiple independently targetable reentry vehicles by 2003. In 1990, before the Iron Curtain came tumbling down, the defense budget constituted 5.278 percent of GDP. After the Iron Curtain fell, Bush slashed the defense budget to 4.666 percent in 1992. Economists stopped calling the defense cuts "correctives" and started branding the phenomenon as a "restructuring."[578] In 1992, Rockwell reported that its second-quarter profits fell 36 percent. The firm's net income fell to 45 cents per share, down from 66 cents per share, or $155.2 million, a year earlier. Sales were down 8 percent from the previous year. Rockwell Chief Executive Donald R. Beall said that the firm was hurt by a 51 percent drop in earnings for the company's aerospace businesses. Beall also noted that the aerospace cuts harmed the firm's commercial businesses—particularly electronics and printer manufacturing. Seeking to stay solvent, Rockwell contracted its Los Angeles aerospace businesses and closed some of its commercial facilities around the country, including its automotive parts plant in Winchester, Kentucky.[579] Other companies, including grocery stores and banks close to aerospace factories, indirectly suffered from the defense cuts and closed their

[578] Ronnie Lowenstein and Richard Peach, "The Impact of the Current Defense Build-down," *FRBNY Quarterly Review* (Autumn 1992): 59-60; George L. Rueckert, *Global Double Zero: The INF Treaty from Its Origins to Implementation* (Westport: Greenwood Press, 1993), xii; Stockholm International Peace Research Institute, *Yearbook: Armaments, Disarmament and International Security* (2019), https://data.worldbank.org/indicator/MS.MIL.XPND.GD.ZS?locations=US; Didion, *Where I Was From,* 132.

[579] Dean Takahashi, "Rockwell Profits Decline 36% in Second Quarter," *Los Angeles Times*, 22 April 1992; "Rockwell Employees Approve Closure Plan," *AP*, 11 May 1992.

doors. “Ironically, what’s really slowing the economy,” *Business Week* wrote, “is the most cheerful news in 50 years: the end of the Cold War.”[580]

The Clinton administration continued to slash the defense budget as a portion of GDP in an effort to “cut the deficit by half by 1996” and expand the economy. This strategy was problematic. As *Fortune* put it, Clinton “won the White House by promising to expand the economy and put millions of unemployed Americans to work. At the same time, he pledged to further dismantle one of the greatest job makers of recent years, the defense industry.” Theoretically, these goals were not contradictory. Shifting more of the nation’s resources from military to civilian uses in theory would make it easier for the nation to generate high-wage, high-skill employment in the long run. But in the short run, this plan devastated Los Angeles. In 1993, Clinton slashed the defense budget to 4.327 percent of GDP and promised to lower it further to less than 3 percent by 1997.[581] As cuts increased, the city’s research institutions restructured and downsized. For example, Jet Propulsion Laboratory (JPL), the largest employer in the San Gabriel Valley, announced that it was preparing to cut about 1,000 of its 7,500 workers over the next five years. JPL Director Edward Stone blamed the reductions on “the realities of the federal budget,” and the decline in aerospace work brought on by the city’s ailing defense contractors. Along with trimming its workforce, JPL planned to close its Foothill and

[580] “The Cold War’s Grim Aftermath,” *Business Week*, 24 February 1992.
[581] Jack Sweeney, “Clinton Takes on the Economy,” *Business Mexico*, April 1993, 30-1; Martin Feldstein, “A Deficit Reduction Plan to Boost the Economy,” *Wall Street Journal*, 19 November 1992; Lee Smith and Suneel Ratan, “Can Defense Pain Be Turned to Gain?,” *Fortune*, 8 February 1993, 84-5; Stockholm International Peace Research Institute, *Yearbook: Armaments, Disarmament and International Security* (2019), https://data.worldbank.org/indicator/MS.MIL.XPND.GD.ZS?locations=US.

Montrose offices. General Electric chose to get out of the aerospace game altogether and sold its aerospace division to Martin Marietta for $3 billion and 23 percent of Marietta's stock.[582]

Many of the displaced workers remained unemployed for years. In 1993, the *Los Angeles Times* documented the case of Jacob Ramon, a Huntington Beach microcircuit engineer. Ramon had four prestigious degrees from the city's aerospace schools and had made $60,000 a year working at The Aerospace Corporation, the nonprofit systems engineering institution. In 1991, the company laid-off Ramon. During the next three years, Ramon applied for the few jobs left in the city's aerospace industry. He did not receive a single interview. Moreover, in 1993, Ramon noted that he could not even get a job delivering pizza because Los Angeles's broader economy had collapsed. Defeat set in. "Letters come from the bank threatening to foreclose and you look at 10 or 15 bucks and you try to figure out if you are going to buy formula or diapers," Ramon said. "After a year we had exhausted everything. Even the engagement ring had to go. We are just trying to survive." Ramon borrowed money from every possible source, including the government compensation his elderly Japanese American in-laws received for their World War II internment. But the money did not last. Ramon eventually turned insomniac and refused to sleep in his bed for three years. "Every now and then, [my daughter] looks at me with those eyes and says: 'Tell me everything is going to be all right.' I try to say it as convincingly as I can," Ramon said.[583]

Any layoff is bound to be devastating, but in many ways the aerospace families fell hardest. The families had depended on companies that were almost paternalistic in their benefits

[582] Carla Lazzareschi, "Jet Propulsion Lab to Trim 1,000 Jobs Over Next 5 Years," *Los Angeles Times*, 26 February 1993; Howard Banks, "Aerospace & Defense," *Forbes*, 4 January 1993, 96.
[583] Faye Fiore, "Aerospace Fall Takes Heavy Toll on Families," *Los Angeles Times*, 20 December 1993.

and attitudes. Most aerospace firms had styled themselves as “model employers” that embraced their workers and their families. Before the defense cuts, aerospace firms provided their employees with fat pay raises, robust medical coverage, mental health counseling, legal counseling, college funds, on-site childcare, and retirement benefits. The life was so good that sons, daughters, and spouses would go to work for the firm that employed their loved ones. The defense cuts not only caused these Angelenos to lose their jobs, it also caused them to lose a way of life. Malcom Miller, a Los Angeles clinical psychologist treated scores of displaced aerospace workers. He noticed that most of his clients told the same story. “People got tied into the company very strongly. I saw young people in their 20s who were already putting away money for retirement. There was really a feeling that you couldn’t get any more solid than this,” he said. “Then the rug was pulled out from under them.” According to Miller, the collapse led many aerospace workers “to question the values that they were brought up with that if you apply yourself and work hard, you don’t have to worry.” “Many of those people were there to stay,” he continued. “It was like being thrown out of the nest.”[584]

It took a while for Rick Huntington to get used to sitting at home. Huntington had worked for Kaiser Marquardt in Van Nuys as a master scheduler for ramjet engines. He was laid-off in 1992. Despite not having a job, Huntington continued to wake up at 5AM. He spent most of his time searching the classifieds. After months of searching for a new aerospace job, Huntington started doing odd jobs and repair work around town. “I feel so worthless, I go through periods where I don’t even want to get out of bed. But you have to fire yourself up,” he said. “A lot of people depend on you, you can’t lie in bed and not shave for a week.” Huntington’s wife, Barbara, worked forty hours a week, so he tried to help around the house. Barbara worried “more

[584] Ibid.

about his self-esteem than the way he does laundry." "I try not to interfere when he does stuff around the house. I know it's his way of sharing the load. You end up with pink socks once in a while, but we can live with that," she said. Barbara noted that most of the jobless men seemed wiped out by the experience. Their egos were in shambles. Their sense of self-worth was gone. Several attempted suicide.[585]

Aerospace executives also fell victim to the defense cuts. Woody Woodruff of Rancho Palos Verdes had been a vice president at TRW. A former Air Force colonel, Woodruff had made $100,000 a year working at the company. The defense cuts forced him to retire four years early. Although Woodruff and his family were in better financial shape than most, Woodruff's early retirement made things awkward around the house. Woodruff's wife complained that her husband sat on the couch and ate too much food throughout the day, did not take her out for dinner, and got in the way of her at-home aerobics activities. When the telephone rang, Woodruff answered. Most of the neighbors and friends who called often began by asking him why he was answering the phone and not at work. Over time, these innocent questions wore-away at Woodruff's psyche and self-esteem. Woodruff had not fallen financially but his sense of self-worth was in disrepair.[586]

Those lucky few that kept their jobs faced a new work environment and a new home life. Hope Duncan managed to keep her job as a mechanic at Northrop in El Segundo. Before the defense cuts, Duncan worked alongside 27 other mechanics on the F/A-18 Hornet combat jet. After the cuts, Duncan worked alongside five people. Duncan noted that her cadre used to be a "fun group" that would share lunch every day and report to work in costume every Halloween.

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[585] Ibid.
[586] Ibid.

On October 31, 1993, Duncan came to work dressed as a witch. She was the only one in costume. The mood of the company had changed. Because the layoffs left Northrop shorthanded, Duncan was forced to work twelve hours a day, six days a week. Her husband managed to keep his job at Northrop, too. Like Hope, he was rarely home. The Duncans rarely saw each other. Although the Duncans received a large amount of overtime pay, they were afraid to spend it, fearing that another wave of layoffs was on the way. “I don’t know how much longer the work will last,” Duncan said. Instead of eating out or purchasing new clothes and other goods, the Duncans hoarded their paychecks, fearing that the cuts would eventually put them out of work. Although this self-imposed austerity was rational, when the Duncans and other families saved and did not spend their wages they contributed to overall decline in the city’s economy. Still, the Duncans cannot be blamed for this economic reality. The duo was merely trying to do what was best for themselves. Hope feared that if she lost her job there would be no future for her. “Northrop is my life. I don’t know anything but building aircraft,” she said.[587]

Between 1988 and 1993 some 800,000 jobs were lost in California. More than half of the jobs lost were in Los Angeles County. Many were linked to the ailing aerospace industry. In May 1993, the Commission on State Finance in Sacramento estimated that the state would lose another 90,000 aerospace jobs between 1993 and 1997. The Bank of America estimated that the cuts would reverberate across the greater economy and force somewhere between four to five hundred thousand more job losses between 1993 and 1995.[588]

During the 1950s and the 1960s, Americans had flocked to Los Angeles to work in the nation’s ICBM program. For fifty years, defense dollars propped up the city. In some years the

[587] Ibid.
[588] Didion, *Where I Was From*, 134.

net gain was as much as $8 billion. The INF Treaty and the end of the Cold War destroyed this calculus. During the 1990s, Los Angeles County paid more in federal taxes than it received in defense expenditures. As residents learned that the aerospace recession was not going to dissipate in short order, thousands fled the City of Angels. During the 1990s, the City of Los Angeles alone lost 200,000 white, non-Latino residents—almost one-fifth of its total white population. Some flocked to Washington state looking for commercial aerospace jobs. Others went to Texas, Georgia, Utah, and Arizona in search of a new beginning. In a way, the Soviet Union had made Los Angeles. When it collapsed it took much of the city with it.[589]

Although Bill Clinton had argued that voters care more about the economy than any other issue, his administration did nothing to save Los Angeles's aerospace industry. Instead of increasing the defense budget or pouring cash into non-defense aerospace work, such as space exploration, the Clinton administration told the aerospace firms that they would have to save themselves through consolidation. In 1993, Deputy Defense Secretary William Perry held a dinner with a group of CEOs representing the nation's top aerospace contractors. Perry told the executives that their companies would have to merge into larger entities if they wanted to survive the defense cuts. "Consolidate or evaporate," he said at what became known as "The Last Supper" in defense lore. "We expect defense companies to go out of business. We will stand by and watch it happen," Perry stated. The group took the warning to heart and left the meeting with forks in their hands.[590]

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[589] Mike Davis, *City of Quartz: Excavating the Future in Los Angeles* (New York: Verso, 2006), xiii, xvi.
[590] John A. Tirpak, "The Distillation of the Defense Industry," *Air Force Magazine,* 16 June 2008, https://www.airforcemag.com/article/0798industry/; John Mintz, "How A Dinner Led to a Feeding Frenzy," *Washington Post*, 4 July 1997; "U.S. Owes Industry an Update on Merger Policy," *Aviation Week & Space Technology*, April 1998, 94; "Carved Up Over Dinner," *The Guardian*, 16 December 1996.

After the dinner, the aerospace firms picked the bones of the companies most hurt by the recession. Take Grumman Corporation, for example. In 1990, Grumman posted $4.04 billion in sales. After the collapse of the Soviet Union, Grumman's sales sharply fell. In 1993, the company posted $3.24 billion in sales. As the company continued to fall, Northrop Aircraft purchased the firm in 1994. The electronics firm Litton Industries Inc. faced a similar fate. In 1990, Litton posted sales of $5.52 billion. In 1993, the firm only yielded $3.47 billion in sales. It too was eventually purchased by Northrop in 2001. Other firms sold their defense and aerospace divisions off to hungry defense monopolists. In 1990, Rockwell's aerospace division sold $2.90 billion worth of goods. In 1993, the division recorded $2.28 billion in sales. In 1996, Rockwell sold its defense and aerospace businesses, including what was once North American Aviation and Rocketdyne, to Boeing.[591] That same year, Boeing merged with McDonnell Douglas while Lockheed merged Martin Marietta Corporation and acquired Loral Corporation. Raytheon followed by purchasing the defense holdings of Hughes and Texas Instruments Inc. Each purchase put pressure on those firms who had not yet made transactions to join the fray or acquiesce to their failure. The feasting firms hoped that they could survive the cuts by becoming too big to fail. They were right. By gobbling up their competitors, Boeing, Lockheed, Northrop, Raytheon, and General Dynamics increased their equity prices based on the expectation of revenue growth and margin improvement from cost savings. This is not to suggest that consolidation abated job losses. On the contrary, industry executives continued laying off employees throughout the late 1990s at a rate of approximately 300,000 jobs per year. By doing so, the surviving firms hoped to save cash in a dwindling defense economy. By the summer of

[591] Grumman, Sixty-First Annual Report, 1990, 1; Grumman Corp., 1993 Annual Report, 1993, 1; Litton, Annual Report for the Fiscal Year 1990, 1990, 1; Litton, Annual Report for the Fiscal Year 1993, 1993, 2; Rockwell International, Annual Report 1991, 1991, 10; Rockwell International, Annual Report 1993, 1993, 8.

1997, Lockheed had spent $2.3 billion closing offices and laying off people. As a result, it expected to save $2.6 billion a year. By the end of the 1990s, 107 firms had become five, creating the current, top-heavy defense industry.[592] Los Angeles's aerospace bonanza was over. A new order had emerged.

The INF Treaty and the end of the Cold War transformed the military-industrial complex, but these developments did not erase the system's footprint on the West. Although Rocky Flats Plant fell under federal scrutiny for its environmental practices in the late 1980s, the fall of the U.S.S.R. destroyed the United States's demand for nuclear triggers and led the DOE to shutter Rocky Flats Plant for good. Following the shutdown, the federal government and its contractors attempted to rid the landscape of its radioactive pollutants. While the EPA declared remediation complete in 2006, the landscape continues to emit radiation. The INF Treaty led the DOE to shutdown Hanford's Z Plant and place PUREX on standby. When the Soviet Union disintegrated the DOE permanently closed PUREX, making remediation Hanford's sole mission. Remediation continues to this day. It is unclear if it will be a success. Pantex managed to weather the end of the Cold War but faced an uncertain future dismantling nuclear warheads. Pantex had become ingratiated in the West Texas economy. West Texans depended on Pantex for employment and consequently petitioned the federal government to expand Pantex's mission. The INF Treaty and the end of the Cold War also fundamentally changed Los Angeles's aerospace industry. As

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[592] "Carved Up Over Dinner," *The Guardian*, 16 December 1996; Jeff Cole, "Defense Industry Regroups—War of Attrition," *Wall Street Journal Europe*, 9 December 1996; Thomas E. Ricks and Jeff Cole, "Jumping the Gun," *Wall Street Journal*, 19 June 1998; Jeff Cole, "War of Attrition," *Wall Street Journal*, 6 December 1996; John Deutch, "Consolidation of the U.S. Defense Industrial Base," *Acquisition Review Quarterly*, Fall 2001, 140; Charles Grant, "Land of Giants," *The Economist*, 14 June 1997, S5-S11; Aaron Mehta, "30 Years: William Perry—Reshaping the Industry," *DefenseNews*, 25 October 2016, https://www.defensenews.com/30th-annivesary/2016/10/25/30-years-william-perry-reshaping-the-industry/.

federal demand for missiles dissipated, the Bush and Clinton administrations slashed the defense budget and struck a blow to the aerospace economy. Some aerospace companies failed outright. Others survived by purchasing struggling companies and becoming too big to fail.

In sum, the INF Treaty and the collapse of the Soviet Union had real material, economic, and environmental consequences for the West. These international developments prompted the remediation of Rocky Flats Plant and Hanford, devastated the Los Angeles economy, and created new anxieties in Amarillo. The end of the Cold War and the dawn of demilitarization left westerners with a new uncertain future. It remains to be seen if westerners can fully rid Rocky Flats Plant and Hanford of radioactive pollutants, whether Amarillo can economically survive without Pantex, and if the new aerospace oligopoly will prove to be a benefit or a burden to the West.

Conclusion

While workers in Los Angeles and at Rocky Flats Plant, Pantex, and Hanford faced the reconfiguration of their economies and, in some cases, a legacy of environmental degradation, uranium country confronted an ongoing human tragedy as well. The federal response to the plight of its miners offers a fitting conclusion to our discussion of the Atomic West. Many western business and workers enthusiastically participated in the military-industrial complex that fueled regional economic growth following World War II. Yet the wealth and consequences of this participation were never experienced equally. And, as the Cold War came to an end, westerners and the nation grappled with its financial, ecological, and corporeal aftermath.

During the 1990s the federal government provided some fiscal compensation to the uranium families and began plotting the remediation of uranium country. Of course, no amount of money could fully heal their damaged bodies and psyches. At the same time, while the government moved to remediate some abandoned uranium mines and mills, it did not plan to tend to all hazardous uranium sites in the West. Indeed, federal officials combated the human health and the environmental problems of the business of atomic war with incomplete solutions. As a result, the legacies of uranium mining and milling in the West, including uranium-borne illnesses and environmental contamination, persist today.

In October 1990, Congress passed and President George H.W. Bush signed into law the Radiation Exposure Compensation Act (RECA). The law began with a formal apology: "Congress recognizes that the lives and health of uranium miners and of innocent citizens who lived downwind of the Nevada tests were sacrificed to serve the national security interests of the United States, and Congress apologizes to these citizens and their families on behalf of the

Nation." The RECA then established a $100 million trust fund to compensate those Americans who had worked in the underground uranium mines or lived downwind from the Nevada Test Site. The law tasked the U.S. Department of the Treasury to administer the trust fund and assigned the Justice Department the responsibility for screening claimants and distributing the payments.[593]

Notably, RECA did not require claimants to establish causation. Rather, claimants qualified for compensation if they worked in an underground mine between 1942 and 1971, the period when the U.S. government was the sole purchaser of uranium, and had developed lung cancer, fibrosis of the lung, pulmonary fibrosis, silicosis, pneumoconiosis, or cor pulmonale related to fibrosis of the lung. Recognizing that smoking could have caused several of the listed diseases, Congress created additional criteria to screen claimants. Specifically, Congress established working level months (WLM) of exposure to uranium, a calculation which gauged whether a lung illness was a product of uranium mining or smoking. One WLM consisted of 170 hours of exposure to uranium. In order to qualify for RECA compensation, a nonsmoker needed 200 WLM, or 34,000 hours, of exposure to uranium. A smoker who developed a listed respiratory disease or cancer before the age of 45 needed 300 WLM. A smoker who developed a listed disease after the age of 45 needed 500 WLM.[594]

Miners who passed this screening were eligible to receive a one-time, lump sum payment of $100,000. Additionally, in the event that the miner had died, the miner's widow and children could receive the $100,000 payment if they could prove that they were married or related to the miner and that the deceased met the eligibility criteria. Eighteen months after Bush signed RECA

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[593] *An Act to Provide Jurisdiction and Procedures for Claims for Compassionate Payments for Injuries due to Exposure to Radiation from Nuclear Testing*, Public Law 101-426, *U.S. Statutes at Large* 104 (1990): 920-926.
[594] Ibid.

into law, compensation began flowing to the uranium miners and their survivors. On May 27, 1992, several hundred Navajos gathered at Window Rock, Arizona, the capital of the Navajo Nation, to witness the delivery of the first checks to four widows of Navajo uranium miners.[595]

Although RECA appeared to offer a modicum of justice to the uranium families, the law proved problematic. RECA funneled cash to the lawyers that represented the uranium families. Before Congress passed RECA, Utah Senator Orrin Hatch, one of the bill's sponsors, placed a provision in the bill to limit attorney fees to 10 percent, in an attempt to prevent the law from becoming "a playground to benefit the lawyers." Nonetheless, some former miners believed that the $10,000 attorney fee was egregious. "10 percent seemed like money taken away from the people without reason," one former miner opined. "I really disapprove of the [attorney fees] they took from them. When they were making the legislation, they should have made it so that the people got all of the money, because they were the ones who did the work."[596] Still other uranium families argued that the basic compensation was inadequate. "We have all been exposed to uranium, and then the gratitude of one hundred thousand dollars is just not enough," one uranium wife wrote. "The people have been contaminated, it is in their blood, and some children never got to see their fathers come home to them. Money is something that just disappears in your hands, and human beings are priceless. Human beings can greet you all their life. Money

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[595] *An Act to Provide Jurisdiction and Procedures for Claims for Compassionate Payments for Injuries due to Exposure to Radiation from Nuclear Testing*, Public Law 101-426, *U.S. Statutes at Large* 104 (1990): 920-926; Susan E. Dawson, Perry H. Charley, and Phillip Harrison Jr., "Advocacy and Social Action Among Navajo People: Uranium Workers and Their Families, 1988-1995," in *The Navajo People and Uranium Mining*, ed. Doug Brugge, Timothy Benally, and Esther Yazzie-Lewis (Albuquerque: University of New Mexico Press, 2006), 59; Eichstaedt, *If You Poison Us*, 153; Macro Juarez, Jr., "Radiation Compensation, U.S. Pays First Navajo Claims," *Gallup Independent,* 28 May 1992.

[596] Larry C. Johns with Alan R. Johns, *The Baneberry Disaster: A Generation of Atomic Fallout* (Reno: University of Nevada Press, 2017), 183; George Tutt, interview by Timothy Benally, December 1995, in *The Navajo People and Uranium Mining*, ed. Doug Brugge, Timothy Benally, and Esther Yazzie-Lewis (Albuquerque: University of New Mexico Press, 2006), 19.

does not greet you."[597] Furthermore, many uranium miners and families emphasized that RECA did not cover other diseases associated with uranium mining, such as renal cancer, chronic renal disease, and kidney tubal-tissue injury. And the RECA provided no aid for above-ground miners and millers.[598]

Perhaps the most problematic aspect of RECA was it tasked the U.S. Surgeon General with certifying claimants' medical records. Throughout modern medical history, the federal government had considered hospital records and physician signatures to be official, accurate, and truthful. However, the RECA certification process dictated that attorneys gather health records from hospitals and the Indian Health Service and send them to Washington D.C. for certification. This process was particularly time-consuming for Navajo claimants who relied on the Indian Health Service for healthcare. Navajo miners and their families flooded the Indian Health Service with thousands of records requests. The financially-strapped service needed to hire dozens of clerks to process the paperwork. Lacking medical training, the clerks copied and sent thousands of irrelevant documents. The Surgeon General's office then had to sift through thick medical dossiers and extract relevant documentation for each claimant. At its best, this process took six months. Meanwhile, non-Indian claimants simply secured their relevant medical records from private hospitals and submitted the documents to the Surgeon General. In most cases, non-Indian claimants received certification for their records within a week. An understaffed and inefficient Indian Health Service had prolonged the agony of the Navajo uranium families.[599]

[597] Leroy and Lorraine Jack, interview by Phil Harrison, December 1995, in *The Navajo People and Uranium Mining*, ed. Doug Brugge, Timothy Benally, and Esther Yazzie-Lewis (Albuquerque: University of New Mexico Press, 2006), 54.
[598] Thomas G. Smith, *Stewart L. Udall: Steward of the Land* (Albuquerque: University of New Mexico Press, 2017), 320.
[599] *An Act to Provide Jurisdiction and Procedures for Claims for Compassionate Payments for Injuries due to Exposure to Radiation from Nuclear Testing*, Public Law 101-426, *U.S. Statutes at Large* 104

The Justice Department further complicated the compensation process for Navajo and other Native American families by requiring marriage documentation. The Justice Department refused to recognize traditional Native American marriages because of the lack of legal documentation associated with these unions. Thousands of Native Americans had been wed by tribal spiritual leaders and did not record their unions with government offices. Consequently, the Justice Department turned away widows that attempted to claim RECA compensation and were unable to provide papers documenting their marriage. Holy vows, witnesses, and a lifetime of living together did not constitute a marriage in the eyes of the Justice Department.[600]

Stewart Udall, a longtime uranium activist and lawyer for 200 uranium families, was incensed by RECA's shortcomings and the Justice Department's marriage policy. "They've put these people in a bureaucratic legal maze designed to prevent compensation to Navajo miners," Udall told the *New York Times*. "There's no pity for what happened to these people. No understanding. You have a compassionate program administered in an utterly uncompassionate manner." Udall also noted that non-Indian uranium miners and families were getting compensated "twice as fast" as Navajo victims. Seeking justice for the uranium families, Udall wrote a scathing letter to Assistant Attorney General Stuart M. Gerson on December 17, 1993. "You and your staff have turned a program Congress enacted to provide 'compassionate payments' to the victims of our nation's radiation tragedies into a nightmare of frustration and confusion," he said. "The pattern of your payments reveals an anti-Indian bias." Udall listed

(1990): 920-926; Eichstaedt, *If You Poison Us*, 154; Stewart Udall to U.S. Department of Justice Assistant Attorney General Stuart M. Gerson and Torts Branch Director Helene Goldberg, 17 December 1992, folder 8, box 244, Stewart L. Udall Papers, University of Arizona Special Collections, Tucson, Arizona.

600 Eichstaedt, *If You Poison Us*, 155; Stewart Udall to U.S. Department of Justice Assistant Attorney General Stuart M. Gerson and Torts Branch Director Helene Goldberg, 17 December 1992, folder 8, box 244, Stewart L. Udall Papers, University of Arizona Special Collections, Tucson, Arizona.

seventeen Navajo widows who had filed claims in April and June of 1992. These claims were still unprocessed after six months. Udall also noted that the Justice Department had denied some of his clients' claims because they did not have documented marriages. "Has this inaction been prompted by a desire to punish these widows because they were in the group which went to court and proved that agencies of the federal government had sacrificed the safety of their husbands for supposed 'national security' reasons?" Udall asked. The attorney concluded with a postscript recommending that Congress amend RECA to include more diseases, provide more money to victims, and reduce the medical and bureaucratic hurdles for claimants.[601]

Gerson shot back in a January 14, 1993 letter to Udall. Gerson absolved his department of blame and argued that the delays in processing Navajo claims were Udall's fault for failing to ensure that the Surgeon General received only the appropriate medical records. According to Gerson, Udall should have worked more closely with the Indian Health Service to procure only the relevant health records. Furthermore, Gerson alleged that his department was not at all biased. "In sum, your allegations of bigotry, unfairness and delay and completely unfounded and mask serious shortcomings in your fulfilling the uncomplicated requirements of the law," he wrote. Regarding the undocumented marriages, Gerson pointed out that the Navajo Nation had an office which kept track of tribal marriages, the Navajo Office of Vital Statistics. Gerson noted that this office did not have records for several of Udall's widowed clients and therefore reasoned that these widows were not widows at all, but opportunists hoping to make a quick buck through deceit. Gerson failed to realize that few Navajos registered their traditional

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[601] Scott Raymond Einberger, *With Distance in His Eyes: The Environmental Life and Legacy of Stewart Udall* (Reno: University of Nevada Press, 2018), 252-3; Keith Schneider, "A Valley of Death for the Navajo Uranium Miners," *New York Times*, 3 May 1993; Eichstaedt, *If You Poison Us*, 169; Stewart Udall to U.S. Department of Justice Assistant Attorney General Stuart M. Gerson and Torts Branch Director Helene Goldberg, 17 December 1992, folder 8, box 244, Stewart L. Udall Papers, University of Arizona Special Collections, Tucson, Arizona.

marriages with the Navajo Office of Vital Statistics. In many cases, Navajo marriages took place forty of fifty years before the office was established and thus many miners did not register their nuptials with the institution. The Justice Department was failing Udall's clients. Once again, Udall and the uranium families looked to Congress for justice.[602]

While Udall and the uranium families petitioned Congress to rectify the shortcomings of RECA, Big Uranium continued to work the American West. Most of this activity occurred near Uravan, Colorado, and on the Navajo Reservation. One firm, Uranium Energy Corporation: AMEX moved to establish new uranium fields in South Texas. Another uranium juggernaut, Powertech Uranium Corporation, petitioned the U.S. Nuclear Regulatory Commission for a license to mine uranium in the Black Hills near Edgemont. Following the collapse of the Soviet Union, Kerr-McGee acquired uranium fields in Kazakhstan and moved towards a global monopolization of the ore. With the Soviet threat abated, Big Uranium hoped to sell the ore to U.S. energy firms, Russia, and China.[603]

While Big Uranium continued to dominate the uranium market, the DOE and the EPA investigated the environmental legacies of uranium mining and milling. Although the DOE and the EPA examined and monitored the contaminants near the Wind River Reservation, both organizations refused to remediate the area. The DOE argued that although the groundwater near

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602 Stuart M. Gerson to Stewart Udall, 14 January 1993, folder 8, box 244, Stewart L. Udall Papers, University of Arizona Special Collections, Tucson, Arizona; Eichstaedt, *If You Poison Us*, 155-6.

603 Energy Fuels, "Sunday Complex," accessed 20 January 2020, https://web.archive.org/web/20131019110707/http://www.energyfuels.com/projects/sunday_complex/; Byron W. King, "Update on Uranium," Energy & Scarcity Investor, 2 March 2010, https://www.uraniumenergy.com/_resources/media/Update_on_Uranium-Byron_King.pdf; Talli Nauman, "Oglala Sioux Tribe Victory in Uranium Case," *Native Sun News*, 8 May 2015; "Kerr-McGee, Oryx Join U.S. Merger Frenzy," *Oil & Gas Journal* 96, no. 43 (October 1998): 38-40; John Solomon and Alison Spann, "Uranium One Deal Led to Some Exports to Europe, Memos Show," The Hill, 2 November 2017, https://thehill.com/policy/national-security/358339-uranium-one-deal-led-to-some-exports-to-europe-memos-show.

the old Susquehanna-Western mill contained harmful radioactive substances "no one is drinking site-contaminated ground water" and therefore "no human health risks are currently associated with the affected ground water." "We chose…natural attenuation as the remediation strategy at Riverton," one DOE official explained. All the while, local residents continued to claim that the contamination had caused cancers and deformities to manifest in Wind River. Both bureaucracies also decided against remediating the landscape surrounding the old mines and mills near Edgemont. This decision was reached in part because local ranchers owned most of the land surrounding the mines and mills and refused to allow the EPA to investigate their properties for contamination. "I don't want the government on my place. I don't trust the government," one rancher explained. Many of the ranchers feared that if the bureaucracies found contamination on their properties it would threaten the viability of their businesses and potentially leave them with the cleanup bill. Susquehanna Corporation, the giant holding company that had controlled much of the mining and milling in the Edgemont area, had legally dissolved in 1994. This left the ranchers "potentially liable parties" in the eyes of the EPA if the administration determined a cleanup was warranted. Thus, each time EPA investigators descended on Edgemont they were met with angry ranchers that ordered them to leave.[604]

While the DOE and the EPA failed to remediate Riverton and Edgemont, the organizations did move to clean up the contaminated Navajo landscape. In 1994, the DOE aided the EPA in establishing a Superfund site which encompassed all of the uranium mines on the

[604] U.S. Department of Energy, "Baseline Risk Assessment of Ground Water Contamination at the Uranium Mill Tailings Site Near Riverton, Wyoming," September 1995, CS-1, https://inis.iaea.org/collection/NCLCollectionStore/_Public/27/019/27019611.pdf?r=1&r=1; "Cancer-Riddled Wind River Reservation Fights EPA Over Uranium Contamination," *Indian Country Today*, 19 January 2012; Seth Tupper, "EPA: Cleanup Not Necessary at Old Edgemont Uranium Mines," *Rapid City Journal*, 27 April 2016; Seth Tupper, "Scars Upon the Land in the Southern Hills," *Rapid City Journal*, 1 November 2015.

Navajo Nation, called the Abandoned Uranium Mines on the Navajo Nation. In late 1997, the EPA conducted a helicopter survey of one corner of the 27,000 square-mile Superfund site. The EPA also partnered with the Navajo Nation Environment Protection Agency to create a program to evaluate structures on the reservation that may have been constructed using abandoned mine materials. In 2005, the Navajo Nation finally banned uranium mining and milling on their reservation. The EPA has not yet begun cleaning up the Navajo uranium mines but has appropriated $1.7 billion to remediate 219 of the 523 abandoned mines. Additionally, the EPA has endowed the Navajo Nation with $122 million to develop new water systems to combat radioactive effluent in the groundwater.[605]

In July 2000, Congress finally amended RECA to address the problems with the compensation process. The amendments allowed above-ground miners and uranium mill workers to receive compensation. The amendments also did away with the Surgeon General's certification requirement, respected undocumented traditional marriages, and expanded the diseases covered to include renal cancer, chronic renal disease, and kidney tubal-tissue injury. Additionally, the amendments created a grant to fund community-based institutions to screen for cancers, chronic renal disease, and kidney tubal-tissue injury. On October 5, 2000, Congress passed the Energy Employees Occupational Illness Compensation Program Act (EEOICPA) as part of the 2001 defense department appropriations. EEOICPA raised RECA compensation to $150,000 for future claimants and provided a $50,000 retroactive payment to past beneficiaries.

[605] U.S. Environmental Protection Agency, "U.S. EPA to Perform Helicopter Survey of Abandoned Uranium Mies in the Oljato Area," September 1997, http://navajoboy.com/media/pdfs/NAVA2.PDF; The Navajo Nation, "Navajo Nation President Joe Shirley, Jr. Signs Diné Natural Resources Protection Act of 2005," 30 April 2005, https://www.nrc.gov/docs/ML0721/ML072150169.pdf; U.S. Environmental Protection Agency, "Cleaning Up Abandoned Uranium Mines," 19 June 2019, https://www.epa.gov/navajo-nation-uranium-cleanup/cleaning-abandoned-uranium-mines; U.S. Environmental Protection Agency, "USEPA Support for Navajo Nation," April 2016, https://www.epa.gov/sites/production/files/2016-06/documents/navajo_nation_support_4-16_web.pdf.

EEOICPA also provided funds to reimburse medical expenses for those uranium miners and millers that qualified for RECA. Finally, the measure tasked the DOE and the Labor Department to create resource centers to help uranium workers and their families file RECA and EEOICPA claims.[606]

In the end, the federal government offered a modicum of justice to the uranium families. From April 1992 to July 2000, the Justice Department paid 1,599 RECA claims and denied 1,554 claims, despite the fact that more than 10,000 people were eligible for the program. It is unclear how many uranium families did not file claims because of lack of knowledge of the program.[607] Although RECA and EEOICPA helped some uranium families, they did not, and could not, fully address the disastrous legacies of uranium mining and milling. Environmental contamination, psychological traumas, and the loss of loved ones could not be erased by cash. As the child of one uranium miner put it: “My dad remains dead and I remain bitter; so continues the legacy of the Navajo uranium miners.”[608]

The business of atomic war left numerous footprints across the West. Nuclear weapons jobs spurred new migrations, fiscally and socially empowered westerners, galvanized local economies, and gave rise to new communities. The great uranium hunt tantalized westerners, sparking new dreams of a golden future paved in uranium ore, but ultimately gave way to a new oligopoly in the region. Real and perceived fears about nuclear waste ushered in grassroots struggles which pit environmentalists and peace advocates against nuclear workers and their

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[606] *An Act to Amend the Radiation Exposure Compensation Act, and for Other Purposes*, Public Law 106-245, *U.S. Statues at Large* 114 (2000): 501-510; *An Act to Authorize Appropriations for Fiscal Year 2001 for Military Activities of the Department of Defense*, Public Law 106-398, *U.S. Statutes at Large* 114 (2000): 1654-1654A-513; Doug Brugge and Rob Goble, “The Radiation Exposure Compensation Act: What is Fair?,” in *The Navajo People and Uranium Mining*, ed. Doug Brugge, Timothy Benally, and Esther Yazzie-Lewis (Albuquerque: University of New Mexico Press, 2006), 146-7, 150-1.
[607] Brugge and Goble, “The Radiation Exposure Compensation Act,” 141.
[608] Dawson, Charley, and Harrison Jr., “Advocacy and Social Action Among Navajo People,” 75.

corporate overlords. Although many of them closed in the 1990s, the West's nuclear production facilities have their own metaphorical "half-life." Amarillo's economy remains entangled with Pantex. The Tri-Cities continues to depend on the Hanford remediation project for employment. Los Angeles's suburban network remains intact, yet the city has not found a new economic motor that rivals its previous aerospace engine. Westerners still suffer from radioactive diseases stemming from Cold War nuclear production. Radioactive contaminants continue to plague Rocky Flats Plant, Hanford, and uranium country. Local communities remain divided over whether the business of atomic war, and the military-industrial complex more generally, was on balance a benefit or a burden.

In the end, this story is really about how the United States relied on old patterns of development and organization to produce materiel to prepare for, and to deter, a potential nuclear conflict. Drawing on its history of corporate dependency, the American state utilized private firms to procure uranium, plutonium, nuclear weapons triggers, ICBMs, and assemble nuclear warheads. Although we often imagine that the state rigorously controlled nuclear weapons procurement, the record shows that corporations had far more power in this effort than we might have suspected. Corporations decided how their facilities would operate, what materials they would produce, and the rate of production. Indeed, while the state articulated what types of weapons the government desired to purchase, private firms determined the rest. In exchange for this work, the nuclear firms were rewarded with fixed fees or fixed uranium prices. The power these nuclear firms received was not won by monetary compensation. Rather, their power was derived from the fact that they alone produced nuclear components. In order to keep pace with the Soviet Union's atomic program, the American state became dependent on American nuclear firms.

The state also drew on an older pattern of abusing the western landscape and westerners to produce nuclear weapons. During the nineteenth and early twentieth centuries, the state allowed private firms to pillage the West of its natural resources and abuse its peoples in the name of industrialization, corporate profits, and the growth of the national economy. In pursuit of nuclear weapons, the state augmented this pattern. Reading the West's natural and economic landscape, the state targeted the West for nuclear weapons fabrication and encouraged westerners to mine uranium. It branded this new nuclear program as an economic positive for westerners and as an endeavor that would not flush corporations with wealth. Federal officials, corporate executives, and local boosters stylized nuclear weapons fabrication as the means to uplift western economies, providing new blue- and white-collar jobs to local residents. Not only did a large swath of westerners imbibe this rhetoric, they experienced the financial rewards it promised. The business of atomic war was fiscally good for many western communities for decades. The West was not saddled with this system. It consented to it and nourished it.

The costs of this business manifested by the 1970s. Lung cancer and radioactive waste plagued many of the western communities that had embraced the business of atomic war. However, these problems did not affect all westerners involved in the industry. Environmental contamination was not equally shared. Consequently, the West divided against itself. Some nuclear weapons workers remained dedicated to the industry, recognizing that it empowered their bank accounts, granted them a higher perch on the social hierarchy, and facilitated the doctrines of nuclear deterrence and peace through strength. Other workers took to whistleblowing and identified the hazardous nature of nuclear weapons work and the environmental problems it posed. At the same time, environmentalists and anti-war advocates set their sights on the nuclear industries in their backyards and called for their closure, the end of the

Cold War, environmental remediation, and compensation for nuclear-borne illnesses. This divide persists. Nuclear hawks and doves continue to flutter within the ranks of blue- and white-collar Americans. Westerners continue to weigh the economic benefits and the physical and environmental pains of the nuclear weapons industry.

In the end, we can take away several indispensable, interrelated conclusions. First, the military-industrial complex was not a top-down organization directed by a scientific-technological elite, but a diffuse system supported by, and comprised of, blue- and white-collar Americans who found lucrative paychecks and a distinctive social status by taking jobs in the weapons industry. Second, private firms as much as the federal government, and at times even more than the federal government, shepherded the U.S. effort to procure nuclear weapons and delivery systems. Third, the state's demand for nuclear weapons pushed private firms to manufacture nuclear materiel as quickly as possible and overlook the environmental and human health consequences of rapid nuclear procurement. Fourth, this dedication to procurement over human and environmental health galvanized thousands of westerners to form anti-nuclear movements and seek justice for decades of radioactive contamination.

The business of atomic war was shaped by blue- and white-collar Americans. People, such as Crawford Greenewalt and Simon Ramo, interacted with this system by organizing nuclear developments. Other people, such as Jack Weaver, Ezequiel Varela, and Charlie Steen, participated by building nuclear technologies or mining uranium. Some people, including Larry Haler, Clint Groff, Kathy Erickson, and W. Winfred Moore, found their role by defending the system in the public arena. Still others, such as Pam Solo, Stewart Udall, Harry Tome, and Leroy Matthiesen, interacted with the system by challenging it politically and demanding justice from it. The business of atomic war, therefore, reached across, enveloped, and transformed the

American West. And while the end of the Cold War dealt damaging blows, the business of atomic war persisted. Westerners continue to interact with this system today.

The changes in West's economy, environment, and society launched by the nuclear military-industrial complex during the Cold War were entrenched and irrevocable. Westerners and private corporations had created a new, complex system that transformed western pocketbooks, living spaces, bodies, and relationships. The business of atomic war was unlike any other industrial endeavor. It was at once an economic, environmental, human health, and social phenomenon negotiated by average westerners in disparate corners of the region. It was a pervasive, but by no means monolithic system. Its founding, maturation, and latter-day transformations reflected westerners' desires and actions. In a way, the nuclear military-industrial complex reflected the broader character of the American political and economic system. Although international events set the system in motion in 1942 and prompted its reconfiguration in the 1990s, American businesses and the American people operated it. Corporations and working Americans produced nuclear weapons, nuclear waste, and nuclear divides.

Bibliography

Archives, Museums, and Repositories

Air Force Systems Command, Norton Air Force Base, California.

Bancroft Library, University of California, Berkeley, Berkeley, California.
    Henry Kaiser Papers

Carl Albert Center Congressional Archives, University of Oklahoma, Norman, Oklahoma.
    Robert S. Kerr Collection

Carnegie Library for Local History, Boulder, Colorado.

Center for Southwest Research, University Libraries, University of New Mexico, Albuquerque, New Mexico.
    Joseph M. Montoya Papers

Denver Public Library, Denver, Colorado.

Diocese of Amarillo Archives, Amarillo, Texas.

Dwight D. Eisenhower Library, Abilene, Kansas.
    Dwight D. Eisenhower's Papers as President
    John Stewart Bragon Papers

Hagley Museum and Library, Wilmington, Delaware.
    Crawford Greenewalt Manhattan Project Diary Transcripts
    DuPont Atomic Energy Division Records
    F.T. Matthias Papers
    James W. Parker Memoir
    Records of E.I. du Pont de Nemours & Co.

Hanford History Project Archives, Washington State University Tri-Cities, Richland, Washington.

Harry S. Truman Library and Museum, Independence, Missouri.
    Harry S. Truman Papers

J. Willard Marriott Library Special Collections, University of Utah, Salt Lake City, Utah.
    Utah Uranium Oral History Project
    Simon Ramo Papers

Library of Congress, Washington, D.C.
    NAACP Records
    Papers of the NAACP

Los Angeles Air Force Base, California.

National Archives and Records Administration (NARA), College Park, Maryland.
    Record Group 77: Records of the Office of the Chief of Engineers
    Record Group 128: Records of Joint Committees of Congress
    Record Group 326: Records of the Atomic Energy Commission

National Archives and Records Administration, Rocky Mountain Region, Denver, Colorado.
    Identifier 434-99-208

NNSA/NSO Nuclear Testing Archive, Las Vegas, Nevada.

Northwest African American Museum, Seattle, Washington.

Oklahoma Historical Society, Oklahoma City, Oklahoma.
    Kerr-McGee Corp. Collection

Richland Public Library.

Ronald Reagan Presidential Library and Museum, Simi Valley, California.

Southwest Collection, Texas Tech University, Lubbock, Texas.
    Toxic Tour of Texas Collection
    Uncatalogued Peace Farm Materials
    Wallet S 1392.1

The Huntington Library, San Marino, California.
    Aerospace Oral History Project
    Albert R. Hibbs Papers
    Clarence L. Johnson Papers

University of Arizona Special Collections, Tucson, Arizona.
    Stewart L. Udall Papers

University of Colorado Boulder Libraries, Special Collections and Archives, Boulder, Colorado.
    Edward Putzier Collection
    Kathy Partridge Papers
    Two Rivers Citizen Association Collection

University of Virginia Libraries, Charlottesville, Virginia.

U.S. Department of Energy, Office of Scientific and Technical Information, Oak Ridge, Tennessee.

U.S. Department of Energy, Pacific Northwest National Laboratory Public Reading Room, Richland Operations Office, Richland, Washington.

Wyoming State Geological Survey, Laramie, Wyoming.
Uranium—Miscellaneous Reports and Letters File

Congressional Records and Reports

U.S. Congress, House of Representatives. Subcommittee of the Committee on Government Operations. *Organization and Management of Missile Programs: Hearings before a Subcommittee of the Committee on Government Operations*. 86th Cong., 1st sess., 1959.

U.S. Congress. House of Representatives. Committee on Government Operations. *Organization and Management of Missile Programs: Eleventh Report by the Committee on Government Operations*. 86th Cong., 1st sess., 1959.

U.S. Congress. House of Representatives. Committee on Interior and Insular Affairs. Subcommittee on Energy and the Environment. *Mill Tailings Dam Break at Church Rock, New Mexico: Oversight Hearing before the Subcommittee on Energy and the Environment of the Committee on Interior and Insular Affairs*. 96th Cong., 1st sess., October 1979.

U.S. Congress. House of Representatives. Committee on Science and Astronautics. *Progress of Atlas and Polaris Missiles*. 86th Cong, 1st sess., 1959.

U.S. Congress. House of Representatives. Committee on Science, Space, and Technology. Subcommittee on Investigations and Oversight. *Environmental Crimes at the Rocky Flats Nuclear Weapons Facility: Hearings Before the Subcommittee on Investigations and Oversight of the Committee on Science, Space, and Technology*. 102nd Cong., 2nd sess., 1992.

U.S. Congress. House of Representatives. Subcommittee for Special Investigations of the Committee on Armed Services. *The Aerospace Corporation, A Study of Fiscal and Management Policy and Control: Hearings before the Subcommittee for Special Investigations of the Committee on Armed Services.* 89th Cong., 1st sess., 1965.

U.S. Congress. House of Representatives. Subcommittee for Special Investigations of the Committee on Armed Services. *Weapons System Management and Team System Concept in Government Contracting: Hearings before the Subcommittee for Special Investigations of the Committee on Armed Services.* 86th Cong., 1st sess., 1959.

U.S. Congress. House of Representatives. Subcommittee of the Committee on Government Operations. *Organization and Management of Missile Programs, Part I—Department of Defense, Part II—Air Defense, Part III—Air Force: Hearings before a Subcommittee of the Committee on Government Operations*. 86th Cong., 2nd sess., 1960.

U.S. Congress. House of Representatives. Subcommittee on the Civil Service of the Committee on Post Office and Civil Service and Subcommittee on Civil and Constitutional Rights of the Committee on the Judiciary. *Standards and Due Process Procedures for Granting, Denying, and Revoking Security Clearances: Joint Hearings before the Subcommittee on the Civil Service of the Committee of Post Office and Civil Service and the Subcommittee on Civil and Constitutional Rights of the Committee on the Judiciary*. 101st Cong., 1st and 2nd sess., 1989 and 1990.

U.S. Congress. Senate. Committee on Armed Services. *Department of Defense Authorization for Appropriations for Fiscal Year 1995 and the Future Years Defense Program: Hearings Before the Committee on Armed Services, United States Senate*. 103rd Cong., 2nd sess., 1994.

U.S. Congress. Senate. *Report of the Special Committee on Investigation of the Munition Industry (Nye Report).* 74th Cong, 2nd sess., 1936.

U.S. Congress. Senate. Subcommittee of the Committee on Appropriations. *Public Works for Water and Power Development and Atomic Energy Commission Appropriations for Fiscal Year 1972: Hearings before a Subcommittee of the Committee on Appropriations*. 92nd Cong., 1st sess., 1972.

Freedom of Information Act Documents

Aerospace Corporation. “Annual Progress Report, 1 July 1960 through 20 June 1961.” El Segundo, California.

Dow Chemical Company. “Schedule 3, The Dow Chemical Company, Rocky Flats Plant, Contract No. AT(29-1)-1106, Base Employment Rate for Cafeteria Personnel, Effective July 23, 1953.”

Dow Chemical Company. “Schedule 3, The Dow Chemical Company, Rocky Flats Plant, Contract No. AT(29-1)-1106, Base Employment Rate for Technically Trained Employees, Effective February 9, 1953.”

Dow Chemical Company. “Schedule 4.”

Dow Chemical Company. “Schedule 5, The Dow Chemical Company, Rocky Flats Plant, Contract No. AT(29-1)-1106, Base Employment Rate for Plant Protection Personnel.”

Dow Chemical Company, Rocky Flats Division. “Report of Investigation of Serious Incident in Building 71 on September 11, 1957.” J.G. Epp, author. Document IN-732, 7 October 1957.

Procter & Gamble Company. “The Procter & Gamble Model at Work.” 15 May 1952.

Procter & Gamble Company. “Working at Pantex.” 20 June 1952.

Simon Ramo FBI Files.

U.S. Atomic Energy Commission. "Atomic Energy Commission Decision on AEC 382, Selection of a Site and Method of Operation for New H.E. Fabrication Facility, Note by the Secretary." Roy B. Snapp, author. AEC 382/1, 28 November 1950.

U.S. Atomic Energy Commission. "Method of Operation of New HE Fabrication Facility." AEC 382/3. 13 March 1951.

U.S. Atomic Energy Commission. "Selection of Operating Contractor for Project Orange, Report by Director Military Application," AEC 382/2, 21 February 1951.

U.S. Atomic Energy Commission. "Selection of a Site and Method of Operation for New HE Fabricating Facility." AEC 382. 28 November 1950.

U.S. Atomic Energy Commission. "Selection of a Site and Method of Operation for New HE Fabricating Facility." AEC 382/2. 21 February 1951.

U.S. Atomic Energy Commission, Albuquerque Operations Office. *Investigation of the Tritium Release Occurrence at the Rocky Flats Plant*. 26 November 1973.

U.S. Atomic Energy Commission, Director of Military Application. "Selection of a Site for Project Apple." AEC 394/3. 19 March 1951.

Laws

An Act to Amend the Radiation Exposure Compensation Act, and for Other Purposes. Public Law 106-245. *U.S. Statues at Large* 114 (2000): 501-510.

An Act to Authorize Appropriations for Fiscal Year 2001 for Military Activities of the Department of Defense. Public Law 106-398. *U.S. Statutes at Large* 114 (2000): 1654-1654A-513.

An Act to Provide Federal Government Aid for the Readjustment in Civilian Life of Returning World War II Veterans. Public Law 78-346. *U.S. Statutes at Large* 58 (1944): 284-301.

An Act to Provide for Liability, Compensation, Cleanup, and Emergency Response for Hazardous Substances Released into the Environment and the Cleanup of Inactive Hazardous Waste Disposal Sites. Public Law 96-510. *U.S. Statutes at Large* 94 (1980): 2796-2811.

An Act to Provide Jurisdiction and Procedures for Claims for Compassionate Payments for Injuries due to Exposure to Radiation from Nuclear Testing. Public Law 101-426. *U.S. Statutes at Large* 104 (1990): 920-926.

An Act to Provide Technical and Financial Assistance for the Development of Management Plans and Facilities for the Recovery of Energy and Other Resources from Discarded Materials and for the Safe Disposal of Discarded Materials, and to Regulate the Management of Hazardous Waste, Public Law 94-580. *U.S. Statutes at Large* 90 (1976): 2795-2841.

Atomic Energy Act of 1946. Public Law 79-585. *U.S. Statues at Large* 60 (1946): 755-775.

National Housing Act of 1934. Public Law 73-479. *U.S. Statutes at Large* 48 (1934): 1246-1265.

The Federal-Aid Highway Act of 1956. Public Law 84-627. *U.S. Statutes at Large* 70 (1956): 374-402.

U.S. Constitution, amend. 5.

Newspapers and Periodicals

Acquisition Review Quarterly

Aircraft & Missiles

Ada Evening News

Navajo Times

Ada Weekly News

Albuquerque Journal

Albuquerque Tribune

Alamogordo Daily News

Air Force/Space Digest

Akwesasne Notes

Amarillo Daily News

Amarillo Globe

Amarillo Globe-News

Amarillo Globe-Times

Amarillo Sunday News-Globe

AP

Arizona Highways

Arizona Republic

Aviation International News

Aviation Week & Space Technology

Barron's National Business and Financial Weekly

Billings Gazette

Boeing Magazine

Boulder Daily Camera

Business Mexico

Business Week

Canyon Country Zephyr

Cascadia Times

Chicago Tribune

Colorado Heritage

Colorado Springs Gazette

Colorado Springs Gazette Telegraph

Daily Ardmoreite

Daily Bruin

Daily Sentinel

Daily World

Denver Post

E Magazine

Edmonton Journal

EPA Journal

Farmington Daily Times

Forbes

Fort Collins Coloradoan

Fortune

Gallup Independent

Galveston Daily News

Greeley Daily Tribune

Harper's

High Country News

Huronite and Daily Plainsman

Hustler

Idaho Free Press

Idaho State Journal

Indian Country Today

Insight on the News

Lawton Morning Press

Lockheed Horizons

Logan Herald Journal

Longview Daily News

Look

Los Angeles Examiner

Los Angeles Times

Louisville Times

Milwaukee Journal

MIT News

Mitchell Daily Republic

Moab Times-Independent

Native Sun News

New York Times

NIHB Health Reporter

Off Our Backs

Pantexan

People

Popular Science

Rapid City Journal

Richland Bulletin

Richland Villager

Richfield Reaper

Rocky Mountain News

Salt Lake Tribune

San Fernando Valley Realtor

San Francisco Chronicle

San Juan Record

Santa Fe New Mexican

Science for the People

Seattle Post-Intelligencer

Seattle Times

Spokane Chronicle

Spokesman-Review

The Economist

The Guardian

The Progressive

The U.C.L.A. Magazine

The Villager

Texas Monthly

Texas Observer

Time

Tri-City Herald

Tyler Morning Telegraph

United Press International

Uranium

U.S. Catholic

USA Today

Wall Street Journal

Wall Street Journal Europe

Walla Walla Union-Bulletin

Washington Post

Westword

West Texas Catholic

Yuma Daily Sun

Legal Cases

Barnson v. Foote Mineral Co. Nos. C-80-0119A, C-81-0719W, C-81-0045W & C-81-0715J (D. Utah 1985).

Barnson v. United States. 630 F. Supp. 418 (D. Utah 1985).

Begay v. United States. 768 F.2d 1059 (9th Cir. 1985).

Bivens v. Six Unknown Named Agents of Federal Bureau of Narcotics. 403 U.S. 388 (1971).

Bricker v. Rockwell Hanford Operations. No. CY-90-3090-AAM, 1991 U.S. Dist. LEXIS 18965 (E.D. Wash. September 17, 1991).

Bricker v. Rockwell Int'l Corp. 10 F. 3d 598 (9th Cir. 1993).

John N. Begay, et al. v. United States of America. 591 F. Supp. 991 (D. Arizona 1984).

Rendon v. Roman Catholic Diocese. 60 S.W.3d 389 (Tex. App. 2001).

Primary Sources in Author's Possession (procured via Ebay and other sellers)

American Electronics, Inc. "Another American Electronics First." Advertisement. circa 1957.

Boeing Company. *Boeing/Vandenberg.* Brochure. circa 1965.

Detectron Corp., "Find Uranium!!" Advertisement. 1953.

Douglas Aircraft Company, Inc. "Douglas Aircraft Company, Inc. Application for Employment." circa 1956.

Douglas Aircraft Corporation. "A Career for You at Douglas." December 1956.

Dow Chemical Company. 1951 Annual Report. July 1951.

Dow Chemical Company. 1953 Annual Report. July 1953.

Dow Chemical Company. 1954 Annual Report. July 1954.

Dow Chemical Company. 1955 Annual Report. July 1955.

Dow Chemical Company. 1956 Annual Report. August 1956.

Dow Chemical Company. 1957 Annual Report. August 1957.

Dow Chemical Company. 1958 Annual Report. August 1958.

Dow Chemical Company. 1959 Annual Report. August 1959.

Dow Chemical Company. 1960 Annual Report. August 1960.

Grumman. Sixty-First Annual Report. 1990.

Grumman Corp. 1993 Annual Report. 1993.

Litton. Annual Report for the Fiscal Year 1990. 1990.

Litton. Annual Report for the Fiscal Year 1993. 1993.

Litton Industries, Inc. "A Report of Financial Condition and Review of Operations for the Fiscal Year which Ended July the Thirty-First Nineteen Hundred Sixty." 1960.

Lockheed Aircraft Corporation, Missile Systems Division. "A Terminal Report on Advanced Telemetering Development for X-17." LMSD-2179. 31 July 1957. Sunnyvale, California.

Lockheed Corporation. "Of Men and Stars: A History of Lockheed Aircraft Corporation." July 1957.

Lockheed Corporation. "Of Men and Stars: A History of Lockheed Aircraft Corporation." August-September 1957.

Lockheed Corporation. "Of Men and Stars: A History of Lockheed Aircraft Corporation." January 1958.

Procter & Gamble Company. Statement of Year Ended June 30, 1951. August 1951.

Procter & Gamble Company. Statement of Year Ended June 30, 1952. August 1952.

Procter & Gamble Company. Statement of Year Ended June 30, 1953. August 1953.

Procter & Gamble Company. Statement of Year Ended June 30, 1954. August 1954.

Procter & Gamble Company. Statement of Year Ended June 30, 1955. August 1955.

Procter & Gamble Company. Statement of Year Ended June 30, 1956. August 1956.

The Aerospace Corporation. “Fact Sheet: The Aerospace Corporation.” December 1983. Los Angeles, California.

Ramo-Wooldridge Corporation. “Background Data Sheet on the Ramo-Wooldridge Anti-Smog Device.” 17 October 1958.

Red Rock Chapter of the Navajo Tribe. “Requesting the United States Congress, the Navajo Tribal Council and Indian Health Service to Take Appropriate Action to Assist Former Navajo Uranium Miners and Their Families.” Resolution RRC-48-76. Photocopy.

Rockwell International. Annual Report 1991. 1991.

Rockwell International. Annual Report 1993. 1993.

R.V. Lloyd Douglas Aircraft Company Paystubs. 1955-1957. Santa Monica, California.

United States Bank of Grand Junction. “The United States Bank of Grand Junction Welcomes You to Western Colorado.” Brochure. 1960.

Published Government Reports and Documents

Albrethsen, Holger, Jr. and Frank E. McGinley. *Summary History of Domestic Uranium Procurement Under U.S. Atomic Energy Commission Contracts Final Report*. Oak Ridge: U.S. Department of Energy, 1982.

Federal Housing Administration. *Underwriting Manual.* Washington, D.C.: U.S. Government Printing Office, 1938.

Finch, Warren I., Arthur P. Butler, Jr., Frank C. Armstrong, and Albert E. Weissenborn. “Uranium.” *United States Mineral Resources, Geological Survey Professional Paper 820*. Donald A. Brobst and Walden P. Pratt, eds. Washington, D.C.: U.S. Government Printing Office, 1973.

Ford, Bacon & Davis Utah Inc. *A Summary of the Engineering Assessment of Inactive Uranium Mill Tailings, Grand Junction Site, Grand Junction, Colorado*. Albuquerque: U.S. Department of Energy, Albuquerque Operations Office, 1981.

Navajo Tribal Council. *Navajo Tribal Council Resolutions, 1922-1951*. Washington, D.C.: U.S. Government Printing Office, 1952.

Neufeld, Jacob. *The Development of Ballistic Missiles in the United States Air Force, 1945-1960*. Washington, D.C.: U.S. Government Printing Office, 1990.

U.S. Atomic Energy Commission, Division of Operational Safety. *Operational Accidents and Radiation Exposure Experience within the United States Atomic Energy Commission 1943-1975*. Washington, D.C.: U.S. Atomic Energy Commission, 1975.

U.S. Atomic Energy Commission, Grand Junction Operations Office. Press Release No. 220, 24 November 1958.

U.S. Atomic Energy Commission, Grand Junction Operations Office. Press Release No. 213, 8 May 1958.

U.S. Atomic Energy Commission. "Domestic Uranium Program Circular 2." *Federal Register*, Document 48-3425, 11 April 1948.

U.S. Atomic Energy Commission. *Geiger Counter Radiation Meter*. William H. Hinch, author. Oak Ridge: Atomic Energy Commission, 1947.

U.S. Bureau of Census. *Census of Housing, 1960, Volume I*. Washington D.C.: U.S. Government Printing Office, 1963.

U.S. Congress, Office of Technology Assessment. *A History of the Department of Defense Federally Funded Research and Development Centers*. Washington, D.C.: U.S. Government Printing Office, 1995).

U.S. Department of Commerce, Census Bureau. *Income of Families and Persons in the United States: 1950*. Washington, D.C.: U.S. Government Printing Office, 1952.

U.S. Department of Commerce. *Census of Population: 1950, Volume I: Number of Inhabitants*. Washington, D.C.: U.S. Government Printing Office, 1952.

U.S. Department of Commerce. *County and City Data Book, 1952*. Washington, D.C.: U.S. Government Printing Office, 1953.

U.S. Department of Commerce. *County and City Data Book, 1952*. Washington, D.C.: U.S. Government Printing Office, 1953.

U.S. Department of Commerce. *County and City Data Book, 1956*. Washington, D.C.: U.S. Government Printing Office, 1957.

U.S. Department of Commerce. *County and City Data Book, 1962*. Washington, D.C.: U.S. Government Printing Office, 1962.

U.S. Department of Commerce. *Family Income in the United States: 1952*. Washington, D.C.: U.S. Government Printing Office, 1954.

U.S. Department of Commerce. *Family Income in the United States: 1954 and 1953*. Washington, D.C.: U.S. Government Printing Office, 1955.

U.S. Department of Energy, Hanford Cultural Resources Program. *Hanford Site Historic District: History of the Plutonium Production Facilities, 1943-1990*. Columbus, OH: Battelle Press, 2002.

U.S. Department of Energy, U.S. Environmental Protection Agency, Washington State Department of Ecology. *Hanford Federal Facility Agreement and Consent Order 89-10*. Richland: U.S. Department of Energy, May 1989.

U.S. Department of Energy. *Domestic Uranium Mining and Milling Industry: 1983 Visibility Assessment*. Washington, D.C.: U.S. Government Printing Office, 1984.

U.S. Department of the Interior, U.S. Bureau of Mines. *Mining Practices at Four Uranium Properties in the Gas Hills, Wyoming*. F.D. Everett, author. Washington, D.C.: U.S. Government Printing Office, 1963.

U.S. Department of the Interior, U.S. Bureau of Mines. *Underground Mining Methods and Costs at Three Salt Wash Uranium Mines of Climax Uranium Co.* W.L. Dare, author. Denver: Bureau of Mines, 1959.

U.S. Department of the Interior, U.S. Geological Survey. *Bibliography of U.S. Geological Survey Reports on Uranium and Thorium, 1942 through May 1958*. Paul E. Soister and Dora R. Conklin, authors. Washington, D.C.: U.S. Government Printing Office, 1959.

U.S. Department of the Interior, U.S. Geological Survey. *Geology of the Area Adjacent to the Free Enterprise Mine, Jefferson County, Montana*. W.A. Roberts and A.J. Gude 3d, authors. Washington, D.C.: U.S. Government Printing Office, 1953.

U.S. Department of the Interior, U.S. Geological Survey. *Physical Exploration for Uranium During 1951 in the Silver Reef District, Washington County, Utah*. Frederick Stugard, Jr., author. Washington, D.C.: U.S. Government Printing Office, 1954.

U.S. Department of the Interior, U.S. Geological Survey. *Preliminary Report on the Comet Area, Jefferson County, Montana.* George E. Becraft, author. Washington, D.C.: U.S. Government Printing Office, 1953.

U.S. Department of the Interior, U.S. Geological Survey. P*reliminary Examination of Uranium Deposits near Marysvale, Piute County, Utah*. Harry C. Granger and Herman L. Bauer, Jr., authors. Washington, D.C.: U.S. Government Printing Office, 1950.

U.S. Department of the Interior, U.S. Geological Survey. *Preliminary Report on Uranium in the Gas Hills Area, Fremont and Natrona Counties, Wyoming*. J.D. Love, author. Washington, D.C.: U.S. Government Printing Office, 1954.

U.S. Department of the Interior, U.S. Geological Survey. *Principal Gold-Producing Districts of the United States*. A.H. Koschmann and M.H. Bergendahl, authors. Washington, D.C.: U.S. Government Printing Office, 1968.

U.S. Department of the Interior, U.S. Geological Survey. *Uranium in the Metal-Mining Districts of Colorado.* R.U. King, B.F. Leonard, F.B. Moore, and C.T. Pierson, authors. Washington, D.C.: U.S. Government Printing Office, 1953.

U.S. Department of the Interior, U.S. Geological Survey. *Uranium Deposits of the Black Hills, South Dakota, and Wyoming.* C.S. Robinson and G.B. Gott, authors. Washington, D.C.: U.S. Government Printing Office, 1958.

U.S. Environmental Protection Agency, Office of Radiation Programs. *Radiological Survey at the Inactive Uranium Mill Site Near Riverton, Wyoming*. Richard L. Douglas, author. Las Vegas: Office of Radiation Program Las Vegas Facility, 1977.

U.S. Environmental Protection Agency, U.S. Bureau of Indian Affairs, U.S. Nuclear Regulatory Commission, U.S. Department of Energy, Indian Health Service, Agency for Toxic Substances and Disease Registry, and Navajo Nation. *Federal Actions to Address Impacts of Uranium Contamination in the Navajo Nation*. Washington, D.C.: U.S. Government Printing Office, 2014.

Published Primary Sources

2nd Annual Atomic Frontier Days Program. Richland: Junior Chamber of Commerce, 1949.

Anderson, C.E. *Keep Your Ducks in a Row!: The Manhattan Project Hanford, Washington 1943-1945*. New York: Page Publishing, 2016.

*Atomic Frontier Days: A New Light on the Old Frontier, Richland, Washington, Sept. 4-5-6, 194*8. Richland: Junior Chamber of Commerce, 1948.

Bolton, Roger E. *Defense Purchases and Regional Growth*. Washington, D.C.: The Brookings Institution, 1966.

[Bonney, Walter T.] *The Aerospace Corporation, 1960-1970: Serving America*. El Segundo: The Aerospace Corporation, 1970.

Compere, Tom, ed. *The Air Force Blue Book, Volume I*. New York: Military Publishing Institute, Inc., 1959.

Compton, Arthur Holly. *Atomic Quest: A Personal Narrative*. New York: Oxford University Press, 1956.

Didion, Joan. *Where I Was From*. New York: Vintage International, 2004.

Dow Chemical Company, Rocky Flats Division. *Unclassified Publications Through 1964*. Springfield, VA: U.S. Department of Commerce, 1965.

DuPont. *Construction—Hanford Engineer Works: History of the Project, Volume 1*. Wilmington: E.I. du Pont de Nemours and Co., 1945.

Eisenhower, Dwight D. "Address in Detroit at the National Automobile Show Industry Dinner." *Public Papers of the Presidents of the United States: Dwight D. Eisenhower, 1960-1*. Washington, D.C.: U.S. Government Printing Office, 1961.

Groves, Leslie R. *Now It Can Be Told: The Story of the Manhattan Project*. New York: Da Capo Press, 1983.

Hanford Education Action League. *Mission Statement and Goals.* Spokane: Hanford Action League, 1985.

Hobbs, Farrel D. *An Insider's View of Rocky Flats: Urban Myths Debunked*. Coppell: CreateSpace Independent Publishing Platform, 2010.

Ikle, Doris. *Southern California's Economy in the Sixties, Report no. P-2077*. Santa Monica: RAND Corporation, 1960.

Iversen, Kristen. *Full Body Burden: Growing Up in the Nuclear Shadow of Rocky Flats*. New York: Broadway Books, 2013.

Lilienthal, David E. *Big Business: A New Era*. New York: Harper & Brothers Publishers, 1953.

Lilienthal, David E. *Change, Hope, and the Bomb*. Princeton: Princeton University Press, 1963.

Lilienthal, David E. *The Journals of David E. Lilienthal, Volume II: The Atomic Energy Years, 1945-1950*. New York: Harper & Row, Publishers, 1964.

Matthiesen, Leroy T. *Wise and Otherwise: The Life and Times of a Cottonpicking Texas Bishop*. Amarillo: Custom Printing Company, 2005.

McKinley, Wes and Caron Balkany. *The Ambushed Grand Jury: How the Justice Department Covered Up Government Nuclear Crimes and How We Caught Them Red Handed*. New York: Apex Press, 2004.

Means, Lorelei DeCora. "Women of All Red Nations." *Red Power: The American Indians' Fight for Freedom*. Alvin M. Josephy Jr., Joane Nagel, and Troy Johnson, eds. Lincoln: University of Nebraska Press, 1999.

Means, Lorelei and Janet McCloud. "Who We Are." *National Indian Civil Rights Issues Hearing Held in Washington, D.C., March 19-20, 1979, Volume II: Exhibits*. United States Commission on Civil Rights, ed. Washington, D.C.: U.S. Government Printing Office, 1979.

National Conference of Catholic Bishops. *The Challenge of Peace: God's Promise and Our Response, A Pastoral Letter on War and Peace, May 3, 1983*. Washington, D.C.: United States Catholic Conference, 1983.

Nichols, K.D. *The Road to Trinity: A Personal Account of How America's Nuclear Policies Were Made*. New York: Morrow, 1987.

Nieburg, H.L. *In the Name of Science*. Chicago: Quadrangle Books, 1966.

Nixon, Richard. *The Memoirs of Richard Nixon*. New York: Grosset & Dunlap, 1978.

Procter & Gamble Company. *Into a Second Century with Procter & Gamble*. Cincinnati: Procter & Gamble Company, 1944.

Ramo, Simon. *The Business of Science: Winning and Losing in the High-Tech Age*. New York: Hill and Wang, 1988.

Schoeni, Robert F., Michael Dardia, Kevin F. McCarthy, and Georges Vernez. *Life After Cutbacks: Tracking California's Aerospace Workers*. Santa Monica: RAND, 1996.

Solo, Pam. *From Protest to Policy: Beyond the Freeze to Common Security*. Cambridge: Ballinger Publishing Co., 1988.

Stockwell, John. *In Search of Enemies: A CIA Story*. New York: W.W. Norton & Co., 1978.

Teller, Edward with Judith L. Shoolery. *Memoirs: A Twentieth-Century Journey in Science and Politics*. Cambridge: Perseus Publishing, 2001.

The Aerospace Corporation. *The Aerospace Corporation, Its Work: 1960-1980*. El Segundo: The Aerospace Corporation, 1980.

The Teapot Committee. "Recommendations of the Teapot Committee." *The Development of Ballistic Missiles in the United States Air Force, 1945-1960*. Jacob Neufeld, author. Washington, D.C.: U.S. Government Printing Office, 1990.

Truman, Harry S. *Memoirs, Volume II: Years of Trial and Hope*. Garden City: Doubleday & Company, Inc., 1956.

Udall, Stewart L. *The Myths of August: A Personal Exploration of Our Tragic Cold War Affair with the Atom*. New York: Pantheon Books, 1994.

United States Vanadium Company. *Mesa Miracle, in Colorado, Utah, New Mexico, Arizona*. New York: Union Carbide and Carbon Corporation, 1953.

von Kármán, Theodore with Lee Edson. *The Wind and Beyond: Theodore von Kármán, Pioneer in Aviation and Pathfinder in Space*. Boston: Little, Brown and Company, 1967.

Waldie, D.J. *Holy Land: A Suburban Memoir*. New York: W.W. Norton & Company, 1996.

Oral History Interviews

Allen, Rose. Interview by Robert Franklin. 12 January 2018. Hanford History Project, Washington State University Tri-Cities, Richland, Washington.

Bailey, DeWitt "Bill." Oral History. *Working on the Bomb: An Oral History of WWII Hanford*. S.L. Sanger, author. Portland, OR: Continuing Education Press, 1995.

Barnes, Dallas. Interview by Robert Franklin. 22 March 2018. Hanford History Project, Washington State University Tri-Cities, Richland, Washington.

Blanc, Robert. Interview by Linda West. August 1970. Utah Uranium Oral History Project, J. Willard Marriott Library Special Collections, University of Utah, Salt Lake City, Utah.

Bowman, Herbert (Herb). Interview by Hannah Nordhaus. 2 September 2004. OH1269. Carnegie Library for Local History, Boulder, Colorado.

Bubenzer, Robert E. Oral History. *Working on the Bomb: An Oral History of WWII Hanford*. S.L. Sanger, author. Portland, OR: Continuing Education Press, 1995.

Campbell, Sam. Oral History. *Working on the Bomb: An Oral History of WWII Hanford*. S.L. Sanger, author. Portland, OR: Continuing Education Press, 1995.

Crippen, Virginia. Interview by Vanessa Moore. Hanford History Project, Washington State University Tri-Cities, Richland, Washington.

Ellsberg, Daniel. Interview by LeRoy Moore. 24 April 1998. OH1530A-B. Boulder Public Library, Boulder, Colorado.

Groff, Cliff. Interview by Robert Franklin. 10 August 2017. Hanford History Project, Washington State University Tri-Cities, Richland, Washington.

Grutt, E.W. Interview by Richard Gibbs and Greg Brolin. 28 July 1970. Utah Uranium Oral History Project, J. Willard Marriott Library Special Collections, University of Utah, Salt Lake City, Utah.

Haler, Larry. Interview by Robert Franklin. 3 April 2018. Hanford History Project, Washington State University Tri-Cities, Richland, Washington.

Jack, Leroy and Lorraine. Interview by Phil Harrison. December 1995. *The Navajo People and Uranium Mining*. Doug Brugge, Timothy Benally, and Esther Yazzie-Lewis, eds. Albuquerque: University of New Mexico Press, 2006.

Kelly, James (Jim) D. Interview by LeRoy Moore. 14 May 1998. OH1503. Carnegie Library for Local History, Boulder, Colorado.

Kleinknecht, Emma. Interview by Robert Franklin. 12 June 2013. Hanford History Project, Washington State University Tri-Cities, Richland, Washington.

Matthias, Franklin T. Oral History. *Working on the Bomb: An Oral History of WWII Hanford*. S.L. Sanger, author. Portland, OR: Continuing Education Press, 1995.

Matthias, Franklin. Interview by Stephane Groueff. 1965. Voices of the Manhattan Project. https://www.manhattanprojectvoices.org/oral-histories/colonel-franklin-matthiass-interview-part-1-1965.

McKay, Charles (Charlie) Church. Interview by Hannah Nordhaus. 6 August 2003. OH115V A-B. Carnegie Library for Local History, Boulder, Colorado.

McNamara, Edwin (Ed). Interview by Hannah Nordhaus. 23 January 2004. OH1209. Carnegie Library for Local History, Boulder, Colorado.

Pruitt, James. Interview by John Skinner. 18 October 2001. Hanford History Project, Washington State University Tri-Cities, Richland, Washington.

Ramo, Simon. Interview by Carol Butler. 6 April 1999. NASA Oral History Project. https://historycollection.jsc.nasa.gov/JSCHistoryPortal/history/oral_histories/NASA_HQ/Ballistic/RamoS/RAMO_4-6-99-amended.pdf.

Ramo, Simon. Interview by Peter Westwick. 4 December 2010. Aerospace Oral History Project, The Huntington Library, San Marino, California.

Ray, Velma. Interview by Vanessa Moore. Hanford History Project, Washington State University Tri-Cities, Richland, Washington.

Richmond, Olden. Interview by Vanis Daniels. 21 June 2001. Hanford History Project, Washington State University Tri-Cities, Richland, Washington.

Schriever, Bernard A. Interview by Carol Butler. 15 April 1999. NASA Oral History Project. https://historycollection.jsc.nasa.gov/JSCHistoryPortal/history/oral_histories/NASA_HQ/Ballistic/SchrieverBA/SchrieverBA_4-15-99.htm.

Shumway, Harold Eugene. Interview by Dorothy Erick and Suzanne Simon. 23 July 1970. Utah Uranium Oral History Project, J. Willard Marriott Library Special Collections, University of Utah, Salt Lake City, Utah.

Silliman, Ken. Interview by Robert Franklin. 2 July 2013. Hanford History Project, Washington State University Tri-Cities, Richland, Washington.

Solo, Pam. Interview by Dorothy D. Ciarlo. 2004. OH1272-V. Boulder Public Library, Boulder Colorado.

Steele, Karen Dorn. Interview by John Osborn. 15 February 2018. Center for Environmental Law and Policy. https://celp.org/karen-dorn-steele/.

Steele, Karen Dorn. Interview by Trisha Pritikin. 15 January 2019. Atomic Heritage Foundation. https://www.manhattanprojectvoices.org/tags/karen-dorn-steele.

Tutt, George. Interview by Timothy Benally. December 1995. *The Navajo People and Uranium Mining*. Doug Brugge, Timothy Benally, and Esther Yazzie-Lewis, eds. Albuquerque: University of New Mexico Press, 2006.

Weaver, Jack Dale. Interview by LeRoy Moore. 2 June 1998. OH1516. Carnegie Library for Local History, Boulder, Colorado.

Williams, Joe. Interview by Vanis Daniels. Hanford History Project, Washington State University Tri-Cities, Richland, Washington.

Williams-Fields, Bessie May. Interview by Vanis Daniels. Hanford History Project, Washington State University Tri-Cities, Richland, Washington.

Scientific Publications

Bodansky, David. *Nuclear Energy Principles, Practices, and Prospects*. New York: Springer, 2004.

Boehm, B.O., S. Rosinger, D. Belyi, and J.W. Dietrich. “The Parathyroid as a Target for Radiation Damage.” *New England Journal of Medicine* 365, no. 7 (August 2011), 676-678.

Emsley, John. *Nature’s Building Blocks: An A to Z Guide to the Elements*. New York: Oxford University Press, 2001.

Hart, Olin M. *Ore Deposits in the United States, 1933-1967*. New York: American Institute of Mining Engineers, 1968.

Hersey, Roy V. *Forty-Ninth Annual Report of the State Mine Inspector*. Phoenix: Prescott Printing Co., 1960.

International Atomic Energy Agency. *Geological Environments of Sandstone-Type Uranium Deposits.* Vienna: IAEA, 1985.

L’Annunziata, Michael F. *Radioactivity: Introduction and History.* Amsterdam: Elsevier Science, 2007.

Langden, Raymond E. and A.L. Kidwell. “Geology and Geochemistry of the Highland Uranium Deposit.” *Wyoming Geological Association Earth Science Bulletin* (December 1973), 41-48.

Li, Jin, Tong Tong Zhang, Wen Yang, and Yu Zhang. “The Environmental Impact of Mining and Its Countermeasures.” *MATEX Web of Conferences* 63 (2016): 1-7.

Martell, E.A., P.A. Goldan, J.J. Kraushaar, D.W. Shea, and R.H. Williams. “Fire Damage.” *Environment: Science and Policy for Sustainable Development* 12, no. 4 (1970), 14-21.

Mongan, T.R., S.R. Ripple, G.P. Brorby, and D.G. diTommaso. “Plutonium Releases from the 1957 Fire at Rocky Flats.” *Health Physics* 71, no. 4 (October 1996), 510-521.

Pattison, J.E., R.P. Hugtenburg, M.W. Charles, and A.H. Beddoe. “Experimental Simulation of A-bomb Gamma-ray Spectra for Radiobiology Studies.” *Radiation Protection Dosimetry* 95 no. 2 (May 2001), 125-136.

Poet, S.A. and E.A. Martell. “Plutonium-239 and Americium-241 Contamination in the Denver Area.” *Health Physics* 23, no. 4 (October 1972), 537–548.

Rivkees, Scott A., Charles Sklar, and Michael Freemark. “The Management of Graves’ Disease in Children, with Special Emphasis on Radioiodine Treatment.” *Journal of Clinical Endocrinology & Metabolism* 83, no. 11 (November 1998), 3767–3776.

Robbins, Jacob and Arthur B. Schneider. “Thyroid Cancer Following Exposure to Radioactive Iodine.” *Reviews in Endocrine and Metabolic Disorders* 1, no. 3 (April 2000), 197-203.

Rothkamm, K., and M. Löbrich. “Evidence for a Lack of DNA Double-Strand Break Repair in Human Cells Exposed to very low X-ray Doses.” *Proceedings of the National Academy of Sciences of the United States of America* 100, no. 9 (April 2003), 5057-5062.

Ruttenber, A.J., Jr., K. Kreiss, R.L. Douglas, T.E. Buhl, and J. Millard. “The Assessment of Human Exposure to Radionuclides from a Uranium Mill Tailings Release and Mine Dewatering Effluent.” *Health Physics* 47, no. 1 (July 1984), 21-35.

Shapley, Deborah. “Rocky Flats: Credibility Gap Widens on Plutonium Plant Safety,” *Science* 174, no. 4009 (November 1971), 569-571.

Simon, Steven L., André Bouville, and Charles E. Land. “Fallout from Nuclear Weapons Tests and Cancer Risks: Exposures 50 Years Ago Still Have Health Implications Today that Will Continue into the Future.” *American Scientist* 94, no. 1 (January-February 2006), 48-57.

Books and Book Chapters

Abbott, Carl, Stephen J. Leonard, and Thomas J. Noel. *Colorado: A History of the Centennial State*. Boulder: University Press of Colorado, 2005.

Ackland, Len. *Making a Real Killing: Rocky Flats and the Nuclear West*. Albuquerque: University of New Mexico Press, 1999.

Albertson, Trevor. *Winning Armageddon: Curtis LeMay and Strategic Air Command, 1948-1957*. Annapolis: Naval Institute Press, 2019.

Amundson, Michael A. *Yellowcake Towns: Uranium Mining Communities in the American West*. Boulder: University of Colorado Press, 2002.

Anderson B.C. and R.M. Schletter. *A History of the Radioactive Waste Management Complex at the Idaho National Engineering Laboratory*. Idaho Falls: IDO Nuclear Fuel Cycle Division, 1979.

Ball, Howard. *Justice Downwind: America's Atomic Testing Program in the 1950s*. New York: Oxford University Press, 1986.

Bauman, Robert. "'It Was Like an Invasion!' The Federal Government and the Displacement of People in the Priest Rapids Valley." *Nowhere to Remember: Hanford, White Bluffs, and Richland to 1943*. Robert Bauman and Robert Franklin, eds. Pullman: Washington State University Press, 2018.

Baumgartner, John Stanley. *The Lonely Warriors: The Case for the Military-Industrial Complex*. Los Angeles: Nash Publishing, 1970.

Becker, John T. "Jack." "The Texas Panhandle." *West Texas: A History of the Giant Side of the State*. Paul H. Carlson and Bruce A. Glasrud, eds. Norman: University of Oklahoma Press, 2014.

Billington, David P. and Donald C. Jackson. *Big Dams of the New Deal Era: A Confluence of Engineering and Politics*. Norman: University of Oklahoma Press, 2006.

Bird, Kai and Martin J. Sherwin. *American Prometheus: The Triumph and Tragedy of J. Robert Oppenheimer.* New York: Alfred A. Knopf, 2005.

Bix, Herbert P. *Hirohito and the Making of Modern Japan*. New York: Harper Perennial, 2016.

Blair Roger D. and Jeffrey L. Harrison. *Monopsony in Law and Economics*. New York: Cambridge University Press, 2010.

Blum, Elizabeth D. *Love Canal Revisited: Race, Class, and Gender in Environmental Activism*. Lawrence: University Press of Kansas, 2008.

Brandes, Stuart D. *Warhogs: A History of War Profits in America*. Lexington: University Press of Kentucky, 1997.

Brandt, E.N. *Growth Company: Dow Chemical's First Century*. East Lansing: Michigan State University Press, 1997.

Brechin, Gary. *Imperial San Francisco: Urban Power, Earthly Ruin*. Berkeley: University of California Press, 1999.

Brown, Dee. *Bury My Heart at Wounded Knee: An Indian History of the American West*. New York: Holt, Rinehart & Winston, 1970.

Brown, Kate. *Plutopia: Nuclear Families, Atomic Cities, and the Great Soviet and American Plutonium Disasters*. New York: Oxford University Press, 2013.

Brugge, Doug and Rob Goble. "The Radiation Exposure Compensation Act: What is Fair?" *The Navajo People and Uranium Mining*. Doug Brugge, Timothy Benally, and Esther Yazzie-Lewis, eds. Albuquerque: University of New Mexico Press, 2006.

Campbell, Randolph B. *Gone to Texas: A History of the Lone Star State*. New York: Oxford University Press, 2003.

Carlson, Paul H. *Amarillo: The Story of a Western Town*. Lubbock: Texas Tech University Press, 2006.

Chandler, Alfred D. *Strategy & Structure: Chapters in the History of the Industrial Enterprise*. Mansfield Centre: Martino Publishing, 2013.

Chandler, Alfred D. *The Visible Hand: The Managerial Revolution in American Business*. Cambridge: The Belknap Press of Harvard University Press, 1977.

Chapman, John L. *Atlas: The Story of a Missile*. New York: Harper & Brothers, 1960.

Clark, Claudia. *Radium Girls: Women and Industrial Health Reform, 1910-1935*. Chapel Hill: University of North Carolina Press, 1997.

Cleary, Mark C. *The 6555th: Missile and Space Launches Through 1970*. Patrick AFB: 45th Space Wing History Office, 1991.

Clements, Eric L. *After the Boom in Tombstone and Jerome, Arizona: Decline in Western Resource Towns*. Reno: University of Nevada Press, 2003.

Cohen, Lizabeth. *A Consumers' Republic: The Politics of Mass Consumption in Postwar America*. New York: Vintage Books, 2003.

Cooke, Stephanie. *In Mortal Hands: A Cautionary History of the Nuclear Age*. New York: Bloomsbury, 2009.

Craig, Campbell. *Destroying the Village: Eisenhower and Thermonuclear War*. New York: Columbia University Press, 1998.

Culver, Lawrence. *The Frontier of Leisure: Southern California and the Shaping of Modern America*. New York: Oxford University Press, 2002.

D'Antonio, Michael. *Atomic Harvest: Hanford and the Lethal Toll of America's Nuclear Arsenal*. New York: Crown, 1993.

Davis, Mike. *City of Quartz: Excavating the Future in Los Angeles*. New York: Verso Books, 2006.

Dawson, Susan E., Perry H. Charley, and Phillip Harrison Jr. "Advocacy and Social Action Among Navajo People: Uranium Workers and Their Families, 1988-1995." *The Navajo People and Uranium Mining*. Doug Brugge, Timothy Benally, and Esther Yazzie-Lewis, eds. Albuquerque: University of New Mexico Press, 2006.

Deverell, William. *Whitewashed Adobe: The Rise of Los Angeles and the Remaking of Its Mexican Past*. Berkeley: University of California Press, 2004.

Dochuk, Darren. *From Bible Belt to Sunbelt: Plain Folk Religion, Grassroots Politics, and the Rise of Evangelical Conservatism*. New York: W.W. Norton, 2010.

Duany, Andres, Elizabeth Plater-Zyberk, and Jeff Speck. *Suburban Nation: The Rise of Sprawl and the Decline of the American Dream*. New York: North Point Press, 2000.

Dundjerski, Marina. *UCLA: The First Century*. London: Third Millennium Publishing, 2012.

Eichstaedt, Peter H. *If You Poison Us: Uranium and Native Americans*. Santa Fe: Red Crane Books, 1994.

Einberger, Scott Raymond. *With Distance in His Eyes: The Environmental Life and Legacy of Stewart Udall*. Reno & Las Vegas: University of Nevada Press, 2018.

Engelbrecht, H.C. and F.C. Hanighen. *Merchants of Death: A Study of the International Armament Industry*. New York: Dodd, Mead & Company, 1934.

Estes, Nick. *Our History is the Future: Standing Rock versus the Dakota Access Pipeline, and the Long Tradition of Indigenous Resistance*. New York: Verso, 2019.

Fernlund, Kevin J. "The Cold War West: A New Image?" *The Cold War American West, 1945-1989*. Kevin J. Fernlund, ed. Albuquerque: University of New Mexico Press, 1998.

Fiege, Mark. *The Republic of Nature: An Environmental History of the United States*. Seattle: University of Washington Press, 2012.

Findlay, John M. and Bruce Hevly. *Atomic Frontier Days: Hanford and the American West*. Seattle: Center for the Study of the Pacific Northwest in association with the University of Washington Press, 2011.

Fishman, Robert. *Bourgeois Utopias: The Rise and Fall of Suburbia*. New York: Basic Books, 1987.

Fox, Sarah Alisabeth. *Downwind: A People's History of the Nuclear West*. Lincoln: Bison Books, 2014.

Franklin, Robert and Robert Bauman. "'Making a History of It May Help': The Hanford Site and Its Spaces and Places of Meaning." *Nowhere to Remember: Hanford, White Bluffs, and Richland to 1943*. Robert Bauman and Robert Franklin, eds. Pullman: Washington State University Press, 2018.

Franklin, Robert. "'We Worked in the Orchards and We Played in the River': Life in the Towns of Richland, White Bluffs, and Hanford." *Nowhere to Remember: Hanford, White Bluffs, and Richland to 1943*. Robert Bauman and Robert Franklin, eds. Pullman: Washington State University Press, 2018.

Franks, Kenny A. *The Osage Oil Boom*. Oklahoma City: Western Heritage Books, Inc., 1989.

Franks, Ray and Jay Ketelle. *Amarillo, Texas: The First Hundred Years, 1887-1987: A Picture Postcard History*. Amarillo: Ray Franks Publishing, 1986.

Friedberg, Aaron L. *In the Shadow of the Garrison State: America's Anti-Statism and Its Cold War Grand Strategy*. Princeton: Princeton University Press, 2000.

Gaddis, John Lewis. *Strategies of Containment: A Critical Appraisal of American National Security Policy During the Cold War*. New York: Oxford University Press, 2005.

Gaddis, John Lewis. *The Long Peace: Inquiries into the History of the Cold War*. New York: Oxford University Press, 1987.

Gainor, Christopher. *The Bomb and America's Missile Age*. Baltimore: John Hopkins University Press, 2018.

Geiger, Jeffrey E. *Camp Cooke and Vandenberg Air Force Base, 1941-1966: From Armor and Infantry Training to Space and Missile Launches*. Jefferson: McFarland & Company, Inc., 2014.

Gerber, Michele Stenehjem. *On the Home Front: The Cold War Legacy of the Hanford Nuclear Site.* Lincoln: University of Nebraska Press, 2007.

Gilio-Whitaker, Dina. *As Long as Grass Grows: The Indigenous Fight for Environmental Justice, From Colonization to Standing Rock*. Boston: Beacon Press, 2019.

Goldsmith, Barbara. *Obsessive Genius: The Inner World of Marie Curie*. New York: W.W. Norton, 2005.

Goodstein, Judith R. *Millikan's School: A History of The California Institute of Technology*. New York: W.W. Norton & Company, 1991.

Gottlieb, Robert. *Forcing the Spring: The Transformation of the American Environmental Movement*. Washington, D.C.: Island Press, 2005.

Graham, Wade. "Blueprinting the Regional City: The Urban and Environmental Legacies of the Air Industry in Southern California." *Blue Sky Metropolis: The Aerospace Century in Southern California*. Peter J. Westwick, ed. Berkeley: University of California Press and The Huntington Library, 2012.

Grann, David. *Killers of the Flower Moon: The Osage Murders and the Birth of the FBI*. New York: Vintage Books, 2017.

Greever, William S. *The Bonanza West: The Story of the Western Mining Rushes, 1848-1900*. Norman: University of Oklahoma Press, 1963.

Gregory, James N. *The Southern Diaspora: How the Great Migrations of Black and White Southerners Transformed America*. Chapel Hill: University of North Carolina Press, 2005.

Griswold, Robert L. *Fatherhood in America*: *A History*. New York: Basic Books, 1993.

Hackemer, Kurt. *The U.S. Navy and the Origins of the Military-Industrial Complex*. Annapolis: Naval Institute Press, 2001.

Harvey, David W. "An Oasis in the Desert?: White Bluffs, Hanford, and Richland, The Early Years." *Nowhere to Remember: Hanford, White Bluffs, and Richland to 1943*. Robert Bauman and Robert Franklin, eds. Pullman: Washington State University Press, 2018.

Harvey, Kyle. *American Anti-Nuclear Activism, 1975-1990: The Challenge of Peace*. New York: Palgrave Macmillan, 2014.

Hasegawa, Tsuyoshi. *Racing the Enemy: Stalin, Truman, and the Surrender of Japan*. Cambridge: The Belknap Press of Harvard University Press, 2005.

Hays, Samuel P. *Beauty, Health, and Permanence: Environmental Politics in the United States, 1955-1985*. New York: Cambridge University Press, 1987.

Hevly, Bruce and John M. Findlay. "The Atomic West: Region and Nation, 1942-1992." *The Atomic West*. Bruce Hevly and John M. Findlay, eds. Seattle: University of Washington Press, 1998.

Hewlett, Richard G. and Francis Duncan. *Atomic Shield, 1947-1952: A History of the United States Atomic Energy Commission*. University Park: Pennsylvania State University Press, 1969.

Hewlett, Richard G. and Oscar E. Anderson, Jr. *The New World, 1939/1946, Volume I of a History of the United States Atomic Energy Commission*. University Park: The Pennsylvania State University Press, 1962.

Hise, Greg. *Magnetic Los Angeles: Planning the Twentieth-Century Metropolis*. Baltimore: The Johns Hopkins University Press, 1997.

Hixson, Walter L. *American Settler Colonialism: A History*. New York: Palgrave Macmillan, 2013.

Hounshell, David A. and John Kenly Smith Jr. *Science and Corporate Strategy: Du Pont R&D, 1902-1980*. New York: Cambridge University Press, 1988.

Hughes, Thomas P. *Rescuing Prometheus*. New York: Pantheon Books, 1998.

Hunner, Jon. *Inventing Los Alamos: The Growth of an Atomic Community*. Norman: University of Oklahoma Press, 2007.

Jackson, Kenneth T. *Crabgrass Frontier: The Suburbanization of the United States*. New York: Oxford University Press, 1985.

Jacobs, Chip and William J. Kelly. *Smogtown: The Lung-Burning History of Pollution in Los Angeles*. Woodstock: The Overlook Press, 2008.

Jacobson, Timothy C. *TRW 1901-2001: A Tradition of Innovation.* Cleveland: TRW Inc., 2001.

Johns, Larry C. with Alan R. Johns. *The Baneberry Disaster: A Generation of Atomic Fallout*. Reno: University of Nevada Press, 2017.

Johnston, Barbara Rose, Susan Dawson, and Gary Madsen. "Uranium Mining and Milling: Navajo experiences in the American Southwest." *Indians & Energy: Exploitation and Opportunity in the American Southwest*. Sherry L. Smith and Brian Frehner, eds. Santa Fe: School for Advanced Research Press, 2010.

Johnston, Sean F. *The Neutron's Children: Nuclear Engineers and the Shaping of Identity*. New York: Oxford University Press, 2012.

Jones, Vincent C. *Manhattan: The Army and the Atomic Bomb*. Washington, D.C.: Center of Military History, U.S. Army, 1985.

Josephy, Alvin M. Jr., Joane Nagel, and Troy Johnson, eds. *Red Power: The American Indians' Fight for Freedom*. Lincoln: University of Nebraska Press, 1999.

Kaplan, Edward. *To Kill Nations: American Strategy in the Air-Atomic Age and the Rise of Mutually Assured Destruction.* Ithaca: Cornell University, 2015.

Kaplan, Louise. “Public Participation in Nuclear Facility Decisions: Lessons from Hanford.” *Science, Technology, and Democracy*. Daniel Lee Kleinman, ed. Albany: SUNY Press, 2000.

Kennedy, David M. *Freedom from Fear: The American People in Depression and War, 1929-1945*. New York: Oxford University Press, 1999.

Kennedy, Paul. *Engineers of Victory: The Problem Solvers Who Turned the Tide in the Second World War*. New York: Random House, 2013.

Koistinen, Paul A.C. *State of War: The Political Economy of American Warfare, 1945-2011*. Lawrence: University Press of Kansas, 2012.

Koistinen, Paul A.C. *The Military-Industrial Complex: A Historical Perspective*. New York: Praeger Publishers, 1980.

Koppes, Clayton R. *JPL and the American Space Program: A History of the Jet Propulsion Laboratory*. New Haven: Yale University Press, 1982.

Kuletz, Valerie L. *The Tainted Desert: Environmental Ruin in the American West*. New York: Routledge, 1998.

Ledbetter, James. *Unwarranted Influence: Dwight D. Eisenhower and the Military-Industrial Complex*. New Haven: Yale University Press, 2011.

Leffler, Melvyn P. *A Preponderance of Power: National Security, the Truman Administration, and the Cold War*. Stanford: Stanford University Press, 1992.

Lehmann-Russbueldt, Otto. *Die Blutige Internationale Der Rüstungsindustire*. Hamberg-Bergedorf: Fackelreiter Verlag, 1929.

Lens, Sidney. *The Military-Industrial Complex*. Philadelphia and Kansas City: Pilgrim Press & the National Catholic Reporter, 1970.

Lief, Alfred. *“It Floats”: The Story of Procter & Gamble*. New York: Rinehart & Company, Inc., 1958.

Limerick, Patricia Nelson. “The Significance of Hanford in American History.” *Washington Comes of Age: The State in the National Experience*. David H. Stratton, ed. Pullman: Washington State University Press, 1993.

Limerick, Patricia Nelson. *The Legacy of Conquest: The Unbroken Past of the American West*. New York: W.W. Norton & Company, 1987.

Lindee, M. Susan. *Suffering Made Real: American Science and the Survivors at Hiroshima*. University of Chicago Press, 1994.

Lipsett, Brian. "Rocky Flats: A Plea Bargain in Public View." *Environmental Crime: Enforcement, Policy, and Social Responsibility*. Mary Clifford, ed. Gaithersburg: Aspen Publishers, Inc., 1998.

Lotchin, Roger W. *Fortress California, 1910-1961: From Warfare to Welfare*. New York: Oxford University Press, 1992.

Lowitt, Richard. *The New Deal and the West*. Norman: University of Oklahoma Press, 1993.

Madley, Benjamin. *An American Genocide: The United States and the California Indian Catastrophe*. New Haven: Yale University Press, 2016.

Makhijani, Arjun, A. James Ruttenber, Ellen Kennedy, and Richard Clapp. "The United States." *Nuclear Wastelands: A Global Guide to Nuclear Weapons Production and Its Health and Environmental Effects*. Arjun Makhijani, Howard Hu, and Katherine Yih, eds. Cambridge: The MIT Press, 1995.

Markhijani, Arjun and Scott Saleska, "The Production of Nuclear Weapons and Environmental Hazards." *Nuclear Wastelands: A Global Guide to Nuclear Weapons Production and Its Health and Environmental Effects*. Arjun Makhijani, Howard Hu, and Katherine Yih, eds. Cambridge: The MIT Press, 1995.

Markusen, Ann, Peter Hall, Scott Campbell, and Sabina Deitrick. *The Rise of the Gunbelt: The Military Remapping of Industrial America*. New York: Oxford University Press, 1991.

May, Elaine Tyler. *Homeward Bound: American Families in the Cold War Era*. New York: Basic Books, 2008.

McGirr, Lisa. S*uburban Warriors: The Origins of the New American Right*. Princeton: Princeton University Press, 2001.

McNeill, J.R. *Something New Under the Sun: An Environmental History of the Twentieth-Century World.* New York: W.W. Norton & Company, 2000.

Mellor, Robynne. "A Comparative Case Study of Uranium Mine and Mill Tailings Regulation in Canada and the United States." *Mining North America: An Environmental History since 1522.* J.R. McNeill and George Vrtis, eds. Oakland: University of California Press, 2017.

Melman, Seymour. *Pentagon Capitalism: The Political Economy of War*. New York: McGraw-Hill Book Company, 1970.

Melman, Seymour. *The Permanent War Economy: American Capitalism in Decline*. New York: Simon and Schuster, 1974.

Miller, Char and Jeff Crane, eds. *The Nature of Hope: Grassroots Organizing, Environmental Justice, and Political Change*. Louisville: University Press of Colorado and Utah State University Press, 2018.

Mills, C. Wright. *The Power Elite*. New York: Oxford University Press, 1956.

Mogren, Eric. "Mining the Atom: Uranium in the Twentieth-Century American West." *Mining North America: An Environmental History since 1522*. J.R. McNeill and George Vrtis, eds. Oakland: University of California Press, 2017.

Mojtabai, A.G. *Blessed Assurance: At Home with the Bomb in Amarillo, Texas*. Syracuse: Syracuse University Press, 1997.

Monteyne, David. *Fallout Shelter: Designing for Civil Defense in the Cold War*. Minneapolis: University of Minnesota Press, 2011.

Montoya, María E. "Landscapes of the Cold War West." *The Cold War American West, 1945-1989*. Kevin J. Fernlund, ed. Albuquerque: University of New Mexico Press, 1998.

Moore, Kate. *The Radium Girls: The Dark Story of America's Shining Women*. Naperville: Sourcebooks, Inc., 2017.

Moore, LeRoy. *Plutonium and People Don't Mix: A Guide to Rocky Flats, Colorado's Defunct Nuclear Bomb Factory*. Boulder: Rocky Flats Nuclear Guardianship and Rocky Mountain Peace & Justice Center, 2017.

Moreton, Bethany. *To Serve God and Wal-Mart: The Making of Christian Free Enterprise*. Cambridge: Harvard University Press, 2009.

Nash, Gerald D. *The American West Transformed: The Impact of the Second World War*. Lincoln: University of Nebraska Press, 1985.

Nash, Gerald D. *The Federal Landscape: An Economic History of the Twentieth-Century West*. Tucson: University of Arizona Press, 1999.

Ndiaye, Pap A. *Nylon and Bombs: DuPont and the March of Modern America*. Baltimore: John Hopkins University Press, 2007.

Needham, Andrew. *Power Lines: Phoenix and the Making of the Modern Southwest*. Princeton: Princeton University Press, 2014.

Nicolaides, Becky M. *My Blue Heaven: Life and Politics in the Working-Class Suburbs of Los Angeles, 1920-1965*. Chicago: University of Chicago Press, 2002.

Nixon, Rob. *Slow Violence and the Environmentalism of the Poor*. Cambridge: Harvard University Press, 2011.

Orlans, Harold. *Contracting for Atoms: A Study of Public Policy Issues Posed by the Atomic Energy Commission's Contracting for Research, Development, and Managerial Services*. Washington, D.C.: The Brookings Institution, 1967.

Ostler, Jeffrey. *The Plains Sioux and U.S. Colonialism from Lewis and Clark to Wounded Knee*. New York: Cambridge University Press, 2004.

Pasternak, Judy. *Yellow Dirt: An American Story of a Poisoned Land and a People Betrayed*. New York: Free Press, 2010.

Pendle, George. *Strange Angel: The Otherworldly Life of Rocket Scientist John Whiteside Parsons*. Orlando: Harcourt, Inc., 2005.

Phillips-Fein, Kim. *Invisible Hands: The Making of the Conservative Movement from the New Deal to Reagan*. New York: W.W. Norton, 2010.

Pisani, Donald J. *To Reclaim a Divided West: Water, Law, and Public Policy, 1848-1902*. Albuquerque: University of New Mexico Press, 1981.

Pisani, Donald J. *Water and American Government: The Reclamation Bureau, National Water Policy, and the West, 1902-1935*. Berkeley: University of California Press, 2002.

Rashke, Richard. *The Killing of Karen Silkwood: The Story Behind the Kerr-McGee Plutonium Case*. Ithaca: Cornell University Press, 2000.

Rhodes, Richard. *Dark Sun: The Making of the Hydrogen Bomb*. Simon & Schuster, 1996.

Rhodes, Richard. *The Making of the Atomic Bomb*. New York: Simon & Schuster, 1987.

Robbins, William G. *Colony and Empire: The Capitalist Transformation of the American West*. Lawrence: University Press of Kansas, 1994.

Robinson, Joan. *The Economics of Imperfect Competition*. London: Macmillan, 1933.

Roland, Alex. "The Military-Industrial Complex: Lobby and Trope." *The Long War: A New History of U.S. National Security Policy Since World War II*. Andrew J. Bacevich, ed. New York: Columbia University Press, 2007.

Rome, Adam. *The Bulldozer in the Countryside: Suburban Sprawl and the Rise of American Environmentalism*. New York: Cambridge University Press, 2001.

Roth, Herrick. *Local 8031: Its Struggles and Its Victories*. Denver: A.B. Hirschfeld Press, 1989.

Rueckert, George L. *Global Double Zero: The INF Treaty from Its Origins to Implementation*. Westport: Greenwood Press, 1993.

Saler, Bethel. *The Settlers' Empire: Colonialism and State Formation in America's Old Northwest*. Philadelphia: University of Pennsylvania Press, 2014.

Schoneberger William A. with Paul Sonnenburg. *California Wings: A History of Aviation in the Golden State*. Woodland Hills: Windsor Publications, 1984.

Scott, Allen J. *Technopolis: High-Technology Industry and Regional Development in Southern California*. Berkeley: University of California Press, 1993.

Seldes, George. *Iron, Blood and Profits*. New York: Harper and Brothers, 1934.

Sheehan, Neil. *A Fiery Peace in a Cold War: Bernard Schriever and the Ultimate Weapon*. New York: Random House, 2009.

Smith, Thomas G. *Stewart L. Udall: Steward of the Land*. Albuquerque: University of New Mexico Press, 2017.

Stacy, Susan M. *Proving the Principle*. Idaho Falls: Idaho Operations Office of the Department of Energy, 2000.

Starr, Kevin. *The Dream Endures: California Enters the 1940s*. New York: Oxford University Press, 1997.

Stumpf, David K. *Titan II: A History of a Cold War Missile Program*. Fayetteville: University of Arkansas Press, 2000.

Swanson, Michael. *The War State: The Cold War Origins of the Military-Industrial Complex and the Power Elite, 1945-1963*. Scotts Valley: Createspace Independent Publishing Platform, 2013.

Swasy, Alecia. *Soap Opera: The Inside Story of Procter & Gamble*. New York: Random House, 1993.

Szasz, Ferenc Morton. *The Day the Sun Rose Twice: The Story of the Trinity Site Nuclear Explosion, July 16, 1945*. Albuquerque: University of New Mexico Press, 1984.

Taylor, Quintard. *The Forging of a Black Community: Seattle's Central District, from 1870 through the Civil Rights Era*. Seattle: University of Washington Press, 1994.

Thayer, Harry. *Management of the Hanford Engineer Works in World War II: How the Corps, DuPont, and the Metallurgical Laboratory Fast Tracked the Original Plutonium Works*. New York: ASCE Press, 1996.

Thorpe, Rebecca U. *The American Warfare State: The Domestic Politics of Military Spending*. Chicago: University of Chicago Press, 2014.

Voyles, Traci Brynne. *Wastelanding: Legacies of Uranium Mining in Navajo Country*. Minneapolis: University of Minnesota Press, 2015.

Washington, Sylvia Hood. *Packing Them In: An Archaeology of Environmental Racism in Chicago, 1865-1954*. New York: Lexington Books, 2005.

Weaver, Bobby, ed. *A Harvest of Memories: The St. Francis Story*. Amarillo: Southwestern Publications, 1983.

Wehr, Paul. *Conflict Regulation*. Boulder: Westview, 1979.

Weisiger, Marsha. *Dreaming of Sheep in Navajo Country*. Seattle: University of Washington Press, 2011.

Westwick, Peter J. "Photoessay: An Album of Early Southern California Aviation." *Blue Sky Metropolis: The Aerospace Century in Southern California*. Peter J. Westwick, ed. Berkeley: University of California Press and The Huntington Library, 2012.

Westwick, Peter J., ed. *Blue Sky Metropolis: The Aerospace Century in Southern California*. Berkeley: University of California Press and The Huntington Library, 2012.

White, Richard. *"It's Your Misfortune and None of my Own": A New History of the American West*. Norman: University of Oklahoma Press, 1993.

Whitehead, Don. *The Dow Story: The History of the Dow Chemical Company*. New York: McGraw-Hill Book Company, 1968.

Whitman, Willson. *David Lilienthal: Public Servant in a Power Age*. New York: Henry Holt and Company, 1948.

Wilkins, David E. *The Navajo Political Experience*. New York: Rowman & Littlefield Publishers, Inc., 1999.

Williams, Hill. *Made in Hanford: The Bomb that Changed the World*. Pullman: Washington State University Press, 2011.

Wilson, Terry P. *The Underground Reservation: Osage Oil*. Lincoln: University of Nebraska Press, 1985.

Wolfe, Tom. *The Right Stuff*. New York: Farrar, Straus, Grioux, 1979.

Woolf, Amy F. and James D. Werner. *The U.S. Nuclear Weapons Complex: Overview of Department of Energy Sites*. Washington, D.C.: Library of Congress, Congressional Research Service, 2018.

Worster, Donald. *Dust Bowl: The Southern Plains in the 1930s*. New York: Oxford University Press, 2004.

Worster, Donald. *Rivers of Empire: Water, Aridity, and the Growth of the American West*. New York: Oxford University Press, 1985.

Wrobel, David M. *America's West: A History, 1890-1950*. New York: Cambridge University Press, 2017.

Zimring, Carl A. *Clean and White: A History of Environmental Racism in the United States*. New York: New York University Press, 2016.

Articles

Ackland, Len. "The Day They Almost Lost Denver." *Bulletin of the Atomic Scientists* 55, no. 4 (1999), 58-65.

Alvarez, Robert. "Energy in Decay." *Bulletin of the Atomic Scientists* 56, no. 3 (May/June 2000), 25-35.

Bauman, Robert. "Jim Crow in the Tri-Cities, 1943-1950." *The Pacific Northwest Quarterly* 96, no. 3 (Summer 2005), 124-131.

Brinkley, Alan. "The Problem of American Conservatism." *The American Historical Review* 99, no. 2 (April 1994), 409-429.

Brugge, Doug, Jamie L. deLemos, and Cat Bui. "The Sequoyah Fuels Release and the Church Rock Spill: Unpublicized Nuclear Releases in American Indian Communities." *American Journal of Public Health* 97, no. 9 (September 2007), 1595–1600.

Clayton, James L. "Defense Spending: Key to California's Growth." *The Western Political Quarterly* 15, no. 2 (June 1962), 280-293.

Clayton, James L. "The Impact of the Cold War on the Economies of California and Utah, 1946-1965." *Pacific Historical Review* 36, no. 4 (November 1967), 449-473.

Coates, Peter, Tim Cole, Marianna Dudley, and Chris Pearson. "Defending Nation, Defending Nature? Militarized Landscapes and Military Environmentalism in Britain, France, and the United States." *Environmental History* 16, no. 3 (July 2011), 456-491.

Grammer, Elisa J. "The Uranium Mill Tailings Radiation Control Act of 1978 and NRC's Agreement State Program." *Natural Resources Lawyer* 13, no. 3 (1981), 469-522.

Hunt, Alex. "'Host and Hostage': Pantex and the Texas Panhandle." *Southwestern Historical Quarterly* 118, no. 4 (April 2015), 339-363.

Jones-Correa, Michael. “The Origins and Diffusion of Racial Restrictive Covenants.” *Political Science Quarterly* 115, no. 4 (Winter 2000-2001), 541-568.

“Kerr-McGee, Oryx Join U.S. Merger Frenzy.” *Oil & Gas Journal* 96, no. 43 (October 1998), 38-40.

Kimble, John. “Insuring Inequality: The Role of the Federal Housing Administration in the Urban Ghettoization of African Americans.” *Law & Social Inquiry* 32, no. 2 (Spring 2007), 399-434.

Lowen, Rebecca S. “Entering the Atomic Power Race: Science, Industry, and Government.” *Political Science Quarterly* 102, no. 3 (October 1987), 459-479.

Lowenstein, Ronnie and Richard Peach. “The Impact of the Current Defense Build-down.” *FRBNY Quarterly Review* (Autumn 1992), 59-68.

Nash, Gerald D. “The West and the Military-Industrial Complex.” *Montana The Magazine of Western History* 40, no. 1 (Winter 1990), 72-75.

Steele, Karen Dorn. “Hanford in Hot Water,” *Bulletin of the Atomic Scientists* 47, no. 4 (May 1991), 7-8.

Steele, Karen Dorn. “Hanford’s Bitter Legacy,” *Bulletin of the Atomic Scientists* 44, no. 1 (January-February 1988), 17-23.

Unpublished Dissertations, Theses, and Papers and Commentary

Godfrey, Lisa Pitcher. “Mining the Colorado Plateau: The Story of Calamity Mesa, 1910-1970.” Master’s thesis, Utah State University, 1991.

Schroeder, Steven. “On Learning to See Nothing: The Institution of Pantex.” Presented at the *Popular Culture Association Conference*, Las Vegas, Nevada, March 1996.

Taylor, Quintard. “Commentary on Reimagining the Racial Landscape at Hanford and in the Tri-Cities.” Presented at the *Western History Association Conference,* San Antonio, Texas, 19 October 2018.

Van Patten, Susan R. “Sources of Recreational and Community Conflict from Tourism in Moab, Utah.” Master’s thesis, Utah State University, 1996.

Vollan, Linda D. “‘To The Village Square:’ Early Activism Against Rocky Flats Nuclear Weapons Plant.” Master’s thesis, University of Colorado at Boulder, 1992.

Wiley, James T., Jr. “Race Conflict as Exemplified in a Washington Town.” Master’s thesis, State College of Washington, 1949.

Online Sources

Agency for Toxic Substance and Disease Registry. "Public Health Statement: Plutonium." November 2010. https://www.atsdr.cdc.gov/ToxProfiles/tp143-c1-b.pdf.

Agency for Toxic Substance and Disease Registry. "Toxicological Profile for Strontium." April 2004. http://www.atsdr.cdc.gov/toxprofiles/tp159.pdf.

Ahtone, Tristan. "Land Grab: What Happened on the Wind River Reservation?" *Wyoming Public Media.* 15 June 2012. https://www.wyomingpublicmedia.org/post/land-grab-what-happened-wind-river-reservation#stream/0.

Babcock & Wilcox, Technical Services Pantex, LLC with Sapere Consulting, Inc. "Record of Decision for Groundwater, Soil and Associated Media: Pantex Plant, Carson County, Texas." September 2008. https://pantex.energy.gov/sites/default/files/016005.pdf.

"Briefing for Mary L. Walker for Meetings with Admiral Foley, General Counsel Farrell and with the Under Secretary on Rocky Flats," 14 July 1986. https://rockyflatsambushedgrandjury.com/wp-content/uploads/19860714-7-page-Briefing-for-Mary-L.-Walker-et-al.pdf.

Buffer, Pat. "Rocky Flats Site History." Office of Legacy Management, Department of Energy. 2002. https://www.lm.doe.gov/land/sites/co/rocky_flats/closure/references/199-Rocky%20Flats%20History%20Thru%201-2002.pdf.

Bush, George H.W. "Address Before a Joint Session of the Congress on the State of the Union," 28 January 1992. https://www.presidency.ucsb.edu/documents/address-before-joint-session-the-congress-the-state-the-union-0.

Cassingham, Curt. "Larry Cassingham, 1917-2007." 19 June 2005. https://www.curtcass.com/detectron/.

Centers for Disease Control and Prevention. "Radioisotope Brief: Strontium-90." 4 April 2018. https://www.cdc.gov/nceh/radiation/emergencies/isotopes/strontium.htm.

Centers for Disease Control and Prevention. "Radioisotope Brief: Iodine-131 (I-131)." 4 April 2018. https://www.cdc.gov/nceh/radiation/emergencies/isotopes/iodine.htm.

Centers for Disease Control and Prevention. "What is Radiation? Properties of Radioactive Isotopes." 20 August 2015. https://www.cdc.gov/nceh/radiation/isotopes.html.

ChemRisk. "Reconstruction of Historical Rocky Flats Operations & Identification of Release Points." August 1992. https://www.lm.doe.gov/cercla/documents/rockyflats_docs/SW/SW-A-005612.pdf.

Cluff, D. "Amarillo National Resource Center for Plutonium, Work Plan Progress Report, November 1, 1995—January 31, 1996." 1996. https://www.osti.gov/biblio/226142.

Defense Nuclear Agency as Executive Agency for the Department of Defense. "Operation Ranger, Shots Able, Baker, Easy, Baker-2, Fox, 25 January-6 February 1951." Carl Maag, Stephen Rohrer, and Robert Shepanek, authors. 26 February 1982. https://www.dtra.mil/Portals/61/Documents/NTPR/2-Hist_Rpt_Atm/1951_DNA_6022F.pdf.

Donahue, Jim. "The Westinghouse Web." *Multi-National Monitor*. March 1992. https://www.multinationalmonitor.org/hyper/issues/1992/03/mm0392_11.html.

Energy Fuels. "Sunday Complex." https://web.archive.org/web/20131019110707/http://www.energyfuels.com/projects/sunday_complex/. Accessed 20 January 2020.

Environmental Protection Department, Environment, Safety & Health Division, Battelle Pantex, Mason & Hanger-Silas Mason Co., Inc. "1993 Environmental Report for Pantex Plant." June 1994. http://www.iaea.org/inis/collection/NCLCollectionStore/_Public/26/040/26040703.pdf.

Federal Bureau of Investigation. *Application and Affidavit for Search Warrant*, for Rocky Flats, U.S. District Court, case 89-730m. https://rockyflatsambushedgrandjury.com/wp-content/uploads/19890614-Search-Warrant-89-730M-Return.pdf.

Federal Bureau of Investigation. *Application and Affidavit for Search Warrant*, for Rocky Flats, U.S. District Court, case 89-753m. https://rockyflatsambushedgrandjury.com/wp-content/uploads/19890614-FBI-Rocky-Flats-Search-Warrant-Case-No-89-753M.pdf.

Fluor Hanford, Inc. "History of Hanford Site Defense Production (Brief)." M.S. Gerber, author. February 2001. https://www.osti.gov/servlets/purl/805998.

Gerber, Michele. *Plutonium Production Story at the Hanford Site: Processes and Facilities History*. June 1996. https://www.osti.gov/servlets/purl/664389.

Gosling, F.G. and Terrence R. Fehner. *Closing the Circle: The Department of Energy and Environmental Management, 1942-1994* (draft). Washington, D.C.: U.S. Department of Energy, 1994. https://www.energy.gov/sites/prod/files/2013/04/f0/Gosling%20and%20Fehner%20-%20Closing%20the%20Circle%20%28complete%29.pdf.

Hanford Engineer Works. "Alphabet House B." Hanford History Project. http://www.hanfordhistory.com/items/show/650. Accessed 30 November 2018.

Hanford Engineer Works. "Alphabet House L." Hanford History Project. http://www.hanfordhistory.com/items/show/659. Accessed 30 November 2018.

Health Physics Society. "Tritium Fact Sheet." March 2011. https://hps.org/documents/tritium_fact_sheet.pdf.

History Associates Incorporated. "History of the Production Complex: The Methods of Site Selection." September 1987. https://www.osti.gov/servlets/purl/5745137.

International Nuclear Safety Advisory Group. *INSAG-7 The Chernobyl Accident: Updating INSAG-1*. Safety Series No. 75-INSAG-7. 1992. https://www-pub.iaea.org/MTCD/publications/PDF/Pub913e_web.pdf.

King, Byron W. "Update on Uranium." Energy & Scarcity Investor. 2 March 2010. https://www.uraniumenergy.com/_resources/media/Update_on_Uranium-Byron_King.pdf.

Kitchen Debate Transcript. 24 July 1959, U.S. Embassy, Moscow, Soviet Union. https://www.cia.gov/library/readingroom/docs/1959-07-24.pdf.

Lini, D.C. and L.H. Rogers. "Plutonium Finishing Plant." U.S. Department of Energy. June 2006. https://web.archive.org/web/20060926023643/http://www.hanford.gov/rl/uploadfiles/FACT_PFP_0606.pdf.

M.H. Chew & Associates, Inc. "Facility History for Building 771 at the Rocky Flats Plant." April 1992. https://rockyflatsambushedgrandjury.com/wp-content/uploads/1992April-FacilityHistoryforBuilidng771attheRockyFlatsPlant.pdf.

Malina, Frank J. "Memoir on the GALCIT Rocket Research Project, 1936-38." 6 June 1967. http://www.olats.org/OLATS/pionniers/memoir1.shtml.

Matthias, Franklin T. "Diary and Notes of Col. Franklin Matthias, 1942-1945." 22 December 1942. https://reading-room.labworks.org/edocs/matthias_diary.pdf.

Mehta, Aaron. "30 Years: William Perry—Reshaping the Industry." *DefenseNews*. 25 October 2016. https://www.defensenews.com/30th-annivesary/2016/10/25/30-years-william-perry-reshaping-the-industry/.

National Institute of Standards and Technology. "Radionuclide Half-Life Measurements." 6 September 2009. https://www.nist.gov/pml/radionuclide-half-life-measurements-data.

Northrop Grumman. "Advancing Our Legacy: Northrop Grumman's History with the ICBM System." December 2019. https://www.northropgrumman.com/wp-content/uploads/2019/12/ICBM_HistoryBrochure.pdf.

Reagan, Ronald. "Address to the Nation on Nation Security," 26 February 1986. https://www.reaganfoundation.org/media/128843/nation3.pdf.

Solomon, John and Alison Spann. "Uranium One Deal Led to Some Exports to Europe, Memos Show." The Hill. 2 November 2017. https://thehill.com/policy/national-security/358339-uranium-one-deal-led-to-some-exports-to-europe-memos-show.

Sottile, Leah. “In A Small Town in Washington State, Pride and Shame Over Atomic Legacy.” *Al Jazeera America.* 21 July 2015. http://america.aljazeera.com/multimedia/2015/7/richland-washingtons-atomic-legacy.html.

Stockholm International Peace Research Institute. *Yearbook: Armaments, Disarmament and International Security*. 2019. https://data.worldbank.org/indicator/MS.MIL.XPND.GD.ZS?locations=US.

“Suit Claims Priest Fathered Child, Diocese Covered Up Abuse.” MyPlainview. 10 July 2002. https://www.myplainview.com/news/article/Suit-claims-priest-fathered-child-diocese-9029232.php.

The Navajo Nation. “Navajo Nation President Joe Shirley, Jr. Signs Diné Natural Resources Protection Act of 2005.” 30 April 2005. https://www.nrc.gov/docs/ML0721/ML072150169.pdf.

Tirpak, John A. “The Distillation of the Defense Industry.” *Air Force Magazine*. 16 June 2008. https://www.airforcemag.com/article/0798industry/.

Treaty Between the United States of America and the Union of Soviet Socialist Republics on the Elimination of their Intermediate-Range and Shorter-Range Missiles (INF Treaty), proclaimed by U.S. President 27 December 1988. U.S. Department of State. https://2009-2017.state.gov/t/avc/trty/102360.htm#text.

U.S. Department of Energy. “Baseline Risk Assessment of Ground Water Contamination at the Uranium Mill Tailings Site Near Riverton, Wyoming.” September 1995. https://inis.iaea.org/collection/NCLCollectionStore/_Public/27/019/27019611.pdf?r=1&r=1.

U.S. Department of Energy. “Plutonium Finishing Plant.” June 2006. https://web.archive.org/web/20060926023643/http://www.hanford.gov/rl/uploadfiles/FACT_PFP_0606.pdf.

U.S. Department of Health and Human Services, Public Health Service, Agency for Toxic Substances & Disease Registry. “Public Health Statement: Uranium.” February 2013. https://www.atsdr.cdc.gov/ToxProfiles/tp150-c1-b.pdf.

U.S. Department of Health and Human Services, Public Health Service, Agency for Toxic Substances & Disease Registry. “Public Health Statement: Radon.” May 2012. https://www.atsdr.cdc.gov/ToxProfiles/tp145-c1-b.pdf.

U.S. Environmental Protection Agency, U.S. Department of Energy, and the Texas Commission on Environmental Quality. “Pantex Plant Interagency Agreement.” December 2007. https://pantex.energy.gov/sites/default/files/012031.pdf.

U.S. Environmental Protection Agency. “Cleaning Up Abandoned Uranium Mines.” 19 June 2019. https://www.epa.gov/navajo-nation-uranium-cleanup/cleaning-abandoned-uranium-mines.

U.S. Environmental Protection Agency. “Northeast Church Rock Mine Site Update.” January 2020. https://www.epa.gov/sites/production/files/2020-01/documents/northeast_church_rock_mine_fact_sheet-2020-01-13.pdf.

U.S. Environmental Protection Agency. “U.S. EPA to Perform Helicopter Survey of Abandoned Uranium Mies in the Oljato Area.” September 1997. http://navajoboy.com/media/pdfs/NAVA2.PDF.

U.S. Environmental Protection Agency. “United Nuclear Corporation, New Mexico.” August 2002. https://semspub.epa.gov/work/HQ/183036.pdf.

U.S. Environmental Protection Agency. “USEPA Support for Navajo Nation.” April 2016. https://www.epa.gov/sites/production/files/2016-06/documents/navajo_nation_support_4-16_web.pdf.

U.S. Nuclear Regulatory Commission. “Bone Seeker.” 21 March 2019. https://www.nrc.gov/reading-rm/basic-ref/glossary/bone-seeker.html.

U.S. Nuclear Regulatory Commission. “NRC Seeks Public Comment on Environmental Review of Proposed Church Rock Mine Cleanup in New Mexico.” 14 February 2019. https://www.nrc.gov/reading-rm/doc-collections/news/2019/19-008.pdf.

Westinghouse Hanford Company. “A Brief History of the PUREX and UO_3 Facilities.” M.S. Gerber, author. November 1993. https://www.osti.gov/servlets/purl/10115226.

Westinghouse Hanford Company. *A Comparison of N Reactor and Chernobyl.* J.P. McNeece, R.P. Omberg, and E.T. Weber, authors. March 1998. https://pdw.hanford.gov/document/E0029606.

Young, Quentin. “Rogue Agent.” 5280. May 2016. https://www.5280.com/2016/04/rogue-agent/.